Year 7 – Algebraic thinking…

Algebraic notation

What do I need to be able to do?

By the end of this unit you should be able to:

- Be able to use inverse operations and "operation families".
- Be able to substitute into single and two step function machines.
- Find functions from expressions.
- Form sequences from expressions
- Represent functions graphically.

Keywords

Function: a relationship that instructs how to get from an input to an output.
Input: the number/ symbol put into a function.
Output: the number/ expression that comes out of a function.
Operation: a mathematical process
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Commutative: the order of the operations do not matter.
Substitute: replace one variable with a number or new variable.
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)
Evaluate: work out
Linear: the difference between terms increases or decreases by the same value each time
Sequence: items or numbers put in a pre-decided order

Single function machines

INPUT The number that goes IN → [ ] → **OUTPUT** The number that comes out

This box gives the calculation instruction

To find the input from the output
Use the **INVERSE** operation

Using letters to represent numbers

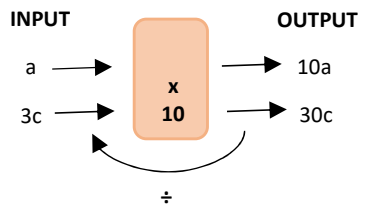
5 + 5 + 5	y + y + y + y	20 ÷ h
3 x 5	y x 4	$\frac{20}{h}$
5 x 3	4 x y	
	4y	

Addition and multiplication can be done in any order **Commutative calculations**

4y: 4 lots of 'y'

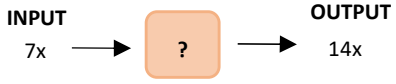
$\frac{20}{h}$: 20 shared into 'h' number of groups

Single function machines (algebra)



To find the input from the output
Use the **INVERSE** operation

Find functions from expressions



Find the relationship between the input and the output
Sometimes there can be a number of possible functions.
e.g. **+7x** or **x 2** could both be solutions to the above function machine

Substitution into expressions

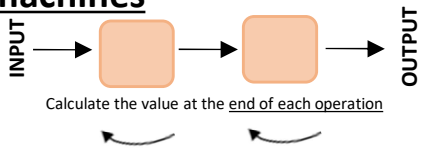
4y ← 4 lots of 'y'

If y = 7 this means the expression is asking for 4 'lots of' 7

4 x 7 **OR** 7 + 7 + 7 +7 **OR** 7 x 4 **= 28**

e.g. : y – 2
= 7 – 2 = **5**

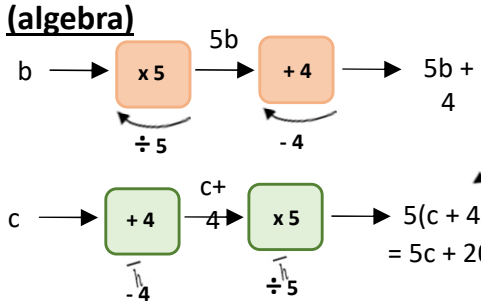
Two step function machines



Calculate the value at the end of each operation

For the input use the **INVERSE** operations

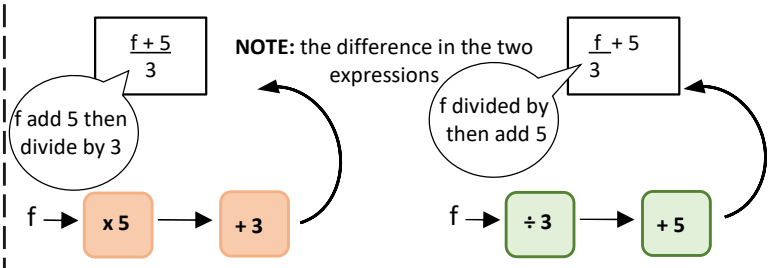
Two step function machines (algebra)



IMPORTANT
Calculate the value at the end of each operation

NOTE:
The whole first output is multiplied by 5

Find functions from expressions



NOTE: the difference in the two expressions

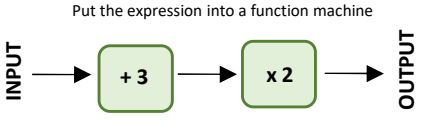
Sometimes it helps to try to explain the expression in word – and consider what has happened to the input

Substitution into an expression

2(x + 3)

Add 3 to the input then times 2

Put the expression into a function machine



If x = 10
10 + 3 = 13….. 13 x 2 = 26

2(x + 3)

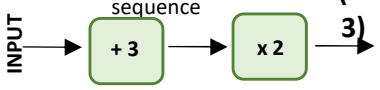
Forming a sequence

INPUT	1	2	3
OUTPUT	8	10	12

The substitution is the 'input' value
The OUTPUT becomes the sequence

Representing functions graphically

Take the function and generate a sequence



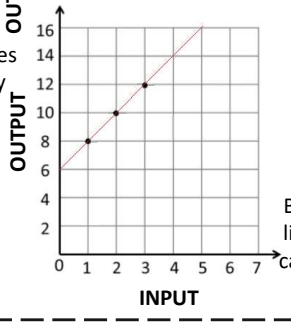
To represent graphically the input becomes x co-ordinates and the output becomes y co-ordinates

y=2(x + 3)

INPUT (x)	1	2	3
OUTPUT (y)	8	10	12

This becomes a co-ordinate pair (2, 10) to plot on a graph

Not all graphs will be linear only those with an integer value for x. Powers and fractions generate differently shaped graphs.



NOTE:
Because this is a linear graph you can predict other values

Question 1 What is the inverse of addition?	**Question 2** If x=10 , what is the value of 3x ?	**Question 3** Simplify the expression y + y + y	**Question 4** What is the inverse of a cube root?
Question 5 Simplify the expression $k \div 2$	**Question 6** True or false: $a \div b = \frac{a}{b}$	**Question 7** If x = 20, what is 2x + 5 ?	**Question 8** What is the inverse of multiplication?
Question 9 If x=4, what is the value of 10 – x ?	**Question 10** What is the inverse of subtraction?	**Question 11** Simplify the expression $p \times 10$	**Question 12** If x = 2.5, what is 3x – 4 ?
Question 13 What is the inverse of squaring?	**Question 14** Simplify the expression $z \times z$	**Question 15** If x=1.2, what is 4x + 10 ?	**Question 16** True or false: if a=0.5 and b=5, $\frac{a}{b}$ is greater than $\frac{b}{a}$
Question 17 True or false: Input = 2x Function : Square Output = $2x^2$	**Question 18** If x=5, what is the value of 7+x ?	**Question 19** What is the inverse of division?	**Question 20** Simplify the expression $2 \times a \times 3$

Answers: 1.Subtraction 2. 30 3. 3y 4. Cubing 5. $\frac{k}{2}$ 6. True 7. 45 8. Division 9. 6 10. Addition 11. 10p 12. 3.5 13. Square rooting 14. z^2 15. 14.8 16. True 17. False 18. 12 19. Multiplication 20. 6a

Year 7 – Algebraic thinking...

Equality and Equivalence

What do I need to be able to do?

By the end of this unit you should be able to:

- .Form and solve linear equations
- Understand like and unlike terms
- Simplify algebraic expressions

Keywords

Equality: two expressions that have the same value
Equation: a mathematical statement that two things are equal
Equals: represented by '=' symbol – means the same
Solution: the set or value that satisfies the equation
Solve: to find the solution.
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Term: a single number or variable
Like: variables that are the same are 'like'
Coefficient: a multiplicative factor in front of a variable e.g. 5x (5 is the coefficient, x is the variable)
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

Equality

$2 + 14 = 5 + 5 + 6$

16 16

"Is equal to"

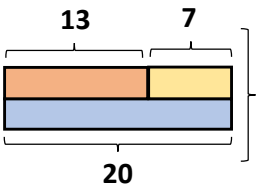
The sum on the left has the same result as the sum on the right

Saying it out loud sometimes helps you to understand equality

Fact Families

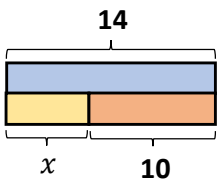
Use a bar model to display the relationships between terms and numbers.

Model the information

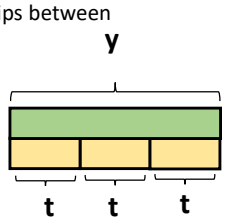


13 + 7 = 20 20 – 7 = 13
7 + 13 = 20 20 – 13 = 7

Fact Family



$x + 10 = 14$ $14 - 10 = x$
$10 + x = 14$ $14 - x = 10$

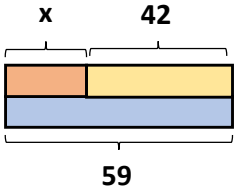


t + t + t = y y – t – t = t
3 x t = y y ÷ 3 = t
3t = y y ÷ t = 3

Solve one step equations (+/-)

There is more to this than just spotting the answer

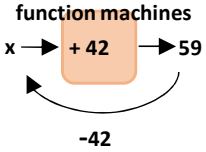
$x + 42 = 59$



x + 42 = 59
42 + x = 59

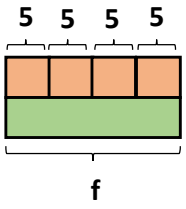
59 – x = 42
59 – 42 = x

Don't forget you know how to use function machines



Solve one step equations (x/÷)

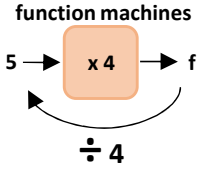
$\frac{f}{4} = 5$



f ÷ 4 = 5
f ÷ 5 = 4

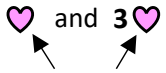
5 x 4 = f
4 x 5 = f

Don't forget you know how to use function machines



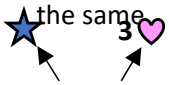
Like and unlike terms

Like terms are those whose variables are he same



and are **like** terms

the variable is the same



are **unlike** terms

the variables are NOT the same

Examples and non-examples

Like terms	Un-like terms
y, 7y	y, 7x
$2x^2$, x^2	$2x^2$, $2c^2$
ab, 10ba	ab, 10a
5, -2	5, -2t

Note here ab and ba are commutative operations, so are still like terms

Equivalence

Check equivalence by substitution
e.g. m=10

5m	2 x 2m	7m – 3m
5 x 10 = 50	2 x (2x10) = 2 x 20 = 40	(7x10) – (3x10) = 70 – 30 = 40

Equivalent expressions

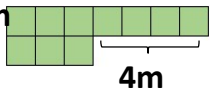
Repeat this with various values for m to check

5m

2 x 2m

4m

7m – 3m



4m

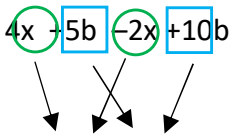
Collecting like terms ≡ symbol

The ≡ symbol means equivalent to.

It is used to identify equivalent expressions

Collecting like terms
Only **like terms** can be combined

$4x + 5b - 2x + 10b$



$2x + 15b$

Common misconceptions

$2x + 3x^2 + 4x \equiv 6x + 3x^2$

Although they both have the x variable x2 and x terms are un-like terms so can not be collected

Question 1 Simplify 3a – a + 4a - 3a	**Question 2** Simplify 8a – a -2a + 4a	**Question 3** Solve x – 10 = -8	**Question 4** Solve x – 10 + -6
Question 5 Simplify 7a + a + 3a + 3a	**Question 6** Simplify 4a + 3a – 4a + 5a	**Question 7** Solve 9 – x = 2	**Question 8** Solve 13 – x = 10
Question 9 Simplify 4a + 4a + 4a – 3a	**Question 10** Simplify 6x – 4x + 3x	**Question 11** Solve 8x = 80	**Question 12** Solve $\frac{x}{8}$ = 4
Question 13 Simplify 3x + 5x – 3x + 4x	**Question 14** Simplify 5a – 2a – a – 2a	**Question 15** Solve x + 4 = 8	**Question 16** Solve x + 4 = 11
Question 17 Simplify 6a – a + 3a – 2a	**Question 18** Simplify 8a + a + 3a + 2a	**Question 19** Solve x – 10 = 0	**Question 20** Solve 2x = 8

Answers 1.3a, 2. 9a, 3. X=2, 4. X=4, 5. 14a, 6. 8a, 7. X=7, 8. X=3, 9. 9a, 10.5x, 11. X=10, 12. X=32, 13. 9x,14. 0, 15. X=4, 16. X=7, 17. 6a, 18. 14a, 19.x=10, 20. X=4

Year 7 – Algebraic thinking…

Sequences

What do I need to be able to do?

By the end of this unit you should be able to:

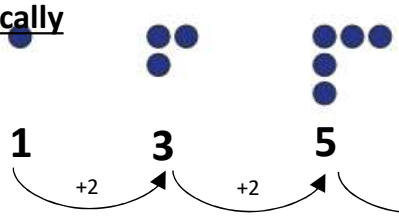
- Describe and continue both linear and non-linear sequences
- Explain term to term rules for linear sequence
- Find missing terms in a linear sequence

Keywords

Sequence: items or numbers put in a pre-decided order
Term: a single number or variable
Position: the place something is located
Rule: instructions that relate two variables
Linear: the difference between terms increases or decreases by the same value each time
Non-linear: the difference between terms increases or decreases in different amounts
Difference: the gap between two terms
Arithmetic: a sequence where the difference between the terms is constant
Geometric: a sequence where each term is found by multiplying the previous one by a fixed non zero number

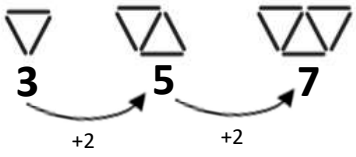
Describe and continue a sequence diagrammatically

Count the number of circles or lines in each image



What will the next number be? Can you draw this?

Predict and check terms



CHECK – draw the next terms

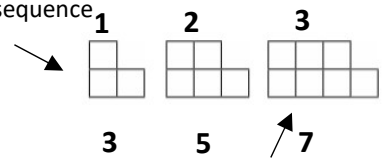
9 11 13

Predictions:
Look at your pattern and consider how it will increase.

e.g. How many lines in pattern 6?
Prediction - 13
If it is increasing by 2 each time - in 3 more patterns there will be 6 more lines

Sequence in a table and graphically

Position: the place in the sequence



"The **term** in **position** 3 has 7 squares"

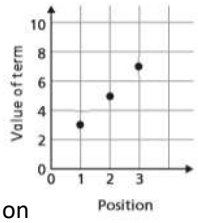
Term: the number or variable **(the number of squares in each image)**

In a tab

Position	1	2	3
Term	3	5	7

+2 +2

Graphically



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Linear and Non Linear Sequences

Linear Sequences – increase by addition or subtraction and the same amount each time

Non-linear Sequences – do not increase by a constant amount – quadratic, geometric and Fibonacci.

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division.

Fibonacci Sequence – look out for this type of sequence

0 1 1 2 3 5 8 …

Each term is the sum of the previous two terms.

Continue Linear Sequences

7, 11, 15, 19…

How do I know this is a linear sequence?
It increases by adding 4 to each term.
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant. (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Continue non-linear Sequences

1, 2, 4, 8, 16 …

How do I know this is a non-linear sequence?
It increases by multiplying the previous term by 2. – this is a geometric sequence because the constant is multiply by 2
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant. (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Explain term-to-term rule How you get from term to term

Try to explain this in full sentences not just with mathematical notation.
Use key maths language – doubles, halves, multiply by two, add four to the previous term etc.

To explain a whole sequence you need to include a term to begin at…

The next term is found by tripling the previous term. The sequence begins at 4.

4, 12, 36., 108..

x3 x3 x3

First term

Question 1 Find the missing numbers 31,_,21_,11,6	**Question 2** Find the missing numbers 35,_,25_,15,10	**Question 3** Find the next 2 terms 1,3,4,7	**Question 4** Find the next 2 terms 81,27,9
Question 5 Which of the equations will produce a straight line graph Y=$\frac{1}{x}$ + 2 or y +x +2?	**Question 6** Find the missing numbers 29,_,19,14,_14,_,4	**Question 7** Find the missing numbers 55,47,_,31,_,15	**Question 8** Find the next 2 terms 1,2,3,5
Question 9 Find the next 2 terms 256,64,16	**Question 10** Which of the equations will produce a straight line graph Y= 10x + 8 or Y = $\frac{8}{x+10}$?	**Question 11** Find the missing numbers 10,15,_,25,_,35	**Question 12** Find the missing numbers _,17,23,29,_,41
Question 13 Find the next 2 terms 81,27,9	**Question 14** Find the next 2 terms 10,50,250	**Question 15** Which of the equations will produce a straight line graph y=3x + 2 or Y= $\frac{3}{x}$ + 2 ?	**Question 16** Find the missing numbers _,49,39,29,19,_
Question 17 Find the missing numbers 3,_,15,21,_,33	**Question 18** Find the next 2 terms 5,2,7,9	**Question 19** Find the next 2 terms 81,27,9	**Question 20** Find the next 2 terms 30000,3000,300

Answers: 1.26,16,2.30,20,3.11,18,4.3,1,5.y+ x + 2,6. 24,9, 7. 39,23 8.8,13, 9.4,1, 10.y=10x + 8, 11.20,30, 12.11,35, 13.3,1, 14. 1250,6250, 15. Y= 3x +2, 16. 59,9, 17.9,27, 18.16,25, 19.3,1, 20.30,3

Year 7 – place value and proportion.

FDP equivalence

What do I need to be able to do?

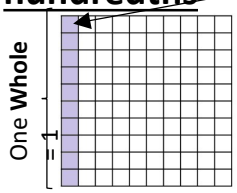
By the end of this unit you should be able to:

- .Convert fluently between fractions, decimals & percentages

Keywords

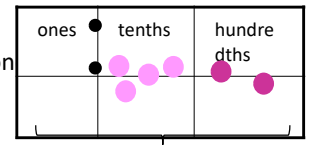
Fraction: how many parts of a whole we have
Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc.
Percentage: a proportion of a whole represented as a number between 0 and 100
Place value: the numerical value that a digit has decided by its position in the number
Placeholder: a number that occupies a position to give value
Interval: a range between two numbers
Tenth: one whole split into 10 equal parts
Hundredth: one whole split into 100 equal parts
Sector: a part of a circle between two radius (often referred to as looking like a piece of pie)
Recurring: a decimal that repeats in a given pattern

Tenths and hundredths



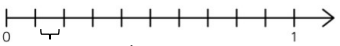
One **hundredth** (one whole split into 100 equal parts) = $\frac{1}{100}$ = 0.01

One **tenth** (one whole split into 10 equal parts) = $\frac{1}{10}$ = 0.1



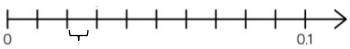
0 ones, 5 tenth and 2 hundredths
0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01
= 0 + 0.5 + 0.02
= **0.52**

On a number line



One tenth = $\frac{1}{10}$ = 0.1

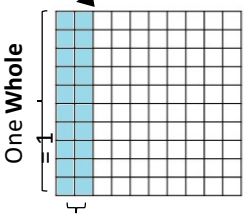
One whole – split into 10 equal parts

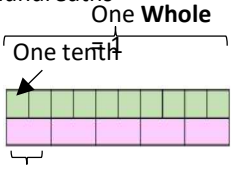


One hundredth = $\frac{1}{100}$ = 0.01

One tenth – split into 10 equal parts

Fifths



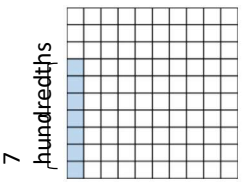


Two tenths = one fifth

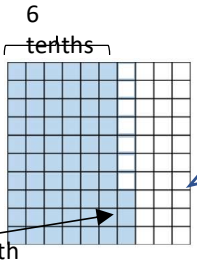
One **fifth** (one whole split into 5 equal parts) = $\frac{1}{5}$ = 0.2

Percentages on a hundred grid

100% = a whole = 100 hundredths



7 hundredths
7 out of 100
7%

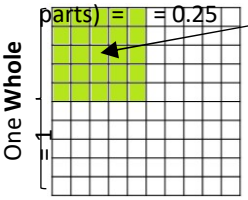


3 hundredths

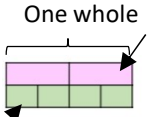
6 tenths and 3 hundredths
63 hundredths
63%

Quarters

One **quarter** (one whole split into 4 equal parts) = $\frac{1}{4}$ = 0.25



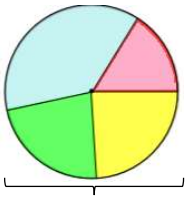
Twenty five hundredths



= 0.5

One quarter = 0.25

Simple pie charts



A pie chart has 360° so all FDP calculations are out of 360

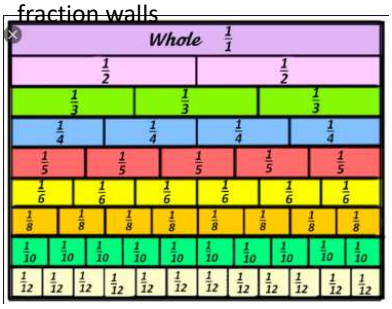
Split into 10 parts
= 10% = 36°

Split into 2 parts
= 50% = 180°

Split into 5 parts
= 20% = 72°

Equivalent fractions

Represent equivalence with fraction walls



Fractions – on a diagram

The denominator is represented by EQUALLY sized parts – this is split into quarters

Fractions – on a number line

This point is at the 6th part
6 is the **numerator**

One whole split into 18 equal parts
18 is the **denominator**

$\frac{6}{18}$ ← $\frac{3}{9}$ ← $\frac{1}{3}$

Convert FDP

$\frac{7}{100}$ → This also means 70 ÷ 100 → 70 out of 100 squares → **70 "hundredths"** = **7 "tenths"** **0.7**

70 hundredths = **70%**

Using a **calculator**

$\frac{\blacksquare}{\square}$ → S⇔D → Convert to a decimal

This will give you the answer in the simplest form

× 100 converts to a percentage

Be careful of recurring decimals
e.g $\frac{1}{3}$ = **0.3333333** = 0.3̇
The dot above the 3

Question 1 Express $\frac{19}{25}$ as a percentage	**Question 2** Express $\frac{9}{50}$ as a decimal	**Question 3** Complete the equivalent fraction: $\frac{2}{3} = \frac{\quad}{12}$	**Question 4** Complete the equivalent fraction: $\frac{6}{7} + \frac{\quad}{28}$
Question 5 Express $\frac{13}{20}$ as a decimal	**Question 6** Express $\frac{22}{25}$ as a percentage	**Question 7** Complete the equivalent fraction: $\frac{3}{8} = \frac{\quad}{56}$	**Question 8** Complete the equivalent fraction: $\frac{8}{9} = \frac{\quad}{81}$
Question 9 Express 60 as a fraction	**Question 10** Express 74 as a fraction	**Question 11** Complete the equivalent fraction: $\frac{3}{4} = \frac{\quad}{28}$	**Question 12** Complete the equivalent fraction: $\frac{4}{7} = \frac{\quad}{21}$
Question 13 Express 0.1 as a fraction	**Question 14** Express $\frac{47}{50}$ as a decimal	**Question 15** Complete the equivalent fraction: $\frac{2}{3} = \frac{\quad}{24}$	**Question 16** Complete the equivalent fraction: $\frac{5}{8} = \frac{\quad}{24}$
Question 17 Express $\frac{7}{10}$ as a decimal	**Question 18** Express $\frac{1}{25}$ as a percentage	**Question 19** Complete the equivalent fraction: $\frac{5}{9} = \frac{\quad}{27}$	**Question 20** Complete the equivalent fraction: $\frac{4}{7} = \frac{\quad}{84}$

Answers: 1. 76%, 2. 0.18, 3. 8, 4.24, 5. 0.65, 6. 88%, 7. 21, 8. 72, 9.$\frac{3}{5}$, 10. $\frac{37}{50}$, 11. 21, 12. 12, 13. $\frac{1}{10}$, 14. 0.94, 15.16, 16. 15, 17. 0.7, 18. 4%, 19. 15, 20. 48

Year 7 – Place Value and proportion

Ordering integers and decimals

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand place value and the number system including decimals
- Understand and use place value for decimals, integers and measures of any size
- Order number and use a number line for positive and negative integers, fractions and decimals;
- use the symbols $=, \neq, <, >$
- Work with terminating decimals and their corresponding fractions
- Round numbers to an appropriate accuracy
- Describe, interpret and compare data distributions using the median and range

Keywords

Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with
Integer: a whole number that is positive or negative
Interval: between two points or values
Median: A measure of central tendency (middle, average) found by putting all the data values in order and finding the middle value of the list.
Negative: Any number less than zero; written with a minus sign.
Place holder: We use 0 as a place holder to show that there are none of a particular place in a number
Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right
Range: The difference between the largest and smallest numbers in a set
Significant figure: A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal fraction is the first non-zero number after the decimal point.

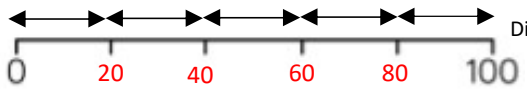
Integer Place Value

Billions			Millions			Thousands			Ones		
H	T	O	H	T	O	H	T	O	H	T	O
		3	1	4	8	0	3	3	0	2	9

Placeholder

Three billion, one hundred and forty eight million, thirty three thousand and twenty nine
1 billion 1, 000, 000, 000
1 million 1. 000, 000

Intervals on a number line



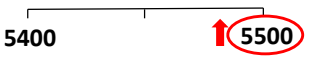
Divide the difference by the number of intervals (gaps).
E..g. 100 ÷ 5 = 20

Rounding to the nearest power of ten

If the number is halfway between we "**round up**"

5495 to the nearest 1000

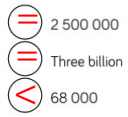
5475 to the nearest 100



5475 to the nearest 10

Compare integers using $<, >, =, \neq$

$<$ *less than*
$>$ greater than
$=$ equal to
$\neq$ not equal to



Question 1 Write in ascending order: 0.06,0.5,0.65	**Question 2** Write in ascending order: 0.7,0.08,0.82	**Question 3** Round 50 correct to 1 significant figure	**Question 4** Round 0.06574 correct to 1 significant figure
Question 5 Write in figures: Four hundred million and twenty two thousand	**Question 6** Write in figures: Three hundred million one hundred and two thousand	**Question 7** Find the median: 6,12,3,11,6	**Question 8** Find the median: 7,10,7,12,7,12
Question 9 Write in ascending order: 3.26, 0.437, 3.07	**Question 10** Write in ascending order: 0.17, 0.2, 0.02	**Question 11** Round 0.0032227 correct to 1 significant figure	**Question 12** Round 0.0218 correct to 1 significant figure
Question 13 Write in figures: sixty three million six hundred	**Question 14** Write in figures: seven hundred and nine million and one	**Question 15** Write in ascending order: 0.8, 0.08, 0.96	**Question 16** Find the range: 12,3,5,6,12,15,3
Question 17 Find the range: 6,15,10,15,6,6,6	**Question 18** Round 6762 correct to 1 significant figure	**Question 19** Round 5059 correct to 1 significant figure	**Question 20** Find the median: 13,15,7,10,14

Answers: 1. 0.06,0.5,0.65, 2. 0.08,0.7,0.82, 3. 50, 4. 0.07, 5. 400022000, 6. 300102000, 7. 6, 8. 8.5, 9. 0.437,3.07,3.26, 10. 0.02,0.17,0.2, 11. 0.003, 12. 00.02, 13. 63000600, 14. 709000001, 15.0.08,0.8,0.96, 16. 12, 17. 9, 18. 7000, 19. 5000, 20. 13

Year 7 – application of number

Solving problems with addition and subtraction

What do I need to be able to do?

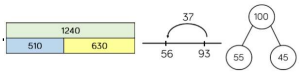
By the end of this unit you should be able to:

- Understand properties of addition/ subtraction
- Use mental strategies for addition/subtraction
- Use formal methods of addition/Subtraction for integers
- Use formal methods of addition/Subtraction for decimals
- Solve problems in context of perimeter
- Solve problems with finance, tables and timetables
- Solve problems with frequency trees
- Solve problems with bar charts and line charts

Keywords

Commutative: changing the order of the operations does not change the result
Associative: when you add or multiply you can do so regardless of how the numbers are grouped
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Placeholder: a number that occupies a position to give value
Perimeter: the distance/ length around a 2D object
Polygon: a 2D shape made with straight lines
Balance: in financial questions – the amount of money in a bank account
Credit: money that goes into a bank account
Debit: money that leaves a bank account

Addition/ Subtraction with



Modelling methods for addition/ subtraction

- Bar models
- Number lines
- Part/ Whole diagrams

Addition is commutative

6 + 3 = 3 + 6

The order of addition does not change the result

Subtraction the order has to stay the same

360 – 147 = 360 – 100 – 40 – 7

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction
- Show your relationships by writing fact families

Formal written methods

	H	T	O
	1	8	7
+	5	4	2

	H	T	O
	4	2	7
–	2	4	9

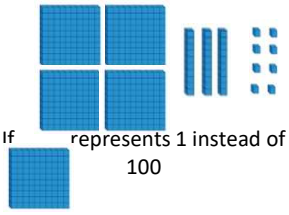
Remember the place value of each column.
You may need to move 10 ones to the ones column to be able to subtract

Addition/ Subtraction with decimals

4	.	3	8	
7	.	9	0	+

0 can be used to fill empty places with value

The decimal place acts as the placeholder and aligns the other values



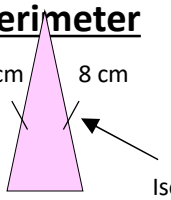
If represents 1 instead of 100

$5.43 + \frac{8}{10}$

Revisit Fraction – Decimal equivalence
5.43 + 0.8

Solve problems with perimeter

Perimeter is the length around the outside of a polygon



Isosceles Triangle notation

The triangle has a perimeter of 25cm. Find the length of x

8cm + 8cm + $x$cm = 25cm

16cm + $x$cm = 25cm

$x$cm = 9cm

Solve problems with

Profit= Income - Costs

Credit – Money coming into an account

Debit – Money leaving an account

Money uses a two decimal place system.
14.2 on a calculator represents £14.20

Check the units of currency – work in the same unit

Tables and timetables

Distance tables

London

211	Cardiff		
556	493	Glasgow	
518	392	177	Belfast

This shows the distance between Glasgow and London.
It is where their row and column intersects

Bus/ Train timetables

Harton	1005	1045	1130
Bridge	1024	1106	1147
Aville	1051	1133	1205
Ware	1117	1202	1233

Each column represents a journey, each row represents the time the 'bus' arrives at that location
TIME CALCUALTIONS – use a number line

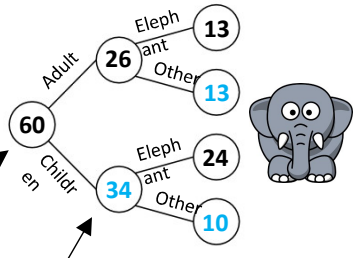
Two-way tables

	H	T
H	HH	HT
T	TH	TT

Where rows and columns intersect is the outcome of that action.

Frequency trees

60 people visited the zoo one Saturday morning.
26 of them were adults. 13 of the adult's favourite animal was an elephant. 24 of the children's favourite animal was an elephant.

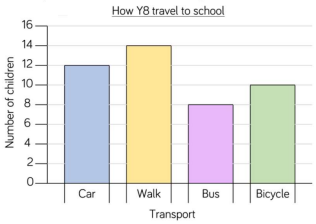


The overall total "60 people'

A frequency tree is made up from part-whole models. One piece of information leads to another

Probabilities or statements can be taken from the completed trees e.g. 34 children visited the zoo

Bar and line charts



Use addition/ subtraction methods to extract information from bar charts.

e.g. Difference between the number of students who walked and took the bus.
Walk frequency – bus frequency

When describing changes or making predictions.

- Extract information from your data source
- Make comparisons of difference or sum of values.
- Put into the context of the scenario

Question 1 **Complete 11018 + _____= 13873**	**Question 2** **Complete _____- 2121= 18021**	**Question 3** **Calculate 47.1 – 2**	**Question 4** **Calculate 7.19 – 0.23**
Question 5 **Complete 8765- _____= 8490**	**Question 6** **Coomplete _____-19235 = 13146**	**Question 7** **Calculate 3.36 + 88.6**	**Question 8** **Calculate 0.466 + 16**
Question 9 **Complete _____19905 = 12063**	**Question 10** **Complete 11969 + _____ = 207711**	**Question 11** **Calculate 6.18 + 0.471**	**Question 12** **Calculate 63.5 + 0.265**
Question 13 **Complete 12445- _____ = 12311**	**Question 14** **Complete 2540 + _____ = 16107**	**Question 15** **Calculate 60.1 – 0.835**	**Question 16** **Calculate 49.1 – 46.7**
Question 17 **Complete 4404 + _____ = 8665**	**Question 18** **Complete 2701 + _____ = 12547**	**Question 19** **Calculate 26.8 – 9.35**	**Question 20** **Calculate 4.8 – 0.586**

Answers:1. 2855, 2. 20142, 3. 45.1,, 4. 6.96, 5. 275, 6. 32381, 7. 91.96, 8. 16.466, 9. 31968, 10. 8802, 11. 6.651, 12. 63.765, 13. 134, 14. 13567, 15. 59.265, 16. 2.4, 17. 4261, 18. 9846, 19. 17.45, 20. 4.214

Year 7 – application of number

Fractions and percentages of amounts

What do I need to be able to do?

By the end of this unit you should be able to:

- Find a fraction of a given amount
- Use a given fraction to find the whole or other fractions
- Find the percentage of an amount using mental methods
- Find the percentage of a given amount using a calculator

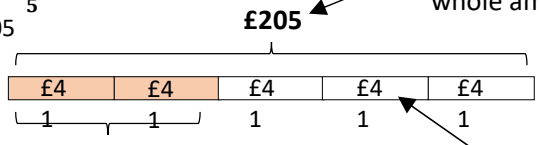
Keywords

Fraction: how many parts of a whole we have
Equivalent: of equal value
Whole: a number with no fractional or decimal part.
Percentage: parts per 100 (uses the % symbol)
Place Value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right
Convert: change into an equivalent representation, often fraction to decimal to a percentage cycle.

Fraction of a given amount

Find $\frac{2}{5}$ of £205

The bar represents the whole amount

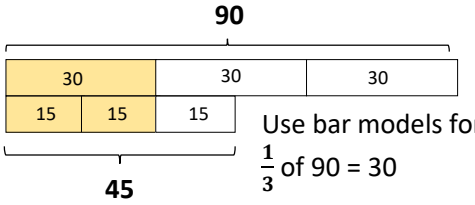


2 out of the 5 equal parts

£205 ÷ 5 = £41

Each part of the bar model represents £41.

2 x £41 = **£82**



Use bar models for comparisons

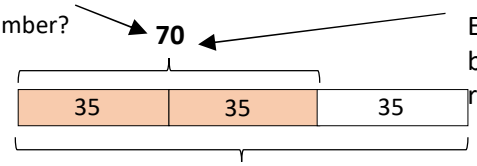
$\frac{1}{3}$ of 90 = 30

$\frac{2}{3}$ of 45 = 30

$\therefore \frac{1}{3}$ of 90 = $\frac{2}{3}$ of 45

Use a fraction of amount

$\frac{2}{3}$ of a value is 70. What is the whole number?



70 ÷ 2 = 35

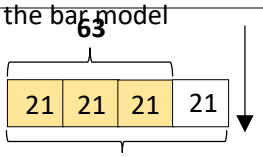
Each part of the bar model represents 35.

35 x 3 = **105**

The whole number is 105

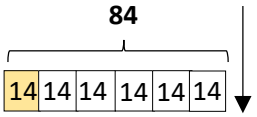
The wording of the question is important to setting up the bar model

$\frac{3}{4}$ of a number is 63.



Find the whole

What is $\frac{1}{6}$ of the number?



Use the whole to find a given part

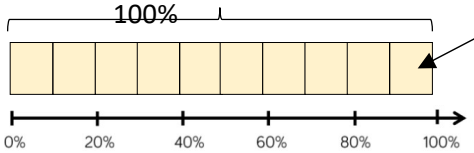
=1

4

Find the percentage of an amount (Mental methods)

The **whole** represents 100%

10% = $\frac{1}{10}$ of the whole



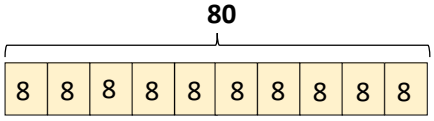
10% = $\frac{1}{10}$ of the whole

50% = $\frac{5}{10}$ = $\frac{1}{2}$ of the whole

20% = $\frac{2}{10}$ = $\frac{1}{5}$ of the whole

5% = $\frac{1}{20}$ of the whole

Find 65% of 80



For bigger percentages it is sometimes easier to take away from 100%

Method 1:
65% = 10% x 6 + 5%
= (8 x 6) + 4
= 52

Method 2:
65% = 50% + 10% + 5%
= 40 + 8 + 4
= 52

Find the percentage of an amount (Calculator methods)

Using a multiplier

Find 65% of 80

Fraction, decimal, percentage conversion

65% = $\frac{65}{100}$ = 0.65 ← The multiplier

0 • 65 x 80 = **52**

Using the percent button

Find 65% of 80

This brings up the % button on screen

You will see 65%

Type **65**

Press SHIFT ((%)

Press × **80** and then press =

You can also use the calculator to support non calculator methods and find 1% or 10% then add percentages together

"of" can represent 'x' in calculator methods

Questiion 1 Calculate $\frac{3}{14}$ of £560	Question 2 Calculate $\frac{3}{7}$ of £511	Question 3 Calculate $\frac{5}{13}$ of £377	Question 4 Calculate $\frac{4}{11}$ of £297
Question 5 Calculate $\frac{3}{4}$ of £64	Question 6 Calculate $\frac{1}{14}$ of £854	Question 7 Calculate $\frac{7}{9}$ of £135	Question 8 Calculate $\frac{7}{13}$ of £481
Question 9 Calculate $\frac{2}{3}$ of £138	Question 10 Calculate $\frac{11}{13}$ of £377		

Answers:1.£120, 2. £219, 3. £145, 4. £108, 5. £48, 6. £61, 7. £105, 8.£259, 9. £92, 10. £319

Year 7 – application of number

Solving problems with multiplication and division

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand and use factors
- Understand and use multiples
- Multiply/ Divide integers and decimals by powers of 10
- Use formal methods to multiply
- Use formal methods to divide
- Understand and use order of operations
- Solve area problems
- Solve problems using the mean

Keywords

Array: an arrangement of items to represent concepts in rows or columns
Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number.
Mili: prefix meaning one thousandth
Centi: prefix meaning one hundredth.
Kilo: prefix meaning multiply by 1000
Quotient: the result of a division
Dividend: the number being divided
Divisor: the number we divide by.

Factors

Arrays can help represent factors

5 x 2 or 2 x 5

10 x 1 or 1 x 10

Factors of 10
1, 2, 5, 10

The number itself is always a factor

Square numbers have an **ODD number** of factors

Factors of 4
1, 2, 4

Factors of 36
1, 2, 3, 4, 6, 9, 12, 18, 36

Be strategic - Lay factors out in pairs can help you not to miss any

Multiples

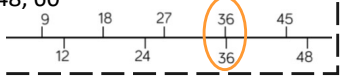
Bar models can represent by something is a multiple. E.g. 20 is a multiple of 4

:Lowest Common Multiples

The first time the multiples match **LCM = 36**

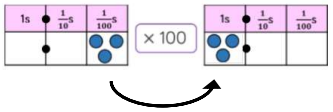
9 9, 18, 27, 36, 45, 54

12 12, 24, 36, 48, 60



Multiply/ Divide by powers of 10

3 x 100 = 300



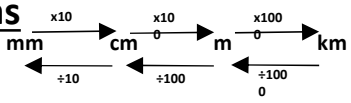
0.03 x 100 = 3

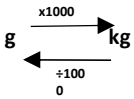
Repeated multiplication and division by powers of 10 is commutative

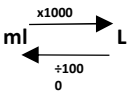
÷ 10 then ÷ 10 → ÷ 100

Metric conversions

Useful Conversions

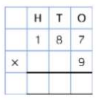




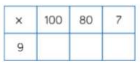


Multiplication methods

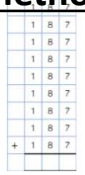
Less effective method especially for bigger multiplication



Long multiplication (column)



Grid method



Repeated addition

Multiplication with decimals

Perform multiplications as integers

e.g. 0.2 x 0.3 → 2 x 3

Make **adjustments** to your answer to match the question:

0.2 x 10 = 2

0.3 x 10 = 3

Therefore 6 ÷ 100 = **0.6**

Estimations: Using estimations allows a 'check' if your answer is reasonable

Division methods

3584 ÷ 7 = **512**

Short division

	5	**1**	**2**
7	3	35	8 14

Complex division

÷ 24 = ÷ **6** ÷ **4**

Break up the divisor using factors

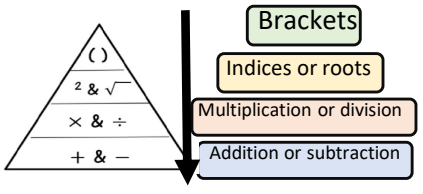
Division with decimals

The placeholder in division methods is essential – the decimal lines up on the dividend and the quotient

2.4 ÷ 0.02 → 24 ÷ 0.2 → 240 ÷2

All give the same solution as represent the same proportion.
Multiply the values in proportion until the divisor becomes an integer

Order of operations



If you have multiple operations from the same tier work from left to right

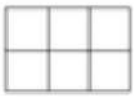
e.g. 10 – 3 + 5 → 10 - 3 → 7 + 5

6 x 4 + 8 x 2

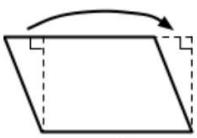
24 + 16 = 40

Area problems

Rectangle
Base x Perpendicular height

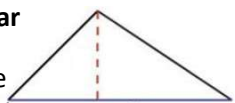


Parallelogram/ Rhombus
Base x Perpendicular height



Triangle
½ x Base x Perpendicular height

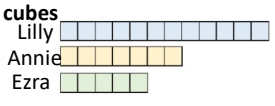
A triangle is half the size of the rectangle it would fit in



Mean problems

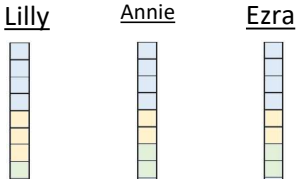
Mean – a measure of average
It gives an idea of the central value

Lilly, Annie and Ezra have the following cubes



24 in total

Finding the mean amount is the average amount each person would have if shared out equally



The mean number of blocks would be 8 each

Questions 1 What is the highest common factor of 77and 147?	**Questions 2** What is the highest common factor of 55 and 50	**Questions 3** Find the lowest multiple of 18 and 15	**Questions 4** Find the lowest common multiple of 30 and 6
Questions 5 Work out 93.9 x 10000 =	**Questions 6** Work out 9710 x 1000 =	**Questions 7** Work out 0.174 ÷ 100 =	**Questions 8** Complete: 4km = _____m
Questions 9 Complete: 5000m = _____km	**Questions 10** Work out 632 ÷ 10000 =	**Questions 11** Work out 1480 x 0.1 =	**Questions 12** What is the higher common factor of 120 and 72?
Questions 13 What is the highest common factor of 134 and 67?	**Questions 14** Find the lowest common multiple of 24 and 8	**Questions 15** Find the lowest common multiple of 22 and 11	**Questions 16** Work out 0.029 x 1000 =
Questions 17 Work out 0.7886 x 10 =	**Questions 18** Work out 362 ÷ 1000 =	**Questions 19** Complete: 9m= _____cm	**Questions 20** Complete: 5000ml = _____litres

Answers: 1. 7, 2. 5, 3. 90, 4. 30, 5. 939000, 6. 9710000, 7. 0.00174, 8. 4000, 9. 5, 10. 0.0632, 11. 148, 12. 24, 13. 67, 14. 24, 15. 22, 16. 29, 17. 7.86, 18. 0.362, 19. 900, 20. 5

Year 7 – directed number

Operations with equations and directed numbers

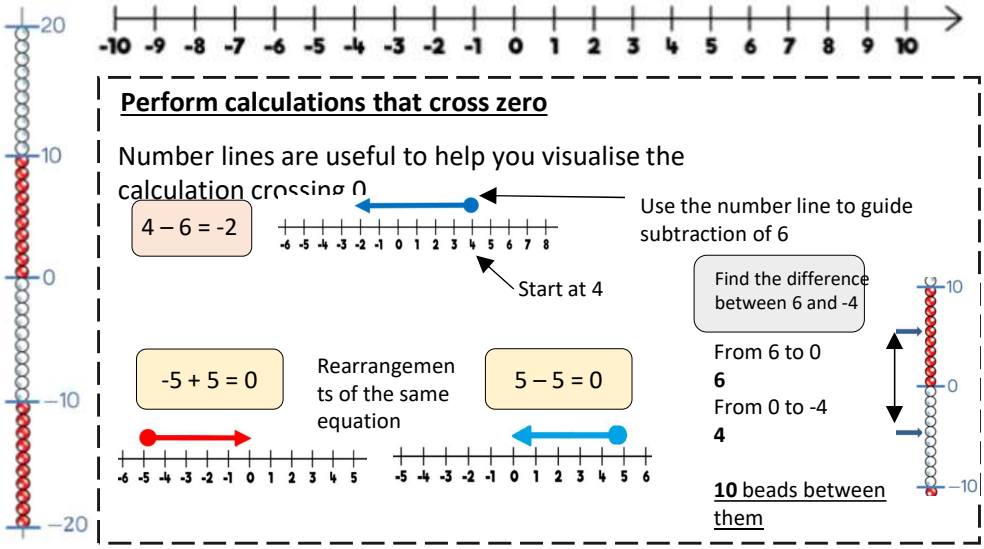
What do I need to be able to do?

By the end of this unit you should be able to:

- Perform calculations that cross zero
- Add/ Subtract directed numbers
- Multiply/ Divide directed numbers
- Evaluate algebraic expressions
- Solve two-step equations
- Use order of operations with directed number

Keywords

Subtract: taking away one number from another.
Negative: a value less than zero.
Commutative: changing the order of the operations does not change the result
Product: multiply terms
Inverse: the opposite function
Square root: a square root of a number is a number when multiplied by itself gives the value (symbol $\sqrt{}$)
Square: a term multiplied by itself.
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)



Perform calculations that cross zero

Number lines are useful to help you visualise the calculation crossing 0

4 – 6 = -2

Use the number line to guide subtraction of 6

Start at 4

-5 + 5 = 0

Rearrangements of the same equation

5 – 5 = 0

Find the difference between 6 and -4

From 6 to 0
6
From 0 to -4
4

10 beads between them

Add directed number

2 + - 4 = -2

= –1
= 1
Representations

Zero pair
(-1 + 1 = 0)

Two " – 1 " left
= =2

8 + -3 = 5

Partitioning

8 + -3 = 5

5 + 3 + - 3 = 5

Partition the value to create a zero pair calculation

Generalisation
+ - = -

Subtract directed numbers

= –1
= 1
Representations

2

"Subtract" – means take away or remove

Representation for calculation

2 - - 1 = 3

Take away

= 3

Start with the representation of 2

2 - - 3 = 5

= 5

Generalisation
- - = +

Multiply/ Divide directed

-3 -3

Two representations of the same calculation

2 x -3 = -6

-2 x -3

Negative, Negative calculation

This is the negative of 2 x -3

The act of making counters into their negative is turning them over

-2 x -3 = 6

Divisions are the inverse operations

Evaluate algebraic expressions

a = 5

b = -4

$a^2 = 5^2$
$a^2 = 25$

$b^2 = (-4)^2$
$b^2 = 16$

With negative numbers the brackets are important so that it performs -4 x -4.

Brackets around negative substitutions helps remove calculation errors

2a – b = 2 x 5 – (-4) = 10 + 4 = 14

3b – 2a = 3(-4) – 2(5) = -12 – 10 = -22

Two-step equations

Bar Model

10

x x x x 2

10

4x + 2 = 10

10 – 4x = 2

Representing the same question (use fact families)

x x x x

8

x

2

Function machine

x → x4 → +2 → 10

Inverse operations to find x

Use order or operations

( )
² & √
× & ÷
+ & –

Brackets
Indices or roots
Multiplication or division
Addition or subtraction

Brackets around negative substitutions helps remove calculation errors

Remember square roots have a positive and negative value

×	-3	-2	-1	0	1	2	3
-3	9	6	3	0	-3	-6	-9
-2	6	4	2	0	-2	-4	-6
-1	3	2	1	0	-1	-2	-3
0	0	0	0	0	0	0	0
1	-3	-2	-1	0	1	2	3
2	-6	-4	-2	0	2	4	6
3	-9	-6	-3	0	3	6	9

Question 1 Work out -8-3	Question 2 Work out -1- - 1	Question 3 Work out 42 ÷ -6 =	Question 4 Work out 24 ÷ -6 =
Question 5 Solve 5x – 10 =5	Question 6 Solve 3x – 10 =20	Question 7 Find the missing number ? - -5 =8	Question 8 Find the missing number ? -2 = -8
Question 9 Work out -4 + 2	Question 10 Work out 2 - -3	Question 11 Work out -3 x -9 =	Question 12 Work out 44 ÷ -11 =
Question 13 Solve 11x + 10 =98	Question 14 Solve 2x – 8 = 0	Question 15 Find the missing number ? + 1 = -5	Question 16 Find the missing number 1 - ? = 7
Question 17 Work out – 1 + - 6	Question 18 Work out 4 - -3	Question 19 Find the value of x + 8, when x = -6	Question 20 Find the value of 7x – 11, when x= -1

Answers: 1. -11 2. 0 3. -7 4. -4 5. 3 6. 10 7. 3 8. -6 9. -2 10. 5 11. 27 12. -4 13. 8 14. 4 15. -6 16. -6 17. -7 18. 7 19. 2 20. -18

Year 7 – Fractional Thinking

Addition and subtraction of fractions

What do I need to be able to do?

By the end of this unit you should be able to:

- Convert between mixed numbers and fractions
- Add/Subtract unit fractions (same denominator)
- Add/Subtract fractions (same denominator)
- Add/Subtract fractions from integers
- Use equivalent fractions
- Add/Subtract any fractions
- Add/Subtract improper fractions and mixed numbers
- Use fractions in algebraic contextS

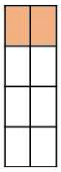
Keywords

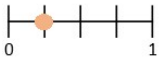
Numerator : the number above the line on a fraction. The top number. Represents how many parts are taken
Denominator: the number below the line on a fraction. The number represent the total number of parts
Equivalent: of equal value
Mixed numbers: a number with an integer and a proper fraction
Improper fractions: a fraction with a bigger numerator than denominator
Substitute: replace a variable with a numerical value
Place value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right

Representing

ons

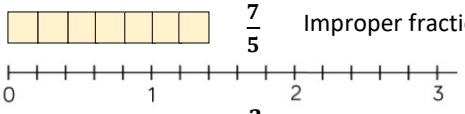
$\frac{1}{4}$ is represented in all the images





$1 \div 4$

Mixed numbers and fractions



$\frac{7}{5}$ Improper fraction

$1\frac{2}{5}$ Mixed number

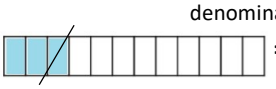
In this model 5 parts make up a whole

Fractions can be bigger than a whole

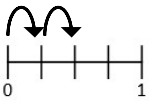
Add/Subtract unit fractions

Same denominator

$\frac{1}{12} + \frac{1}{12} - \frac{1}{12} = \frac{2}{12}$



$\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$



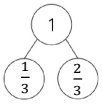
With the same denominator ONLY the numerator is added or subtracted

Add/Subtract fractions

Same denominator

$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$

Sequences



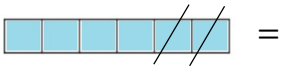
$\frac{1}{3}, 1, 1\frac{2}{3}, 2\frac{1}{3}, 3, \ldots$

$+\frac{2}{3}$ $+\frac{2}{3}$

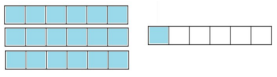
Represent this on a number line to help

Add/Subtract from integers

$1 - \frac{2}{6} = \frac{4}{6}$



$3 + \frac{1}{6} = 3\frac{1}{6}$

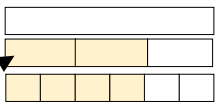


The denominator indicates the number of parts a whole is made up of

Equivalent fractions

$\frac{2}{3} = \frac{4}{6}$

Numerator and denominator have the same multiplier



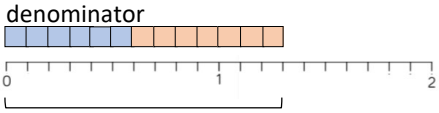
$\frac{1}{3} = \frac{2}{6}$

Add/Subtraction fractions (common multiples)

$\frac{3}{5} + \frac{7}{10}$

$\frac{6}{10} + \frac{7}{10}$

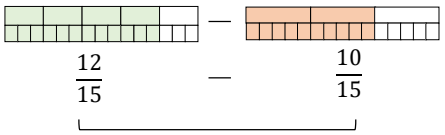
Addition/Subtraction needs a common denominator



$\frac{13}{10}$

Add/Subtraction any fractions

$\frac{4}{5} - \frac{2}{3}$



$= \frac{2}{15}$

$\frac{12}{15}$ — $\frac{10}{15}$

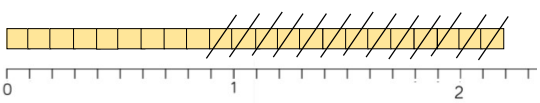
Use equivalent fractions to find a common multiple for both denominators

Add/Subtraction fractions (improper and mixed)

$2\frac{1}{5} - 1\frac{3}{10}$

$2\frac{2}{10}$

$\frac{22}{10} - \frac{13}{10} = \frac{9}{10}$



- Convert to an improper fraction
- Calculate with common denominator

Partitioning method

$2\frac{1}{5} - 1\frac{3}{10} = 2\frac{2}{10} - 1\frac{3}{10} = 2\frac{2}{10} - 1 - \frac{3}{10} = 1\frac{2}{10} - \frac{3}{10} = \frac{9}{10}$

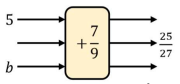
Fractions in algebraic contexts

$p = 5 \quad m = 2$

$k - \frac{5}{8} = 2$

Apply inverse operations

$k = 2 + \frac{5}{8}$



Form expressions with fractions

$b + \frac{7}{9} \rightarrow b + \frac{7}{9}$

$\frac{p}{8} + \frac{1}{m}$

Substitution

$\frac{5}{8} + \frac{1}{2}$

Fractions and decimals

$\frac{1}{10} = 0.1$

$\frac{1}{100} = 0.01$

Example $\frac{6}{10} + 0.3 \rightarrow 0.6 + 0.3$

$\frac{6}{10} + \frac{3}{10}$

Remember to use equivalent fractions and common denominators

Question 1 Express $\frac{23}{50}$ as a decimal	Question 2 Express $\frac{43}{3}$ as a mixed number	Question 3 Express $\frac{24}{7}$ as mixed number	Question 4 Work out $\frac{4}{5} - \frac{3}{8}$
Question 5 Work out $\frac{3}{4} - \frac{3}{5}$	Question 6 Express $\frac{1}{5}$ as a percentage	Question 7 Express $\frac{1}{10}$ as a percentage	Question 8 Express $\frac{30}{13}$ as a mixed number
Question 9 Express $5\frac{1}{6}$ as an improper fraction	Question 10 Work out $\frac{3}{5} + \frac{1}{3}$	Question 11 Work out $\frac{1}{3} - \frac{2}{7}$	Question 12 Express $\frac{2}{5}$ as a percentage
Question 13 Express $\frac{27}{50}$ as a decimal	Question 14 Express $\frac{41}{9}$ as a mixed number	Question 15 Express $\frac{35}{6}$ as a mixed number	Question 16 Work out $\frac{3}{7} + \frac{1}{4}$
Question 17 Work out $\frac{3}{4} + \frac{5}{7}$	Question 18 Express $\frac{1}{25}$ as a percentage	Question 19 Express $\frac{3}{4}$ as a percentage	Question 20 Express $1\frac{11}{13}$ as an improper fraction

Answers: 1. 0.46, 2. $14\frac{1}{3}$, 3. $3\frac{3}{7}$, 4. $\frac{17}{40}$, 5. $\frac{3}{20}$, 6. 20%, 7. 10%, 8. $2\frac{4}{13}$, 9. $\frac{31}{6}$, 10. $\frac{14}{15}$, 11. $\frac{1}{21}$, 12.40%, 13. 0.54, 14. $4\frac{5}{9}$, 15. $5\frac{5}{6}$, 16. $\frac{19}{28}$, 17. $1\frac{13}{28}$, 18. 4%, 19. 75%, 20. $\frac{24}{13}$

Year 7 – lines and angles

Constructing, measuring and using geometric notation

What do I need to be able to do?

By the end of this unit you should be able to:

- Use letter and labelling conventions
- Draw and measure line segments and angles
- Identify parallel and perpendicular lines
- Recognise types of triangle
- Recognise types of quadrilateral
- Identify polygons
- Construct triangles (SAS, SSS, ASA)
- Draw Pie charts

Keywords

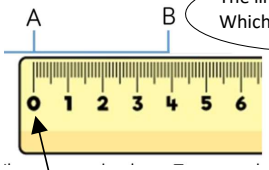
Polygon: A 2D shape made with straight lines
Scalene triangle: a triangle with all different sides and angles
Isosceles triangle: a triangle with two angles the same size and two angles the same size
Right-angled triangle: a triangle with a right angle
Frequency: the number of times a data value occurs
Sector: part of a circle made by two radii touching the centre
Rotation: turn in a given direction
Protractor: equipment used to measure angles
Compass: equipment used to draw arcs and circles.

Letter and labelling convention

Angle Notation: three letters **ABC**
This is the angle at B = 113 °
Line Notation: two letters **EC**
The line that joins E to C.

Draw and measure line segments

Conversions 1cm = 10mm, 1m = 100cm



The line segment is 3.9cm
Which is 39mm

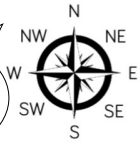
AB is a line segment (part of the line)

Make sure the start of the line is at 0;

Angles as measures of turn

Clockwise Anti-Clockwise

East to South is a quarter turn clockwise



Quarter Turn 90° Clockwise
Half Turn 180°
Three-quarter Turn 270° Anti-Clockwise
Full Turn 360°

Classify angles

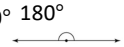
Acute Angles 0°< angle <90°

Right Angles 90°

Right angle notation

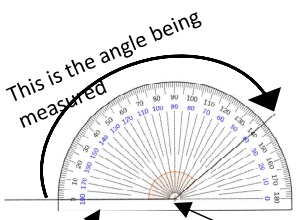
Obtuse 90°< angle <180°

Reflex 180°< angle <360°



Straight Line 180°

Measure angles to 180°



Read from 0° on the base line. Remember to use estimation. This is an obtuse angle so between 90 ° and 180 °

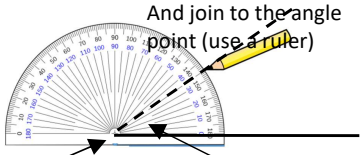
The base line follows the line segment

Make sure the cross is at the point the two lines meet

Draw angles up to 180°

Draw a 35° angle

Make a mark at 35° with a pencil
And join to the angle point (use a ruler)

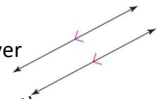


Make sure the cross is at the end of the line (where you want the angle)

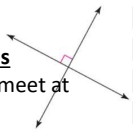
The angle

Parallel and Perpendicular lines

Parallel lines
Straight lines that never meet
(Have the same gradient)



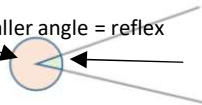
Perpendicular lines
Straight lines that meet at 90°



Angles over 180°

Use your knowledge of straight lines 180 ° and angles around a point 360 °

360 ° - smaller angle = reflex angle



Measure the smaller angle first (less than 180 °

Properties of Quadrilaterals

Square
All sides equal size
All angles 90°
Opposite sides are parallel

Rectangle
All angles 90°
Opposite sides are parallel

Rhombus
All sides equal size
Opposite angles are equal

Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Trapezium
One pair of parallel lines

Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

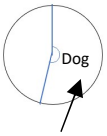
Draw Pie Charts

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

$\frac{32}{60}$ "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60}$ X 360 = 192°



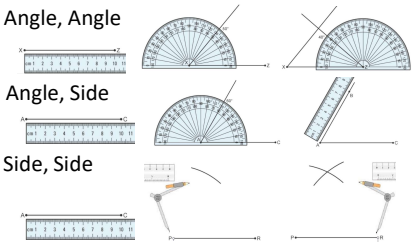
Use a protractor to draw
This is 192°

SAS, SSS, ASA constructions

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side



Polygons

3	- Triangle	5	- Pentagon	8	- Octagon
4	- Quadrilateral	6	- Hexagon	9	- Nonagon
		7	- Heptagon	10	- Decagon

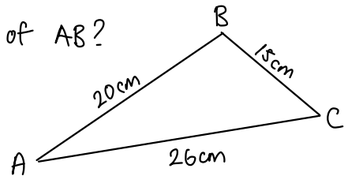
If all the sides and angles are the same, it is a **regular** polygon

Question 1

What is a polygon?

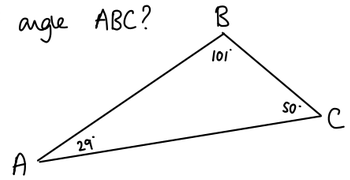
Question 2

What is the length of AB?



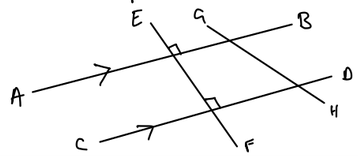
Question 3

What is the size of angle ABC?



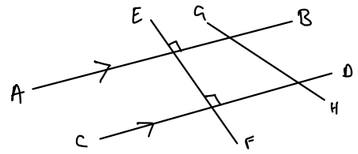
Question 4

Which lines are parallel?



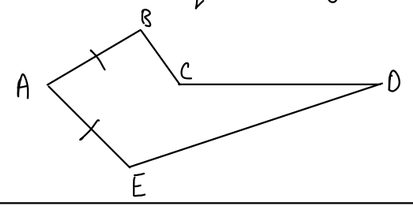
Question 5

Which line is perpendicular to AB?



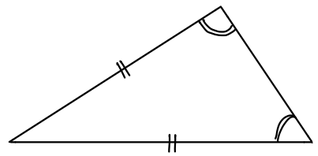
Question 6

Which two lines are equal in length?



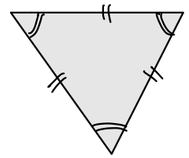
Question 7

What type of triangle is this?



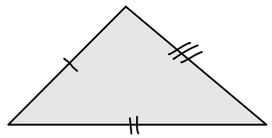
Question 8

What type of triangle is this?



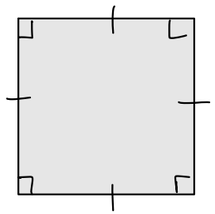
Question 9

What type of triangle is this?



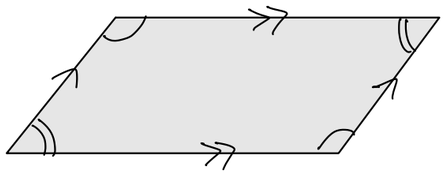
Question 10

Write down the mathematical name for this shape:



Question 11

Write down the mathematical name for this shape:



Question 12

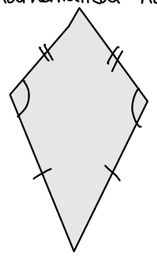
How many degrees are there in a full turn?

Question 13

What angle is needed to represent 40 out of 60 on a pie chart?

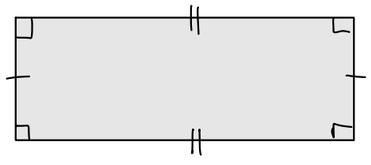
Question 14

Write down the mathematical name for this shape:



Question 15

Write down the mathematical name for this shape:



Question 16

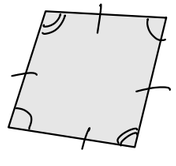
What angle is needed to represent 150 out of 240 on a pie chart?

Question 17

What angle is needed to represent 12 out of 72 on a pie chart?

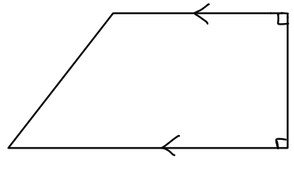
Question 18

Write down the mathematical name for this shape:



Question 19

Write down the mathematical name for this shape:



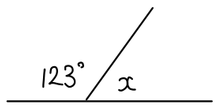
Question 20

What angle is needed to represent 84 out of 100 on a pie chart?

Answers: 1. A 2D shape with straight sides 2. 20cm 3. 101° 4. AB and CD 5. EF 6. AB and AE 7. Isosceles 8. Equilateral 9. Scalene 10. Square 11. Parallelogram 12. 360°. 13. 240° 14. Kite 15. Rectangle 16. 225° 17. 60° 18. Rhombus 19. Trapezium 20. 302.4°

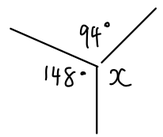
Question 1

Calculate the angle marked x



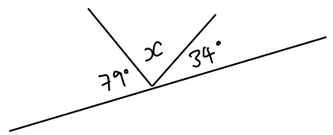
Question 2

Calculate the angle marked x



Question 3

Calculate the angle marked x

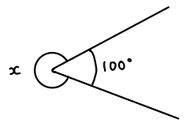


Question 4

Calculate the angle marked x

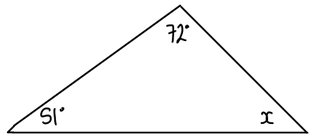
Question 5

Calculate the angle marked x



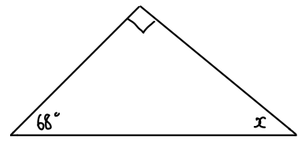
Question 6

Calculate the angle marked x



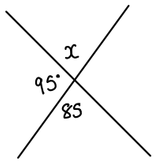
Question 7

Calculate the angle marked x



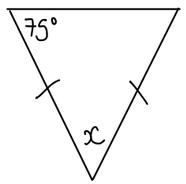
Question 8

Calculate the angle marked x



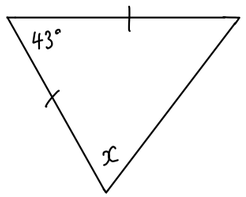
Question 9

Calculate the angle marked x



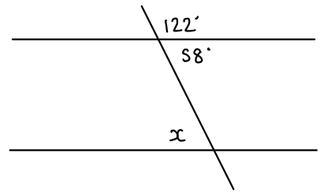
Question 10

Calculate the angle marked x



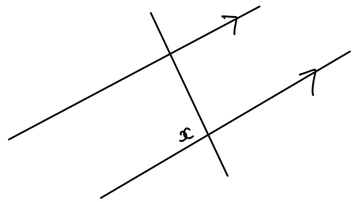
Question 11

Calculate the angle marked x



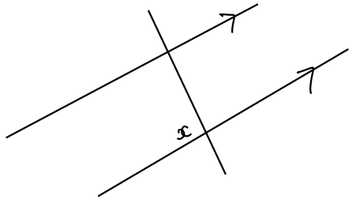
Question 12

Mark an angle that is co-interior to x



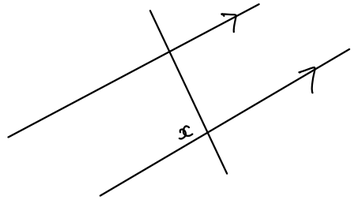
Question 13

Mark an angle that is alternate to x



Question 14

Mark an angle that is corresponding to x



Question 15

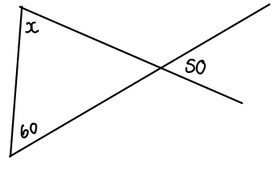
Complete the sentence:

Co-interior angles sum to:

_____

Question 16

Calculate the size of the angle marked x:



Question 17

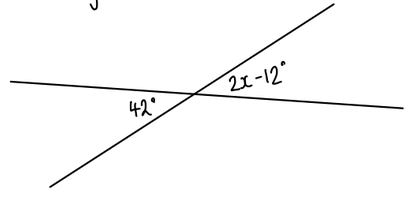
What is the interior angle sum of a pentagon?

Question 18

What is the size of each interior angle in a regular hexagon?

Question 19

Calculate the angle marked x



Question 20

A regular polygon has an interior angle of 172°. How many sides does the polygon have?

Answers: 1. 57° 2. 118° 3. 67° 4. 100° 5. 260° 6. 57° 7. 22° 8. 85° 9. 30° 10. 68.5° 11. 58° 12. 13. 14. 15. 180° 16. 70° 17. 540° 18. 120° 19. 27° 20. 45°

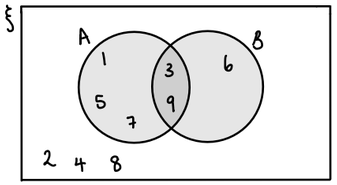
Question 1

What is the probability of rolling a 6 on a regular, fair dice?

Question 2

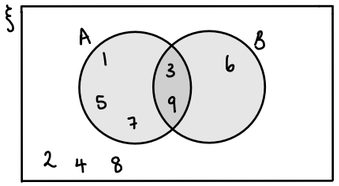
What is the probability of rolling an even number on a regular, fair dice?

Question 3



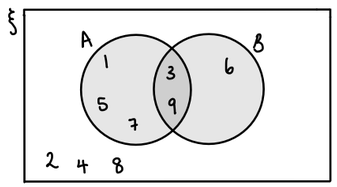
Which numbers are elements of set A?

Question 4



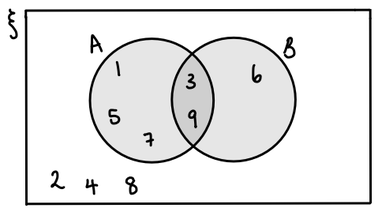
Which numbers are elements of set B?

Question 5



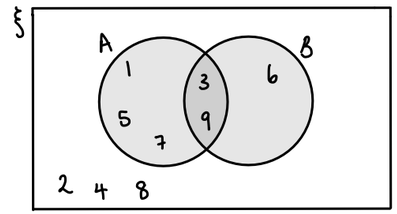
Which numbers are elements of set $A \cap B$?

Question 6



Which numbers are elements of set $A \cup B$?

Question 7



List the numbers in the complement of A.

Question 8

The probability of picking a yellow card is $\frac{1}{4}$.

What is the probability of not getting a yellow card?

Question 9

$\xi = \{\text{numbers between 1 and 100 inclusive}\}$

$A = \{\text{Cube numbers}\}$

List the elements of set A

Question 10

In a deck of cards, picking a red card and picking a King are mutually exclusive.

True or False?

Question 11

In a deck of cards, picking a red card and picking a spade are mutually exclusive.

True or False?

Question 12

In a regular deck of cards (not including Jokers), what is the probability of picking the Ace of Diamonds?

Question 13

Describe the set in words:

$\{3, 6, 9, 12, 15\}$

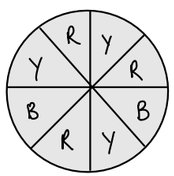
Question 14

These letters are put into a hat:

M A T H E M A T I C S

Write the sample space for the outcomes

Question 15

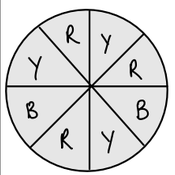


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on red?

Question 16

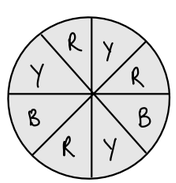


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on blue?

Question 17

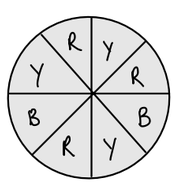


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on red or yellow?

Question 18

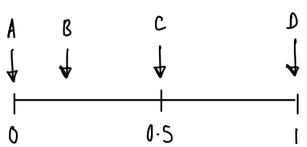


Mike spins the spinner

Each section is equally likely to be landed upon.

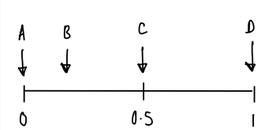
What is the probability of landing on green?

Question 19



Which letter on the probability scale represents the probability of flipping a tail on a fair standard coin?

Question 20



Which letter on the probability scale represents the probability of rolling a 4 on a standard dice?

1. $\frac{1}{6}$ 2. $\frac{3}{6}$ or $\frac{1}{2}$ 3. 1, 3, 5, 7, 9 4. 3, 6, 9 5. 3, 9 6. 1, 3, 5, 6, 7, 9 7. 2, 4, 6, 8 8. $\frac{3}{4}$ 9. 1, 8, 27, 64 10. False 11. True 12. $\frac{1}{52}$ 13. Multiples of 3 up to 15 inclusive 14. {M, A, T, H, E, I, C, S} 15. $\frac{3}{8}$ 16. $\frac{3}{8}$ or $\frac{1}{4}$ 17. $\frac{3}{8}$ or $\frac{3}{4}$ 18. 0 19. C 20. B

Question 1

List the first five multiples of 7

Question 2

List the first five multiples of 13

Question 3

List all of the factors of 35

Question 4

How many factors does a prime number have?

Question 5

What is the LCM of 8 and 10?

Question 6

What is the LCM of $2x$ and $6x$?

Question 7

What is the HCF of 36 and 27?

Question 8

What is the HCF of 42 and 36?

Question 9

List the first ten prime numbers.

Question 10

List the first ten square numbers

Question 11

List the first ten cube numbers

Question 12

List the first ten triangle numbers

Question 13

By drawing a prime factor tree, express 80 as a product of prime factors

Question 14

By drawing a prime factor tree, express 450 as a product of prime factors

Question 15

$P = 3^2 \times 5^3 \times 7$

$Q = 3 \times 5^4 \times 7^2$

What is the LCM of P and Q?

Question 16

$A = 2^2 \times 3^2 \times 5^2 \times 7$

$B = 2^2 \times 3 \times 5^3$

What is the LCM of A and B?

Question 17

$P = 3^2 \times 5^3 \times 7$

$Q = 3 \times 5^4 \times 7^2$

What is the HCF of P and Q?

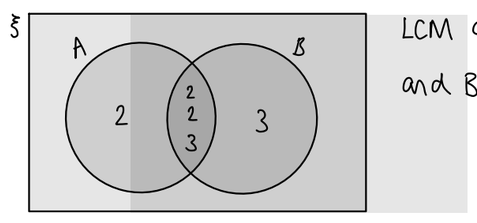
Question 18

$A = 2^2 \times 3^2 \times 5^2 \times 7$

$B = 2^2 \times 3 \times 5^3$

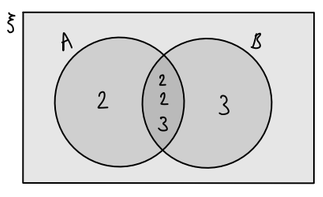
What is the HCF of A and B?

Question 19



What is the LCM of A and B?

Question 20



What is the HCF of A and B?

1. 7, 14, 21, 28, 35 2. 13, 26, 39, 52, 65 3. 1, 5, 7, 35 4. 2 5. 40 6. $6x$ 7. 9 8. 6 9. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 10. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100 11. 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000 12. 1, 3, 6, 10, 15, 21, 28, 36, 45, 55 13. $2 \times 2 \times 2 \times 5$ or $2^4 \times 5$ 14. $2 \times 3 \times 3 \times 5 \times 5$ or $2 \times 3^2 \times 5^2$ 15. 275, 625 16. 31, 500 17. 2625 18. 300 19. 72 20. 12

Year 7 – lines and angles

Geometric reasoning

What do I need to be able to do?

By the end of this unit you should be able to:

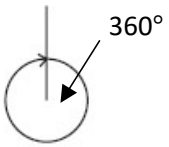
- Understand/use the sum of angles at a point
- Understand/use the sum of angles on a straight line
- Understand/use equality of vertically opposite angles
- Know and apply the sum of angles in a triangle
- Know and apply the sum of angles in a quadrilateral

Keywords

Vertically Opposite: angles formed when two or more straight lines cross at a point.
Interior Angles: angles inside the shape
Sum: total, add all the interior angles together
Convex Quadrilateral: a four-sided polygon where every interior angle is less than 180°
Concave Quadrilateral: a four-sided polygon where one interior angle exceeds 180°
Polygon: A 2D shape made with straight lines
Scalene triangle: a triangle with all different sides and angles
Isosceles triangle: a triangle with two angles the same size and two angles the same size
Right-angled triangle: a triangle with a right angle

Sum of angles at a point

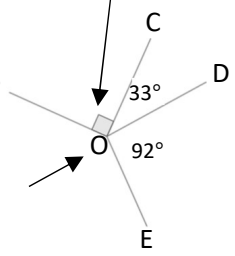
The sum of angles around a point is 360°

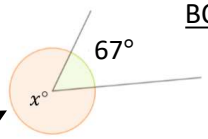


Find angle BOE

90° + 33° + 92° =
205° 360° - 205°
BOE =**155°**

Angle notation – 90°



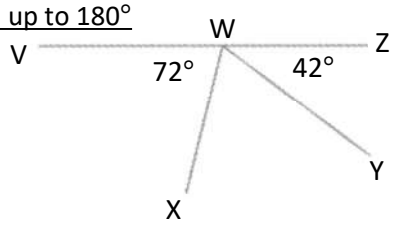


360° - 67°
= 293 °

Angle notation – find this missing angle

Sum of angles on a straight line

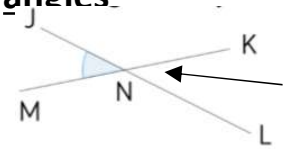
Adjacent angles that share a common point on a line add up to 180°



Find angle XWY

72° + 42° = 114°
180° - 114° = **66°**

Vertically opposite angles

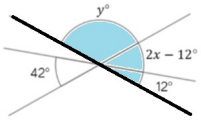


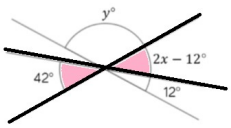
Angle JNM is vertically opposite to angle KNL

JNM = KNL

Vertically opposite angles are the same

Other angle rules still apply. Look for straight line sums and angles around a point

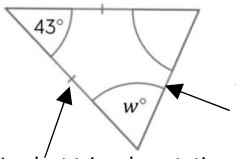




Form equations with information from diagrams:
$2x$-12 = 42
$2x$ = 54
x = 27°

Sum of angles in triangles

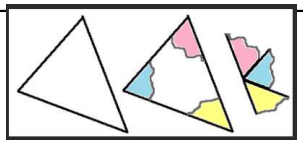
Sum of interior angles in a triangle = 180°



The two base angles will be the same size

Look at triangle notation. This indicates an isosceles triangle
∴ 180 - 43 = 137
137 ÷ 2 = 68.5°

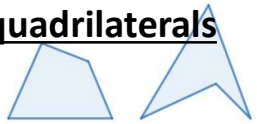
A triangle can only have ONE right angle



Have a go!
Tearing the corners from triangles forms a straight line which is therefore 180°

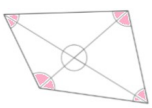
Sum of angles in quadrilaterals

Sum of interior angles in a quadrilateral = 360°

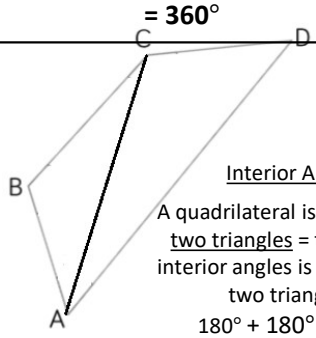


Convex Quadrilateral

Concave Quadrilateral



Interior angles are those that make up the perimeter (outline) of the shape

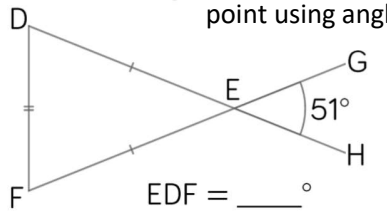


Interior Angles

A quadrilateral is made up of two triangles = the sum of interior angles is the same as two triangles:
180° + 180° = 360°

Angle Problems

Split up the problem into chunks and explain your reasoning at each point using angle notation

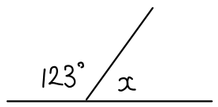


Keep working out clear and notes together

1. Angle DEF = 51° because it is a vertically opposite angle DEF = GEH
2. Triangle DEF is isosceles (triangle notation) ∴ EDF = EFD and the sum of interior angles is 180°
   180° - 51° = 129° 129° ÷ 2 = 64.5°
3. Angle EDF = 64.5°

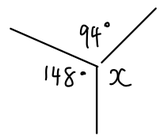
Question 1

Calculate the angle marked x



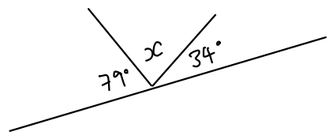
Question 2

Calculate the angle marked x



Question 3

Calculate the angle marked x

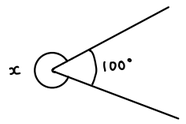


Question 4

Calculate the angle marked x

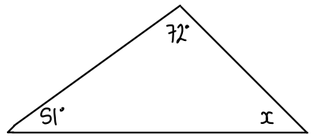
Question 5

Calculate the angle marked x



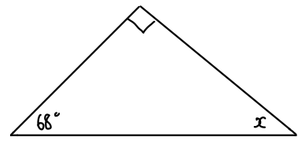
Question 6

Calculate the angle marked x



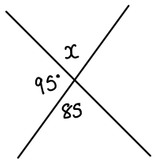
Question 7

Calculate the angle marked x



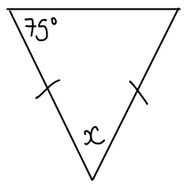
Question 8

Calculate the angle marked x



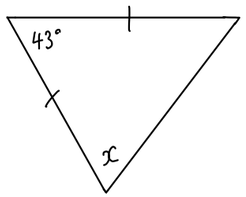
Question 9

Calculate the angle marked x



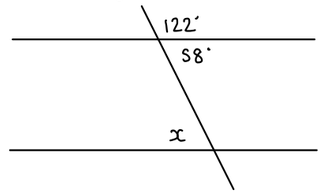
Question 10

Calculate the angle marked x



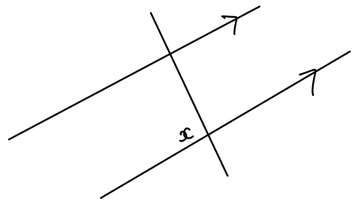
Question 11

Calculate the angle marked x



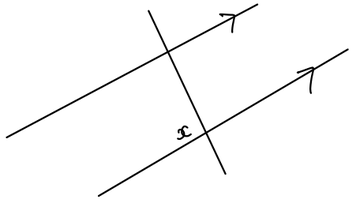
Question 12

Mark an angle that is co-interior to x



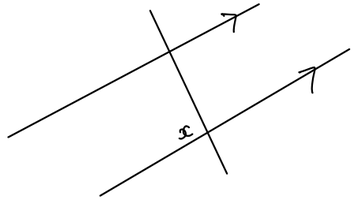
Question 13

Mark an angle that is alternate to x



Question 14

Mark an angle that is corresponding to x



Question 15

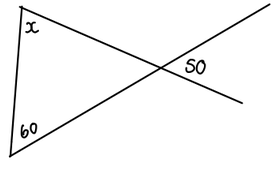
Complete the sentence:

Co-interior angles sum to:

_____

Question 16

Calculate the size of the angle marked x:



Question 17

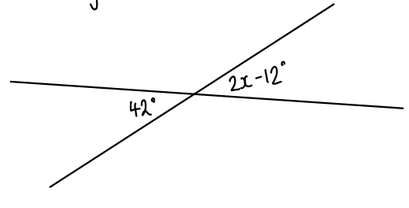
What is the interior angle sum of a pentagon?

Question 18

What is the size of each interior angle in a regular hexagon?

Question 19

Calculate the angle marked x



Question 20

A regular polygon has an interior angle of 172°. How many sides does the polygon have?

Answers: 1. 57° 2. 118° 3. 67° 4. 100° 5. 260° 6. 57° 7. 22° 8. 85° 9. 30° 10. 68.5° 11. 58° 12. 13. 14. 15. 180° 16. 70° 17. 540° 18. 120° 19. 27° 20. 45°

Year 7 – reasoning with number

Developing number sense

What do I need to be able to do?

By the end of this unit you should be able to:

- Know and use mental addition/ subtraction
- Know and use mental multiplication/ division
- Know and use mental arithmetic for decimals
- Know and use mental arithmetic for fractions
- Use factors to simplify calculations
- Use estimation to check mental calculations
- Use number facts
- Use algebraic facts

Keywords

Commutative: changing the order of the operations does not change the result
Associative: when you add or multiply you can do so regardless of how the numbers are grouped
Dividend: the number being divided
Divisor: the number we divide by.
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign
Equation: a mathematical statement that two things are equal
Quotient: the result of a division

Mental methods for addition/ subtraction

Addition is commutative

6 + 3 = 3 + 6

The order of addition does not change the result

Subtraction the order has to stay the same

360 – 147 = 360 – 100 – 40 – 7

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction

Mental methods for multiplication/ division

Multiplication is commutative

2 × 4 = 4 × 2

The order of multiplication does not change the result

Partitioning can help multiplication

24 x 6 = 20 x 6 + 4 x 6
= 120 + 24
= 144

Division is not associative

Chunking the division can help 4000 ÷ 25 "How many 25's in 100" then how many chunks of that in 4000.

Mental methods for decimals

Multiplying by a decimal <1 will make the original value smaller

e.g x 0.1 = ÷ 10

Methods for multiplication 1.2 x 0.03

12 × 3 = 36
1.2 × 3 = 3.6
1.2 × 0.3 = 0.36
1.2 × 0.03 = 0.036

12 × 3 = 36
÷ 10 ÷ 100 ÷ 1000
1.2 × 0.03 = 0.036

Methods for addition

2 + 2 = 4
0.3 + 0.4 = 0.7
4 + 0.7 = 4.7

Methods for division 1.5 ÷ 0.05

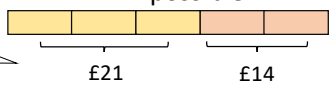
Multiply by powers of 10 until the divisor becomes an integer

1.5 ÷ 0.05
x100 x100
150 ÷ 5 = 30

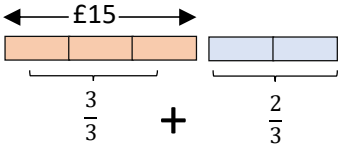
Mental methods for fractions

Use bar models where possible

I've spent $\frac{2}{5}$ of my money. I have £21 left



How much did they have to begin with?



What is $\frac{5}{3}$ of £15?

Using factors to simplify calculations

30 x 16

10 x 3 x 4 x 4

2 x 5 x 3 x 2 x 2 x 2 x 2

10 x 3 x 2 x 8

16 x 10 x 3

Multiplication is commutative
Factors can be multiplied in any order

Estimation

Estimations are useful – especially when using fractions and decimals to check if your solution is possible.

Most estimations round to 1 significant figure

210 + 899 < 1200

This is true because even if both numbers were rounded up, they would reach
300 + 900.
The correct estimation would be 200 + 900 = 1100.

Number facts

Use 124 x 5 = 620

For multiplication, each value that is multiplied or divided by powers of 10 needs to happen to the result

620÷ 12.4 = 50

For division you must consider the impact of the divisor becoming smaller or bigger.
Smaller – the answer will be bigger (It is being shared into less parts)
Bigger – the answer will be smaller (It is being shared into more parts)

Algebraic facts

2a + 2b = 10 — Everything x 2

0.1a + 0.1b = 0.5 — Everything ÷ 10

a + b = 5

Add 2 to the total

a + b + 2 = 7

The unknown quantity isn't changing but the variables change what is done to give the result.

YEAR 7 – REASONING WITH NUMBER

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Developing number sense

What do I need to be able to do?

By the end of this unit you should be able to:

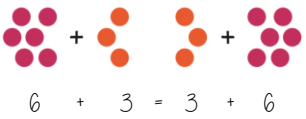
- Know and use mental addition/ subtraction
- Know and use mental multiplication/ division
- Know and use mental arithmetic for decimals
- Know and use mental arithmetic for fractions
- Use factors to simplify calculations
- Use estimation to check mental calculations
- Use number facts
- Use algebraic facts

Keywords

Commutative: changing the order of the operations does not change the result
Associative: when you add or multiply you can do so regardless of how the numbers are grouped
Dividend: the number being divided
Divisor: the number we divide by
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign
Equation: a mathematical statement that two things are equal
Quotient: the result of a division

Mental methods for addition/ subtraction

Addition is commutative



6 + 3 = 3 + 6

The order of addition does not change the result

Subtraction the order has to stay the same

360 – 147 = 360 – 100 – 40 – 7

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction

Mental methods for multiplication/ division

Multiplication is commutative

2 × 4 = 4 × 2

The order of multiplication does not change the result

Partitioning can help multiplication

24 x 6 = 20 x 6 + 4 x 6
= 120 + 24
= 144

Division is not associative

Chunking the division can help 4000 ÷ 25
"How many 25's in 100" then how many chunks of that in 4000.

Mental methods for decimals

Multiplying by a decimal < 1 will make the original value smaller e.g x 0.1 = ÷ 10

Methods for multiplication 1.2 x 0.03

12 × 3 = 36
1.2 × 3 = 3.6
1.2 × 0.3 = 0.36
1.2 × 0.03 = 0.036

12 × 3 = 36
÷ 10 ÷ 100 ÷ 1000
1.2 × 0.03 = 0.036

Methods for addition 2.3+2.4

2 + 2 = 4
0.3 + 0.4 = 0.7
4 + 0.7 = 4.7

Methods for division 1.5 ÷ 0.05

Multiply by powers of 10 until the divisor becomes an integer

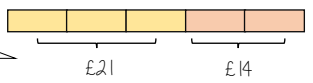
1.5 ÷ 0.05
x100 x100
150 ÷ 5 = 30

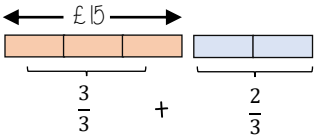
Mental methods for fractions

Use bar models where possible

I've spent $\frac{2}{5}$ of my money. I have £21 left

How much did they have to begin with?





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a + b + 2 = 7

The unknown quantity isn't changing but the variables change what is done to give the result

Year 7 – reasoning with number

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Prime numbers and Proof

What do I need to be able to do?

By the end of this unit you should be able to:

- Find and use multiples
- Identify factors of numbers and expressions
- Recognise and identify prime numbers
- Recognise square and triangular numbers
- Find common factors including HCF
- Find common multiples including LCM

Keywords

Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number.
Prime: an integer with only 2 factors.
Conjecture: a statement that might be true (based on reasoning) but is not proven.
Counterexample: a special type of example that disproves a statement.
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)
HCF: highest common factor (biggest factor two or more numbers share)
LCM: lowest common multiple (the first time the times table of two or more numbers match)

Multiples

The "times table" of a given number

All the numbers in this lists below are multiples of 3.

3, 6, 9, 12, 15…

This list continues and doesn't end

$3x$, $6x$, $9x$ …

x could take any value and as the variable is a multiple of 3 the answer will also be a multiple of 3

Non example of a multiple

4.5 is not a multiple of 3 because it is 3 x 1.5

Not an integer

Factors

Arrays can help represent factors

5 x 2 or 2 x 5

10 x 1 or 1 x 10

Factors of 10

1, 2, 5, 10

The number itself is always a factor

Factors and expressions

$6x \times 1$ OR $6 \times x$

Factors of $6x$

6, x, 1, $6x$, $2x$, 3, $3x$, 2

$2x \times 3$

$3x \times 2$

Prime numbers

- Integer
- Only has 2 factors
- and itself

2

The first prime number

The only even prime number

Learn or how-to quick recall…

2, 3, 5, 7 , 11, 13, 17, 19, 23, 29…

Square and triangular numbers

Square numbers

odd even odd

Representations are useful to understand a square number n^2

1, 4, 9, 16, 25, 36, 49, 64 …

Triangular numbers

Representations are useful – an extra counter is added to each new row

Add two consecutive triangular numbers and get a square number

1, 3, 6, 10, 15, 21, 28, 36, 45…

Common factors and HCF

1 is a common factor of all numbers

Common factors are factors two or more numbers share

HCF – Highest common factor

HCF of18 and 30

18 1, 2, 3, 6, 9, 18

30 1, 2, 3, 5, 6, 10, 15, 30

Common factors (factors of both numbers)

1, 2, 3, 6

HCF = 6

6 is the biggest factor they share

Common multiples and LCM

Common multiples are multiples two or more numbers share

LCM – Lowest common multiple

LCM of 9 and 12

9 9, 18, 27, 36, 45, 54

12 12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

9 18 27 36 45

12 24 36 48

Comparing fractions

$\frac{3}{5}$ and $\frac{7}{10}$

Compare fractions using a LCM denominator

$\frac{6}{10}$ and $\frac{7}{10}$

Conjectures and counterexamples

Conjecture

1, 2, 4…. The numbers in the sequence are doubling each time.

A pattern that is noticed for many cases

Counterexamples

This sequence isn't doubling it is adding 2 each time

Only **one** counterexample is needed to disprove a conjecture

Product of prime factors

Multiplication part-whole models

30 → 2, 15 → 5, 3

30 → 3, 10 → 2, 5

30 → 5, 6 → 2, 3

All three prime factor trees represent the same decomposition

Multiplication is commutative

30 = 2 x 3 x 5

Multiplication of prime factors

Using prime factors for predictions

e.g. **60** 30 x 2 2 x 3 x 5 **x 2**

150 30 x 5 2 x 3 x 5 **x 5**

Question 1

List the first five multiples of 7

Question 2

List the first five multiples of 13

Question 3

List all of the factors of 35

Question 4

How many factors does a prime number have?

Question 5

What is the LCM of 8 and 10?

Question 6

What is the LCM of $2x$ and $6x$?

Question 7

What is the HCF of 36 and 27?

Question 8

What is the HCF of 42 and 36?

Question 9

List the first ten prime numbers.

Question 10

List the first ten square numbers

Question 11

List the first ten cube numbers

Question 12

List the first ten triangle numbers

Question 13

By drawing a prime factor tree, express 80 as a product of prime factors

Question 14

By drawing a prime factor tree, express 450 as a product of prime factors

Question 15

$P = 3^2 \times 5^3 \times 7$

$Q = 3 \times 5^4 \times 7^2$

What is the LCM of P and Q?

Question 16

$A = 2^2 \times 3^2 \times 5^2 \times 7$

$B = 2^2 \times 3 \times 5^3$

What is the LCM of A and B?

Question 17

$P = 3^2 \times 5^3 \times 7$

$Q = 3 \times 5^4 \times 7^2$

What is the HCF of P and Q?

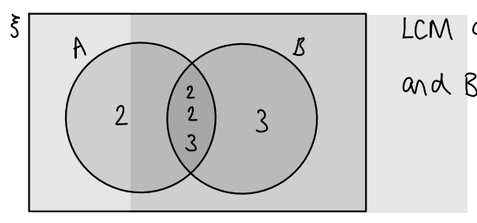
Question 18

$A = 2^2 \times 3^2 \times 5^2 \times 7$

$B = 2^2 \times 3 \times 5^3$

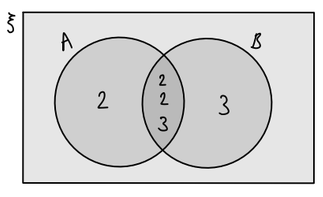
What is the HCF of A and B?

Question 19



What is the LCM of A and B?

Question 20



What is the HCF of A and B?

1. 7, 14, 21, 28, 35 2. 13, 26, 39, 52, 65 3. 1, 5, 7, 35 4. 2 5. 40 6. $6x$ 7. 9 8. 6 9. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 10. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100 11. 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000 12. 1, 3, 6, 10, 15, 21, 28, 36, 45, 55 13. $2 \times 2 \times 2 \times 5$ or $2^4 \times 5$ 14. $2 \times 3 \times 3 \times 5 \times 5$ or $2 \times 3^2 \times 5^2$ 15. 275, 625 16. 31, 500 17. 2625 18. 300 19. 72 20. 12

Year 7 – reasoning with number

Sets and probability

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify and represent sets
- Interpret and create Venn diagrams
- Understand and use the intersection of sets
- Understand and use the union of sets
- Generate sample spaces for single events
- Calculate the probability of a single event
- Understand and use the probability scale

Keywords

Set: collection of things
Element: each item in a set is called an element
Intersection: the overlapping part of a Venn diagram **(AND ∩)**
Union: two ellipses that join **(OR ∪)**
Mutually Exclusive: events that do not occur at the same time
Probability: likelihood of an event happening
Bias: a built-in error that makes all values wrong (unequal) by a certain amount, e.g. a weighted dice
Fair: there is zero bias, and all outcomes have an equal likelihood
Random: something happens by chance and is unable to be predicted.

Identify and represent sets

The **universal set** has this symbol ξ – this means EVERYTHING in the Venn diagram is in this set

A set is a collection of things – you write sets inside curly brackets { }

ξ = {the numbers between 1 and 50 inclusive}

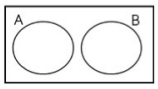
My sets can include every number between 1 and 50 including those numbers

A = {Square numbers}

A = {1, 4, 9, 16 ,25, 36, 49}

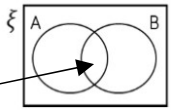
All the numbers in set A are square number and between 1 and 50

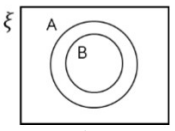
Interpret and create Venn diagrams



Mutually exclusive sets
The two sets have nothing in common
No overlap

Union of sets
The two sets have some elements in common – they are placed in the intersection

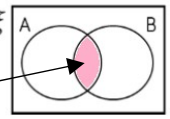




Subset
All of set B is also in Set A so the ellipse fits inside the set.

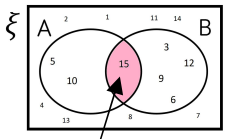
The box
Around the outside of every Venn diagram will be a box. If an element is not part of any set it is placed outside an ellipse but inside the box

Intersection of sets



Elements in the intersection are in set A AND set B
The notation for this is $A \cap B$

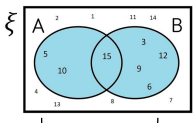
ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}



The element in $A \cap B$ is 15

In this example there is only one number that is both a multiple of 3 and a multiple of 5 between 1 and 15

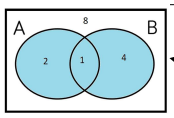
Union of sets



Elements in the union could be in set A OR set B

The notation for this is $A \cup B$

ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}
The elements in $A \cup B$ are
5, 10, 15, 3, 9, 6, 12
There are 7 elements that are either a multiple of 5 OR a multiple of 3 between 1 and 15



This Venn shows the **number of elements** in each set

Sample space – for single events

A sample space for rolling a six-sided dice is
S = {1 , 2, 3, 4, 5, 6}

A sample space for this spinner is
S = {Pink, Blue, Yellow}

You only need to write each element once in a sample space diagram

- A Sample space represents a possible outcome from an event
- They can be interpreted in a variety of ways because they do not tell you the probability

Probability of a single event

Probability = number of times event happens / total number of possible outcomes

P(Blue) = 4/10 = 2/5

There are 4 blue sectors

There are 10 sectors overall

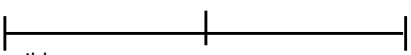
Probability notation P (event)

Probability can be a fraction, decimal or percentage value

4/10 = 40/100 = 0.40 = 40%

Probability is always a value between 0 and 1

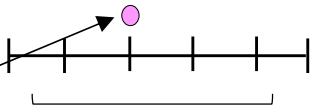
The probability scale



Impossible **0 or 0%**
Even chance **0.5, $\frac{1}{2}$ or 50%**
Certain **1 or 100%**

The more likely an event the further up the probability it will be in comparison to another event (It will have a probability closer to 1)

There are 2 pink and 2 yellow balls, so they have the same probability



There are 5 possible outcomes
So 5 intervals on this scale, each interval value is $\frac{1}{5}$

Sum of probabilities

Probability is always a value between 0 and 1

The probability of getting a blue ball is $\frac{1}{5}$
∴The probability of **NOT** getting a blue ball is $\frac{4}{5}$

The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(white chocolate) = 1 – 0.15 – 0.35
= 0.5

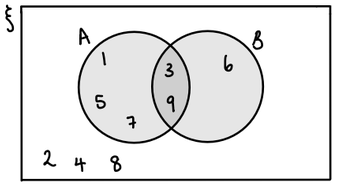
Question 1

What is the probability of rolling a 6 on a regular, fair dice?

Question 2

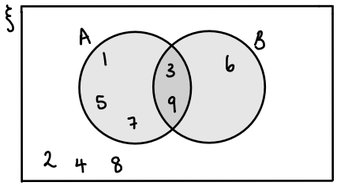
What is the probability of rolling an even number on a regular, fair dice?

Question 3



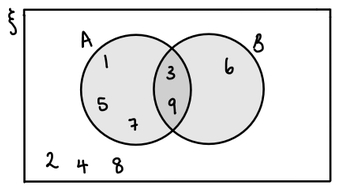
Which numbers are elements of set A?

Question 4



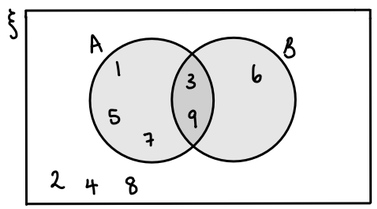
Which numbers are elements of set B?

Question 5



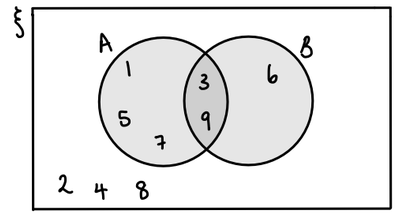
Which numbers are elements of set $A \cap B$?

Question 6



Which numbers are elements of set $A \cup B$?

Question 7



List the numbers in the complement of A.

Question 8

The probability of picking a yellow card is $\frac{1}{4}$.

What is the probability of not getting a yellow card?

Question 9

$\xi = \{\text{numbers between 1 and 100 inclusive}\}$

$A = \{\text{Cube numbers}\}$

List the elements of set A

Question 10

In a deck of cards, picking a red card and picking a King are mutually exclusive.

True or False?

Question 11

In a deck of cards, picking a red card and picking a spade are mutually exclusive.

True or False?

Question 12

In a regular deck of cards (not including Jokers), what is the probability of picking the Ace of Diamonds?

Question 13

Describe the set in words:

$\{3, 6, 9, 12, 15\}$

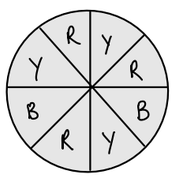
Question 14

These letters are put into a hat:

M A T H E M A T I C S

Write the sample space for the outcomes

Question 15

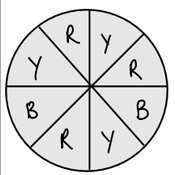


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on red?

Question 16

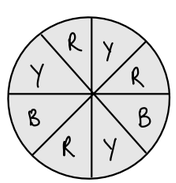


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on blue?

Question 17

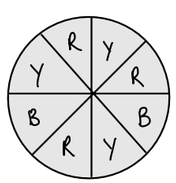


Mike spins the spinner

Each section is equally likely to be landed upon.

What is the probability of landing on red or yellow?

Question 18

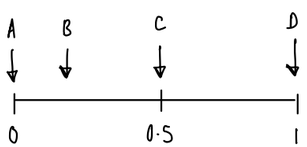


Mike spins the spinner

Each section is equally likely to be landed upon.

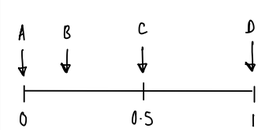
What is the probability of landing on green?

Question 19



Which letter on the probability scale represents the probability of flipping a tail on a fair standard coin?

Question 20



Which letter on the probability scale represents the probability of rolling a 4 on a standard dice?

1. $\frac{1}{6}$ 2. $\frac{3}{6}$ or $\frac{1}{2}$ 3. 1, 3, 5, 7, 9 4. 3, 6, 9 5. 3, 9 6. 1, 3, 5, 6, 7, 9 7. 2, 4, 6, 8 8. $\frac{3}{4}$ 9. 1, 8, 27, 64 10. False 11. True 12. $\frac{1}{52}$ 13. Multiples of 3 up to 15 inclusive 14. {M, A, T, H, E, I, C, S} 15. $\frac{3}{8}$ 16. $\frac{3}{8}$ or $\frac{1}{4}$ 17. $\frac{3}{8}$ or $\frac{3}{4}$ 18. 0 19. C 20. B

Year 8 - Proportional reasoning…

Multiplicative Change

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems and explain direct proportion
- Use conversion graphs to make statements, comparisons and form conclusions.
- Understand and use scale factors for length

Keywords

Proportion: a statement that links two ratios
Variable: a part that the value can be changed
Axes: horizontal and vertical lines that a graph is plotted around
Approximation: an estimate for a value
Scale Factor: the multiple that increases/ decreases a shape in size
Currency: the system of money used in a particular country
Conversion: the process of changing one variable to another
Scale: the comparison of something drawn to its actual size.

Direct Proportion

As one variable changes the other changes at the same rate.

This is a multiplicative change

4 cans of pop = £2.40

4 cans of pop = £2.40 ×0.5 → 2 cans of pop = £1.20 ×0.5

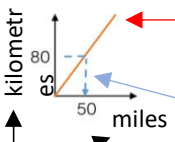
This multiplier is the same
In the same way that this would be for ratio

4 cans of pop = £2.40 ×3 → 12 cans of pop = £7.20 ×3

Sometimes this is easiest if you work out how much one unit is worth first
e.g. **1 can of pop = £0.60**

Conversion Graphs

Compare two variables



This is always a straight line because as one variable increases so does the other at the same rate

Labelling of both axes is vital

To make conversions between units you need to find the point to compare – then find the associated point by using your graph.
Using a ruler helps for accuracy
Showing your conversion lines help as a "check" for solutions

Conversion between currencies

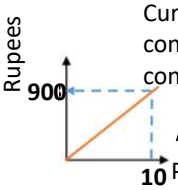
For every £1 I have 90 Rupees

£1 = 90 Rupees

Currency is directly proportional

£1 = 90 Rupees ×10 → £10 = 900 Rupees ×10

Currency can be converted using a conversion graph



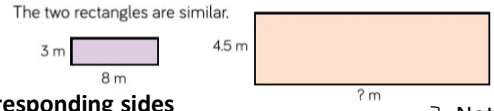
Convert 630 Rupees into Pounds

£1 = 90 Rupees ×7 → £7 = **630 Rupees** ×7

630 ÷ 90 = 7

Ratio between similar shapes

Angles in similar shapes do not change.
e.g. if a triangle gets bigger the angles can not go above 180^0



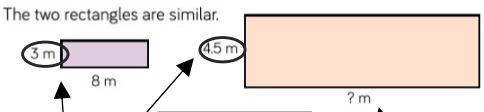
Corresponding sides

3m : 4.5m ÷3 → 1 m : 1.5 m ÷3

8m : 12m ×8 → 1 m : 1.5 m ×8

Note
Simplify to the same ratio

Understand Scale Factor



3 x **1.5** = 4.5

This is a multiplicative change

Use **corresponding** sides to calculate a scale factor

Missing length
8 x 1.5 = 12m

Scale factor can also be calculated by:

Small corresponding side ×SF → Big corresponding side
Big corresponding side ÷SF → Small corresponding side

Draw and interpret scale diagrams

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

The car image is 10cm

Image : Real life
1cm : 30cm ×10 → 10cm : 300cm ×10

The car in real life is 210cm

Image : Real life
1cm : 30cm ×7 → 7cm : 210 cm ×7

Interpret maps with scale factors

mm ÷10 → cm ÷100 → m ÷1000 → km

mm ×10 ← cm ×100 ← m ×1000 ← km

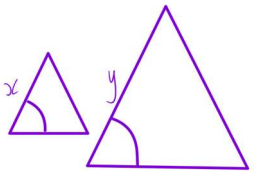
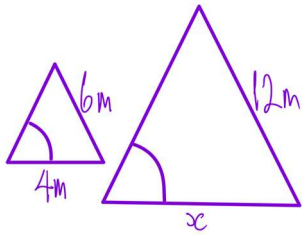
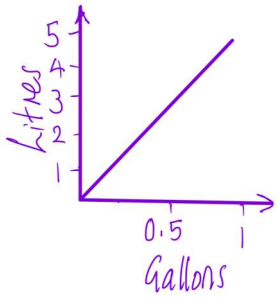
1 cm : 250 m

Ratios need to be in the same units

1 cm : 250m
1 cm : 25000cm

250 x 100 = 25000

For every 1cm on my map is 25000cm in real life.

Q1 - If 4 tickets cost £15.80 how much will 8 tickets cost?	Q2 - Given £1 is 25 Mexican Pesos, convert £50 into Mexican Pesos	Q3 – What is the scale factor to use on a map with a scale of 1cm = 25km?	Q4 - If 8 stamps cost £18.00, how much will 5 stamps cost?	Q5 – is it angles or side lengths that stay the same in similar shapes? 
Q6 – Given that £1 = €1.28 how many Euros is £25?	Q7 – An accurate drawing of a T-Rex fossil skeleton has the skull at 3cm long. If the scale of the drawing is 1:50, how long is the actual skull fossil?	Q8 - If 9 pencils cost £31.50 how much will 11 pencils cost?	Q9 – The straight-line distance between Manchester and Chester is 27 miles. What would the measurement between the two cities be on a map with a scale of 1cm = 3miles?	Q10 – If £1= $1.08, how many pounds will I get for $250, to the nearest penny?
Q11 - If 9 biscuits cost £13.50 how much will 6 biscuits cost?	Q12 – The two triangles are similar. What is x? 	Q13 – Estimate how many litres are in half a gallon. 	Q14 – £1 is worth $1.278 dollars at today's exchange rate. How many £s will I get if I convert $400?	Q15 – Two similar shapes have corresponding sides of 2cm and 9cm. Another side on the smaller shape is 7cm. What is the length of the corresponding side on the larger shape?
Q16 – Two similar shapes have corresponding sides of 2cm and 9cm. What is the scale factor?	Q17 – 5 miles is equal to 8km. How many miles is a 30k race (to 1 decimal place)?	Q18 – on a map with a scale of 1:10,000, a road is 4.5cm long. How long is the real road in km?	Q19 - If 11 sweets cost £13.75 how much will 3 sweets cost?	Q20 – Two similar shapes have corresponding sides of 3mm and 9cm. Another side on the larger shape is 4cm. What is the length of the corresponding side on the smaller shape?

Answers: 1) £31.60 2) 1250 pesos 3) ×250000 4) £11.25 5) Angles 6) €32 7) 1.5m or 150cm 8) £38.50 9) 9cm 10) £231.48 11) £9 12) 8m 13) 2.5l 14) £312 15) 31.5cm 16) ×4.5 17) 18.8 miles 18) 45km 19) £3.75 20) 1.$\dot{3}$mm (must have correct units)

Year 8 - Proportional reasoning…

Multiplying and Dividing Fractions

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Carry out any multiplication or division using fractions and integers.
- Solutions can be modelled, described and reasoned

Keywords

Numerator : the number above the line on a fraction. The top number. Represents how many parts are taken
Denominator: the number below the line on a fraction. The number represent the total number of parts..
Whole: a positive number including zero without any decimal or fractional parts.
Commutative: an operation is commutative if changing the order does not change the result.
Unit Fraction: a fraction where the numerator is one and denominator a positive integer.
Non-unit Fraction: a fraction where the numerator is larger than one.
Dividend : the amount you want to divide up.
Divisor: the number that divides another number.
Quotient: the answer after we divide one number by another. e.g. dividend÷ divisor = quotient
Reciprocal: a pair of numbers that multiply together to give 1.

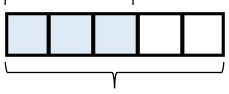
Representing a fraction

Numerator
Denominator

$\frac{3}{5}$

Number of parts represented Numerator

Number of parts to make up the whole Denominator



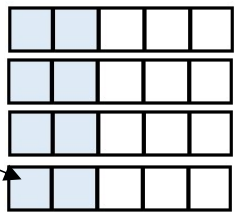
ALL PARTS of a fraction are of equal size

Repeated addition = multiplication by an integer

$4 \times \frac{2}{5} \rightarrow \frac{2}{5}+\frac{2}{5}+\frac{2}{5}+\frac{2}{5}$

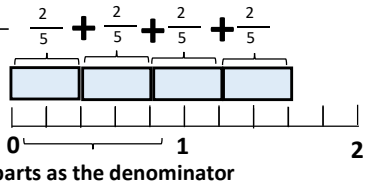
Integer (Whole number)

Each part represents $\frac{1}{5}$



$= \frac{8}{5}$

$= 1\frac{3}{5}$



Each whole is split into the same number of parts as the denominator

Revisit
When adding fractions with the same denominator = add the numerators

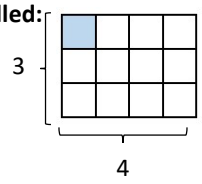
Multiplying unit fractions

$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

Parts shaded

Total number of parts in the diagram

Modelled:



Multiplying non-unit fractions

Shade in 3 parts

Repeat it on this many rows

$\frac{3}{4} \times \frac{2}{3}$

This many columns

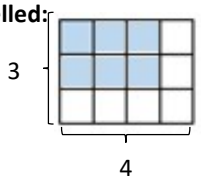
This many rows

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

Parts shaded

Total number of parts in the diagram

Modelled:



Quick Multiplying and Cancelling down

$\frac{\cancel{3}^{1}}{5} \times \frac{4}{\cancel{9}_{3}}$

The 3 and the 9 have a common factor and can be simplified

Quick Solving

Multiply the numerators $\frac{1 \times 4}{5 \times 3} = \frac{4}{15}$

Multiply the denominators

The reciprocal *When you multiply a number by its reciprocal the answer is always 1*

$3 \times \frac{1}{3} = 1$

$\frac{1}{3}+\frac{1}{3}+\frac{1}{3} = 1$

The reciprocal of 3 is $\frac{1}{3}$ and vice versa

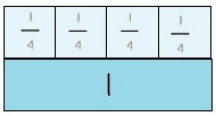
Reciprocals for division

e.g $5 \div \frac{1}{4} = 20$

$5 \times 4 = 20$

Multiplying by a reciprocal gives the same outcome

Dividing an integer by an unit



$1 \div \frac{1}{4} = 4$

How many quarters are in 1?

"There are **4 quarters** in **1 whole.** Therefore, there are **20 quarters** in **5 wholes**"

$5 \div \frac{1}{4} = 20$

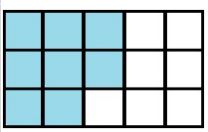
Dividing any fractions *Remember to use reciprocals*

$\frac{2}{5} \div \frac{3}{4}$

$\frac{2}{5} \times \frac{4}{3}$

Multiplying by a reciprocal gives the same outcome

Represented



$= \frac{8}{15}$

Multiplying and Dividing Fractions

Question 1

What is the reciprocal of 5?

Question 2

Work out $\frac{3}{4} \times 3$

Question 3

Work out $\frac{1}{2} \times \frac{2}{7}$

SIMPLIFY YOUR ANSWER

Question 4

Work out $\frac{3}{7} \div \frac{1}{3}$

Question 5

Work out $\frac{5}{7} \times \frac{1}{4}$

Question 6

What is the reciprocal of $\frac{1}{12}$?

Question 7

Work out $\frac{5}{7} \times \frac{1}{3}$

Question 8

Work out $\frac{4}{11} \div 2$

SIMPLIFY YOUR ANSWER

Question 9

Work out $\frac{7}{10} \times 5$

Question 10

Work out $\frac{3}{4} \div \frac{1}{5}$

Question 11

What is the reciprocal of $\frac{4}{7}$?

Question 12

Work out $\frac{1}{2} \div \frac{1}{4}$

Question 13

Work out $\frac{5}{6} \div \frac{1}{4}$

Question 14

Work out $\frac{10}{11} \times 5$

Question 15

Work out $\frac{7}{8} \times \frac{2}{5}$

Question 16

What is the reciprocal of -3?

Question 17

Work out $\frac{5}{6} \div \frac{1}{2}$

Question 18

What is the reciprocal of 4 as a decimal?

Question 19

Work out $\frac{5}{6} \div \frac{4}{5}$

Question 20

Work out $\frac{9}{14} \div 6$

Answers: 1. $\frac{1}{5}$ 2. $\frac{9}{4}$ 3. $\frac{1}{7}$ 4. $\frac{9}{7}$ or $1\frac{2}{7}$ 5. $\frac{5}{28}$ 6. 12 7. $\frac{5}{21}$ 8. $\frac{2}{11}$ 9. $\frac{7}{2}$ or $3\frac{1}{2}$ 10. $\frac{15}{4}$ or $3\frac{3}{4}$ 11. $\frac{7}{4}$ 12. 2 13. $\frac{10}{3}$ or $3\frac{1}{3}$ 14. $\frac{50}{11}$ or $4\frac{6}{11}$ 15. $\frac{7}{20}$ 16. $-\frac{1}{3}$ 17. $\frac{5}{3}$ or $1\frac{2}{3}$ 18. 0.25 19. $\frac{25}{24}$ or $1\frac{1}{24}$ 20. $\frac{3}{28}$

Year 8 - Proportional reasoning…

Ratio and Scale

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Simplify any given ratio
- Share an amount in a given ratio
- Solve ratio problems given a part

Solutions should be modelled, explained and solved.

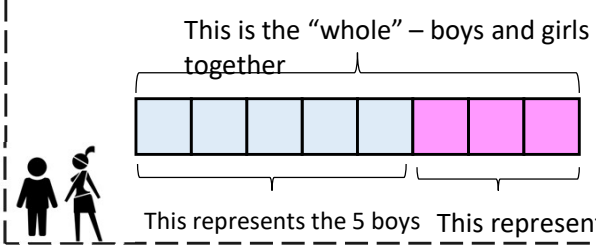
Keywords

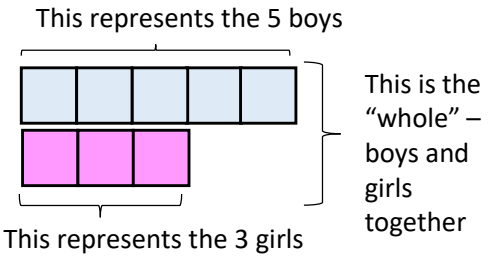
Ratio: a statement of how two numbers compare
Equal Parts:: all parts in the same proportion, or a whole shared equally
Proportion: a statement that links two ratios
Order: to place a number in a determined sequence
Part: a section of a whole
Equivalent: of equal value
Factors: integers that multiply together to get the original value
Scale: the comparison of something drawn to its actual size.

Representing a ratio

"For every 5 boys there are 3 girls"

5:3





Order is Important

"For every dog there are 2 cats"

Dogs: Cats

1:2

The ratio has to be written in the same order as the information is given.
e.g. 2:1 would represent 2 dogs for every 1 cat.

Simplifying a ratio

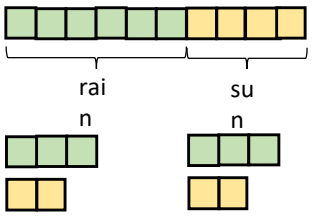
Cancel down the ratio to its lowest form

"For every 6 days of rain there are 4 days of sun"

6:4

÷ by 2

3:2



Find the biggest common factor that goes into all parts of the ratio

For **6** and **4** the biggest factor (number that multiplies into them is **2**)

"For every 3 days of rain there are 2 days of sun" – when this happens twice the ratio becomes 6:4.

Ratio 1:n (or n:1)

This is asking you to cancel down until the part indicated represents 1.

Show the ratio 4:20 in the ratio of 1:n

The question states that **this part has to be 1** unit. Therefore **Divide by 4**

4 : 20

1 : 5

This side has to be divided by 4 too – to keep in **proportion**

Units are important:

When using a ratio – all parts should be in the same units

Useful Conversions

mm ⇄ cm ⇄ m ⇄ km (×10 / ÷10, ×100 / ÷100)

g ⇄ kg (×1000 / ÷1000)

ml ⇄ L (×1000 / ÷1000)

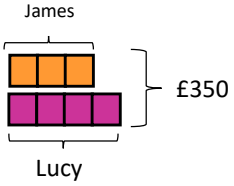
Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

James: Lucy

3 : 4



Find the value of one part

Whole: £350
7 parts to share between (3 James, 4 Lucy)

£350 ÷ 7 = £50

□ = one part = **£50**

Put back into the question

James: Lucy

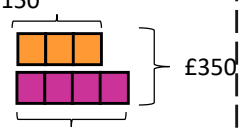
3 : 4

(×50 / ×50)

£150:£200

James = 3 x £50 = £150

Lucy = 4 x £50 = £200



Finding a value given 1:n (or n:1)

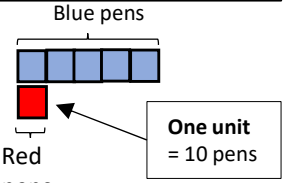
Inside a box are blue and red pens in the ratio 5:1.
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red

5 : 1

□ = one part = **10 pens**



One unit = 10 pens

Put back into the question

Blue : Red

5 : 1

(×10 / ×10)

50: 10

Blue pens = 5 x 10 = 50 pens

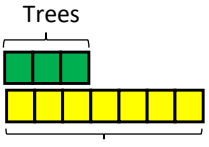
Red pens = 1 x 10 = 10 pens

There are 50 Blue Pens

Ratio as a fraction

Trees: Flowers

3 : 7



There are **3** parts for trees

Number of parts of in group / Total number of parts = **Fraction of trees** 3/10

Tree parts **3** + Flower parts **7** = **10**

Ratio

Fraction

Pi

π

Circumference

Diameter

The ratio of a circles circumference to its diameter

Question 1 Simplify the ratio $80 : 48$	**Question 2** $£x$ is divided in the ratio $5 : 6$. The smallest share is $£500$. What is the difference in the value of the shares?	**Question 3** Divide $£300$ in the ratio $1 : 5$	**Question 4** Express $2 : 220$ in the form $1 : n$	**Question 5** Divide $£720$ in the ratio $1 : 11$
Question 6 $£x$ is divided in the ratio $3 : 2$. The largest share is $£90$. What is the value of the smallest share?	**Question 7** Express $40 : 136$ in the form $1 : n$	**Question 8** Simplify the ratio $14 : 80$	**Question 9** Divide $£840$ in the ratio $3 : 11$	**Question 10** Simplify the ratio $90 : 100$
Question 11 Express $8 : 24$ in the form $1 : n$	**Question 12** $£x$ is divided in the ratio $11 : 10$. The largest share is $£880$. Work out the value of x	**Question 13** Simplify the ratio $72 : 54$	**Question 14** Express $4 : 24$ in the form $1 : n$	**Question 15** Divide $£175$ in the ratio $2 : 3$
Question 16 Divide $£840$ in the ratio $10 : 11$	**Question 17** Simplify the ratio $18 : 70$	**Question 18** Divide $£1235$ in the ratio $7 : 6$	**Question 19** Express $5 : 50000$ in the form $1 : n$	**Question 20** $£x$ is divided in the ratio $3 : 10$. Find the value of x if the difference between the shares is $£175$

Answers: 1) 5:3 2)£100 3) £50:£250 4) 1:110 5) £60:£660 6) £60 7) 1:3.9 8) 7:40 9) £180:£660 10)9:10 11)1:3 12) £1680 13) 4:3 14) 1:6 15)£70:105 16) £400:440 17) 9:35 18) £665:£570 19) 1:10000 20) £325

Year 8 - Representations…

Representing Data

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw and interpret scatter graphs
- Describe correlation and relationships.
- Identify different types of non-linear relationships.
- Design and complete an ungrouped frequency table.
- Read and interpret grouped tables (discrete and continuous data)
- Represent data in two way tables.

Keywords

Variable: a quantity that may change within the context of the problem.
Relationship: the link between two variables (items). E.g. Between sunny days and ice cream sales
Correlation: the mathematical definition for the type of relationship..
Origin: where two axes meet on a graph.
Line of best fit: a straight line on a graph that represents the data on a scatter graph.
Outlier: a point that lies outside the trend of graph.
Quantitative: numerical data
Qualitative: descriptive information, colours, genders, names, emotions etc.
Continuous: quantitative data that has an infinite number of possible values within its range.
Discrete: quantitative or qualitative data that only takes certain values.
Frequency: the number of times a particular data value occurs.

Draw and interpret a scatter graph.

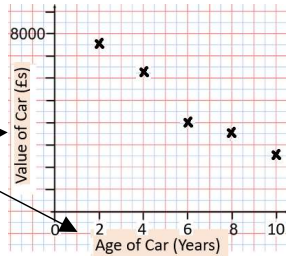
Age of Car (Years)	2	4	6	8	10
Value of Car (£s)	7500	6250	4000	3500	2500

- This data may not be given in size order
- The data forms information pairs for the scatter graph
- Not all data has a relationship

The link between the data can be explained verbally

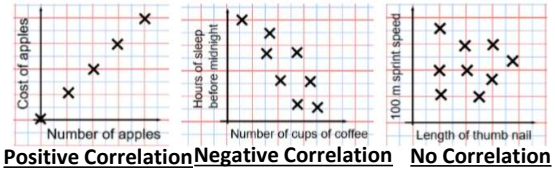
"This scatter graph show as the age of a car increases the value decreases"

All axes should be labelled



The axis should fit all the values on and be equally spread out

Linear Correlation



Positive Correlation

As one variable increases so does the other variable

Negative Correlation

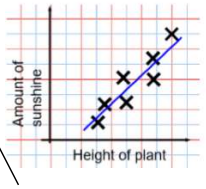
As one variable increases the other variable decreases

No Correlation

There is no relationship between the two variables

The line of best fit

The Line of best fit is used to make estimates about the information in your scatter graph



It is only an estimate because the line is designed to be an average representation of the data

It is always a **straight line.**

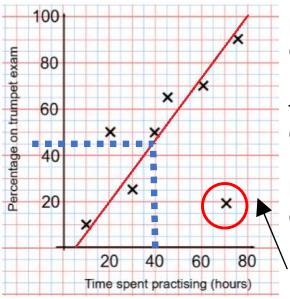
Things to know:

- The line of best fit **DOES NOT** need to go through the origin (The point the axes cross)
- There should be approximately the same number of points above and below the line (It may not go through any points)
- The line extends across the whole graph

Using a line of best fit

Interpolation is using the line of best fit to estimate values inside our data point.

e.g. 40 hours revising predicts a percentage of 45.



Extrapolation is where we use our line of best fit to predict information outside of our data.
This is not always useful – in this example you cannot score more that 100%. So revising for longer can not be estimated

This point is an "**outlier**"
It is an outlier because it doesn't fit this model and stands apart from the data

Ungrouped Data

The number of times an event happened

The table shows the number of siblings students have. The answers were **3, 1, 2, 2, 0, 3, 4, 1, 1, 2, 0, 2**

Number of siblings	Frequency
0	2
1	3
2	4
3	2
4	1

2 people had 0 siblings. This means there are 0 siblings to be counted here

3 + 3 OR 3 x 2 = **6**

2 people have 3 siblings so there are 6 siblings in total

Best represented by discrete data. (Not always a number)

OVERALL there are 0 + 3 + 8 + 6 + 4 Siblings = 21 siblings

Grouped Data

If we have a large spread of data it is better to group it. This is so it is easier to look for a trend. Form groups of equal size to make comparison more valid and spread the groups out from the smallest to the largest value.

Discrete Data The groups do not overlap

Cost of TV (£)	Tally	Frequency
101 - 150	𝍸 ||	7
151 - 200	𝍸 𝍸 |	11
201 - 250	𝍸	5
251 - 300	|||	3

We do not know the exact value of each item in a group – so an estimate would be bused to calculate the overall total (Midpoint)

Continuous Data To make sure all values are included inequalities represent the subgroups

x Weight(g)	Frequency
$40 < x \leq 50$	1
$50 < x \leq 60$	3
$60 < x \leq 70$	5

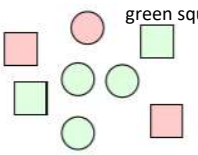
e.g. this group includes every weight bigger that 60Kg, up to and including 70Kg.

Representing data in two-way tables

Two-way tables represent discrete information in a visual way that allows you to make conclusions, find probability or find totals of sub groups

There are 2 green squares

There are 5 green shapes



	Squares	Circles	Total
Green	2	3	5
Red	2	1	3
Total	4	4	8

There are 8 items in total

Using your two-way table

To find a fraction
e.g. What fraction of the items are red? **3 red items** but **8 items in total** $= \frac{3}{8}$

Interleaving: Use your fraction, decimal percentage equivalence knowledge

Question 1

What type of correlation describes the link between the amount of rain and the number of bush fires?

Question 2

Queuing times for lunch is an example of _____ data.

Continuous | Discrete

Question 3

Number of Pets	Frequency
0	4
1	0
2	3
3	5

How many people were surveyed when collecting this data?

Question 4

Number of TVs	0	1	2	3	4
Frequency	2	5	12	8	3

How many people have one TV?

Question 5

True or False:

A line of best fit must go through the origin (0,0)

Question 6

Number of Pets	Frequency
0 – 2	4
2 – 4	0
4 – 6	3
6 – 8	5

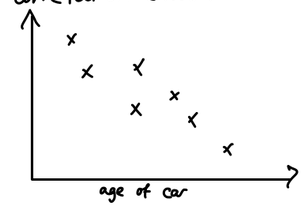
What is wrong with how this grouped frequency table has been constructed?

Question 7

What type of correlation describes the link between how far I travel in my car and how much petrol I have?

Question 8

Describe the correlation shown in the graph:



Question 9

Number of TVs	0	1	2	3	4
Frequency	2	5	12	8	3

How many people have at least two TVs?

Question 10

Number of Pets	Frequency
0	4
1	0
2	3
3	5

How many pets did the people who were surveyed have?

Question 11

The number of people having lunch in the canteen is an example of _____ data.

Continuous | Discrete

Question 12

Marks on a test	Frequency
1 – 10	1
11 – 20	3
21 – 30	6
31 – 40	8

True or False: the range of marks scored on a test is 40 - 1 = 39

Question 13

Complete the two-way table:

	Boys	Girls	Total
Running	6		15
Swimming		12	
Total	19		

Question 14

What type of correlation describes the link between the time I spend running and the number of calories I burn?

Question 15

Height (x cm)	Frequency
$135 < x \leq 140$	1
$140 < x \leq 145$	3
$145 < x \leq 150$	14
$150 < x \leq 155$	8

How many students are between 150 and 155cm tall?

Question 16

True or False:

A line of best fit must be a straight line

Question 17

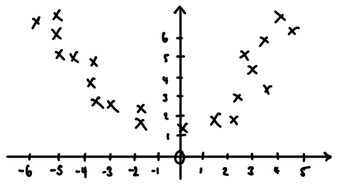
Height (x cm)	Frequency
$135 < x \leq 140$	1
$140 < x \leq 145$	3
$145 < x \leq 150$	14
$150 < x \leq 155$	8

How many students are taller than 145cm?

Question 18

True or False:

The graph shows no correlation



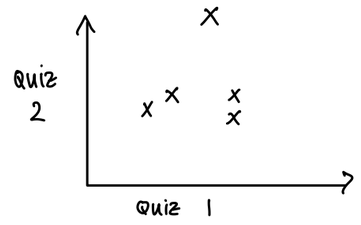
Question 19

Number of TVs	0	1	2	3	4
Frequency	2	5	12	8	3

How many TVs are owned altogether?

Question 20

Circle the outlier:



Answers: 1. Negative 2. Continuous 3. 12 4. 5 5. False 6. The groups overlap 7. Negative 8. Negative 9. 23 10. 21 11. Discrete 12. False – can't tell 13.

	Boys	Girls	Total
Running	6	9	15
Swimming	13	12	25
Total	19	21	40

14. Positive 15. 8 16. True 17. 22 18. False – the correlation is not linear 19. 65 20. The top X

Year 8 - representations…

Tables and Probability

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Construct a sample space diagram.
- Systematically list outcomes.
- Find the probability from two-way tables.
- Find the probability from Venn diagrams.

Keywords

Outcomes: the result of an event that depends on probability.
Probability: the chance that something will happen.
Set: a collection of objects.
Chance: the likelihood of a particular outcome.
Event: the outcome of a probability – a set of possible outcomes.
Biased: a built in error that makes all values wrong by a certain amount.
Union: Notation 'U' meaning the set made by comparing the elements of two sets.

Construct sample space diagrams

Sample space diagrams provide a systematic way to display outcomes from events

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

This is the set notation to list the outcomes **S =**

In between the **{ }** are all the possible outcomes

S = { 1H, 2H, 3H, 4H, 5H, 6H, 1T, 2T, 3T, 4T, 5T, 6T}

Probability from sample space

What is the probability that an outcome has an even number and a tails?

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	(2,T)	3,T	(4,T)	5,T	(6,T)

This is the set notation that represents the question **P**

P (Even number and Tails)= $\frac{3}{12}$

There are three even numbers with tails

Numerator: the event

Denominator: the total number of outcomes

There are twelve possible outcomes

In between the **( )** is the event asked for

Probability from two-way tables

	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	(21)	47
Total	21	44	35	(100)

P (Girl walk to school) = $\frac{21}{100}$

The event

The total in the set

The total number of items

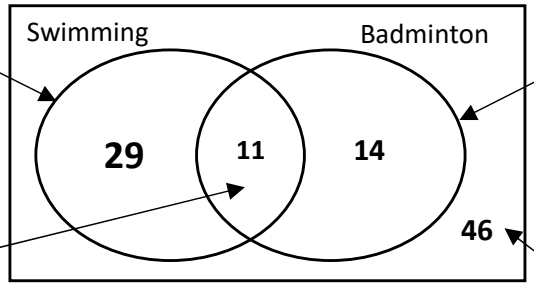
Product Rule

The number of items in event a **x** The number of items in event b

Probability from Venn diagrams

100 students were questioned if they played badminton or went to swimming club.
40 went swimming, 25 went to badminton and 11 went to both.

This whole curve includes everyone that went swimming. Because 11 did both we calculate **just** swimming by 40- 11



The intersection represents both. Swimming **AND** badminton

This whole curve includes everyone that went to badminton. Because 11 did both we calculate **just** badminton by 25 - 11

The number outside represents those that did **neither** badminton or swimming

100 – 29 – 11 – 14

P (Just swimming) = $\frac{29}{100}$

Tables and Probability

Question 1

Tommy, Eva and Mo have a race.

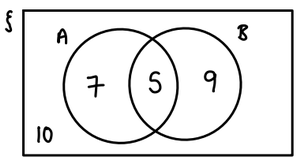
List all of the possible outcomes for the results.

Question 2

	Year 8	Year 9	Total
School Dinner	13	26	39
Packed Lunch	36	25	61
Total	49	51	100

Find the probability of choosing a student who has school dinners.

Question 3



Find the probability of picking someone from set A $(P(A))$.

Question 4

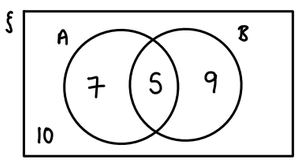
Rosie has 8 number cards and 2 shape cards and chooses one from each.

How many possible outcomes are there?

Question 5

Amir has 8 number cards and some shape cards. He chooses one of each card. There are 32 possible outcomes. How many shape cards does he have?

Question 6



Find the probability of selecting someone from set A and B.

$(P(A \cap B))$

Question 7

Complete the sample space for throwing two fair coins:

	Heads	Tails
Heads		
Tails		

Question 8

	Year 8	Year 9	Total
School Dinner	13	26	39
Packed Lunch	36	25	61
Total	49	51	100

Find the probability of selecting a year 9 student who has a packed lunch.

Question 9

	Year 8	Year 9	Total
School Dinner	13	26	39
Packed Lunch	36	25	61
Total	49	51	100

Find the probability of selecting a year 9 student.

Question 10

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Find the probability of getting an even total.

$P(\text{even}) =$

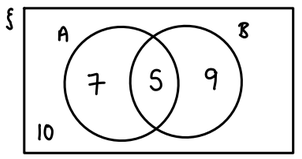
Question 11

Two dice are thrown and their scores added together.

Complete the sample space:

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

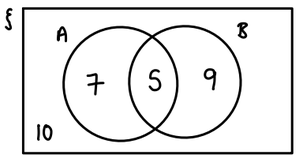
Question 12



Find the probability of selecting someone from either set A or B.

$(P(A \cup B))$

Question 13



Find the probability of selecting someone not in set A.

$(P(A'))$

Question 14

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Find the probability of selecting a prime number

$P(\text{prime}) =$

Question 15

	Year 8	Year 9	Total
School Dinner	13	26	39
Packed Lunch	36	25	61
Total	49	51	100

Find the probability of selecting a year 9 student who has school dinners.

Question 16

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Find the probability of selecting a square number

$P(\text{square}) =$

Question 17

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Find the probability of selecting an even prime number.

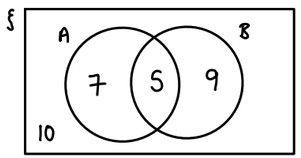
$P(\text{even} \cap \text{prime}) =$

Question 18

	Year 8	Year 9	Total
School Dinner	13	26	39
Packed Lunch	36	25	61
Total	49	51	100

Find the probability of selecting a student who has school dinners from the year 8 students.

Question 19



Find the probability of selecting someone who is in set A but is not in set B.

$(P(A \cap B'))$

Question 20

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Find the probability of selecting a number greater than 20

$P(\text{number} > 20) =$

Answers: 1. TEM, TME, MTE, MET, ETM, EMT 2. $\frac{39}{100}$ 3. $\frac{12}{31}$ 4. 16 5. 4 6. $\frac{5}{31}$ 7. HH HT TH TT 8. $\frac{25}{100}$ 9. $\frac{51}{100}$ 10. $\frac{27}{36}$ 11. Addition calculations carried out 12. $\frac{21}{31}$ 13. $\frac{19}{31}$ 14. $\frac{5}{36}$ 15. $\frac{26}{100}$ 16. $\frac{6}{36}$ 17. $\frac{1}{36}$ 18. $\frac{13}{49}$ 19. $\frac{7}{31}$ 20. $\frac{6}{36}$

Year 8 - representations…

Working in the Cartesian plane

@whisto_maths

What do I need to be able to do?

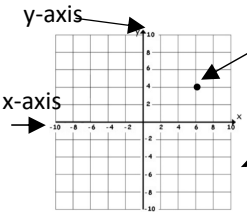
By the end of this unit you should be able to:

- Label and identify lines parallel to the axes
- Recognise and use basic straight lines
- Identify positive and negative gradients
- Link linear graphs to sequences
- Plot y = mx + c graphs

Keywords

Quadrant: four quarters of the coordinate plane.
Coordinate: a set of values that show an exact position.
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)
Origin: (0,0) on a graph. The point the two axes cross
Parallel: Lines that never meet
Gradient: The steepness of a line
Intercept: Where lines cross

Coordinates in four quadrants



Coordinate (6, 4)
(x, y)

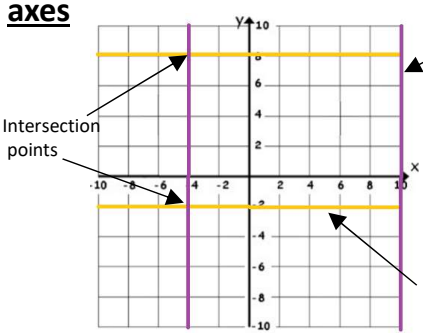
From the origin this coordinate is 6 places along the positive x axis and 4 places up the positive y axis.

(0, a) Will be always be a point on the y axis. (a can be any number)

(a, 0) Will be always be a point on the x axis. (a can be any number)

(x, y)
Always the position on the x axis first
Always the position on the y axis second

Lines parallel to the axes



All the points on this line have a x coordinate of 10

'a' can be ANY positive or negative value including 0

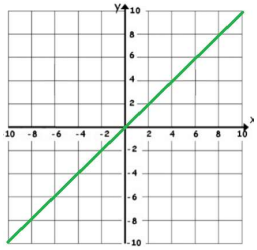
Lines parallel to the **y axis** take the form **x = a** and are **vertical**

Lines parallel to the **x axis** take the form **y = a** and are **horizontal**

All the points on this line have a y coordinate of -2

e.g. (3, -2) (7, -2) (-2, -2) all lay on this line because the y coordinate is -2

Recognise and use the line y=x

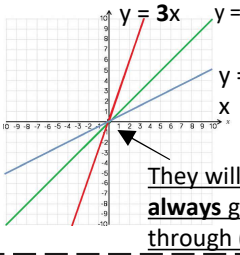


This means the x and the y coordinate have the same value

Examples of coordinates on this line: (0, 0) (-3, -3) (8, 8)

The axes **scale is important** – if the scale is the same y = x will be a straight line at 45^0

Recognise and use the lines y=kx



The value of **k** changes the steepness of the line

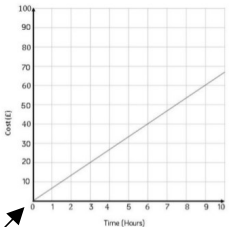
Note: y =x is the same as y=1x

The bigger the value of k the **steeper** the line will be.

The closer to 0 the value of k the closer the line will be to the x axis.

They will **always** go through (0,0)

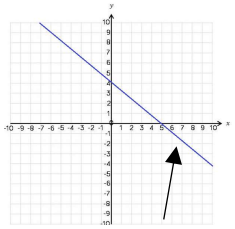
Direct Proportion ysing y=kx



The line must be straight to be directly proportional – variables increase at the same rate **k**

Direct proportion graphs always start at (0,0) as they are describing relationships between two variables

Lines with negative gradients

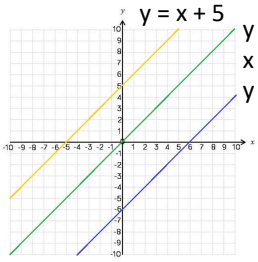


Any straight-line graph with a negative x value has a negative gradient.

E.g. y = -2x
y = -x y + x = 12

Direction of all negative gradients

Lines in the form y = x + a



All the lines are **parallel** because the gradients are the same

y = x + a

This is the line y=x when the y and x coordinate are the same

This shows the translation of that line.

e.g. y = x + 5
Is the line y=x moved 5 places up the graph

5 has been added to each of the x coordinates

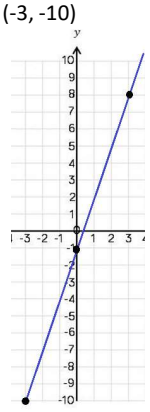
Plotting y = mx + c

$y = 3x - 1$ → 3 x the x coordinate then – 1

x	−3	0	3
y	-10	-1	8

Draw a table to display this information

This represents a coordinate pair (-3, -10)



You only need two points to form a straight line

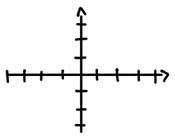
Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

Remember to join the points to make a line

Working in the Cartesian Plane

Question 1

Sketch the graph of $x = 2$



Question 2

Does the point $(4, 9)$ lie on the line $y = 4x - 8$?

Question 3

The point $(0, y)$ lies on the line $y = 10x + 9$

Find y

Question 4

Find the midpoint of the line joining points $(3, 8)$ and $(8, 6)$

Question 5

The point $(0, y)$ lies on the line $y = -x - 7$

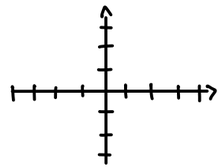
Find y

Question 6

Find the midpoint of the line joining points $(-4, -1)$ and $(7, -6)$

Question 7

Sketch the graph of $x = -1$

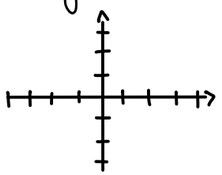


Question 8

Does the point $(-2, 3)$ lie on the line $y = x + 5$?

Question 9

Sketch the graph of $y = 3$

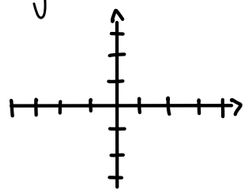


Question 10

Does the point $(5, -46)$ lie on the line $y = -9x - 2$?

Question 11

Sketch the graph of $y = x$



Question 12

The point $(0, y)$ lies on the line $y = -x - 10$

Find y

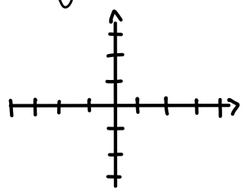
Question 13

The point $(1, y)$ lies on the line $y = 2x + 3$

Find

Question 14

Sketch the graph of $y = -2$



Question 15

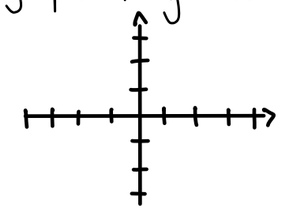
Does the point $(6, -20)$ lie on the line $y = -2x - 8$?

Question 16

Find the midpoint of the line joining points $(10, -2)$ and $(2, 8)$

Question 17

Sketch the graph of $y = -x$



Question 18

The point $(2, y)$ lies on the line $y = 3x - 6$

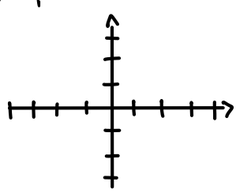
Find y

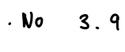
Question 19

Does the point $(4, 46)$ lie on the line $y = 10x + 7$?

Question 20

Sketch the graph of $x = 0.5$



ANSWERS: 1.  2. No 3. 9 4. (5.5, 7) 5. -7 6. (1.5, -2.5) 7. 8. Yes 9. 10. No 11. 12. -10 13. 5 14. 15. Yes 16. (4, 8) 17. 18. 0 19. No 20.

Year 8 - algebraic techniques…

Brackets, Equations & Inequalities

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Form Expressions
- Expand and factorise single brackets
- Form and solve equations
- Solve equations with brackets
- Represent inequalities
- Form and solve inequalities

Keywords

Simplify: grouping and combining similar terms
Substitute: replace a variable with a numerical value
Equivalent: something of equal value
Coefficient: a number used to multiply a variable
Product: multiply terms
Highest Common Factor (HCF): the biggest factor (or number that multiplies to give a term)
Inequality: an inequality compares who values showing if one is greater than, less than or equal to another

Form expressions

More than – **ADD**
Less than/ difference – **SUBTRACT**

For unknown variables, a letter is normally used in its place

e.g. 4 more than t → **t + 4**
8 less than k → **k - 8**

Only similar terms can be grouped together

e.g. Find the perimeter of this shape (Perimeter = length around outside of shape)

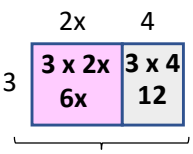
t + 2t + 1 + t + 2t + 1 → **6t + 2**

Directed numbers

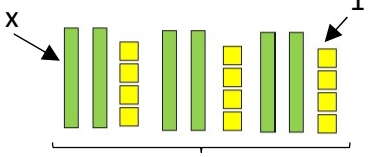
+ + → **+**
- - → **+**
+ - → **-**
- + → **-**

e.g. a = -5 and b = 2
a^2 = a x a = -5 x – 5 = **25**
b + a = 2 + - 5 = **-3**

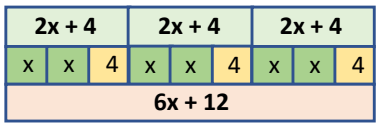
Multiply single brackets 3 (2x + 4)



6x + 12

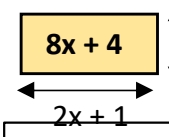


6x + 12



Different representations of 3(2x+4) = 6x + 12

Factorise into a single bracket



8x + 4

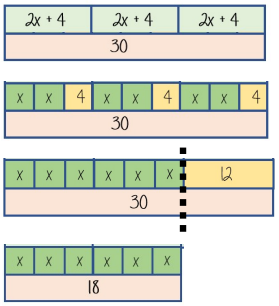
Try and make this the **highest common factor**

The two values **multiply** together (also the area) of the rectangle

8x + 4 ≡ 4 (2x + 1)

Note:
8x + 4 ≡ 2(4x + 2)
This is factorised but the HCF has not been used

Solve equations with brackets 3 (2x + 4) = 30



3 (2x + 4) = 30

Expand the brackets

6x + 12 = 30

-12 -12

6x = 18

÷ 6 ÷ 6

x = 3

Substitute to check your answer.
This could be negative or a fraction or decimal

Simple Inequalities

< less than
≤ Less than or equal to
> More than
≥ More than or equal to

x < 10
Say this out loud "x is a value less than 10"

10 > x
Say this out loud "10 is more than the value"

Note:
x<10 and 10>x represent the same values

x + 2 ≤ 20
"my value + 2 is less than or equal to 20"
x ≤ 18
The biggest the value can be is 18

Form and solve inequalities

Two more than treble my number is greater than 11

Find the possible range of values

Form

x → x3 → +2 → 11

3x + 2 > 11

Solve

x ← ÷3 ← -2 ← 11

x > 3

Check

This would suggest any value bigger than 3 satisfies the statement
3 x 3 + 2 = 11 ✓ 10 x 3 + 2 = 32 ✓

Algebraic constructs

Expression
A sentence with a minimum of two numbers and one maths operation

Equation
A statement that two things are equal

Term
A single number or variable

Identity
An equation where both sides have variables that cause the same answer
includes ≡

Formula
A rule written with all mathematical symbols
e.g. area of a rectangle A = b x h

Brackets, Equations and Inequalities

Question 1

Simplify

$9k - 12k$

Question 2

Solve the equation

$-5x = 20$

Question 3

Expand

$3(t+2)$

Question 4

Simplify

$4d + 3 + -d + 1$

Question 5

Write an expression for

"two more than x"

Question 6

Factorise

$3k + 15$

Question 7

Expand and Simplify

$3(h+5) + 4(h+6)$

Question 8

Solve

$4(x-7) = 32$

Question 9

Expand

$4(5+k)$

Question 10

List the integers that satisfy the inequality

$1 \leq s < 5$

Question 11

Solve the inequality

$2a + 10 > 4$

Question 12

Factorise

$49 + 14m$

Question 13

Solve

$8y + 7 > 3y - 3$

Question 14

Expand

$2(3p+1)$

Question 15

Solve

$3(x+5) > 27$

Question 16

Expand

$x(x-3)$

Question 17

Factorise

$7m^2 + 14m$

Question 18

Expand and Simplify

$4(2p+3q) + 2(p+q)$

Question 19

Solve

$7f + 4 = 4f + 1$

Question 20

Expand and Simplify

$(x+1)(x+3)$

Answers: 1. $-3k$ 2. $x=-4$ 3. $3t+6$ 4. $3d+4$ 5. $x+2$ or $2+x$ 6. $3(k+5)$ 7. $7h+39$ 8. $x=15$ 9. $20+4k$ 10. 1, 2, 3, 4 11. $a>-3$ 12. $7(7+2m)$ 13. $y>-2$ 14. $6p+2$ 15. $x>4$ 16. x^2-3x 17. $7m(m+2)$ 18. $10p+14q$ 19. $f=-1$ 20. x^2+4x+3

Year 8 - algebraic techniques…

Indices

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Add/ Subtract expressions with indices
- Multiply expressions with indices
- Divide expressions with indices
- Know the addition law for indices
- Know the subtraction law for indices

Keywords

Base: The number that gets multiplied by a power
Power: The exponent – or the number that tells you how many times to use the number in multiplication
Exponent: The power – or the number that tells you how many times to use the number in multiplication
Indices: The power or the exponent.
Coefficient: The number used to multiply a variable
Simplify: To reduce a power to its lowest term
Product: Multiply

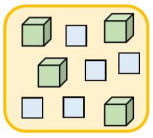
Addition/ Subtraction with indices

Coefficient Power

$5x^2 + 4x^4$

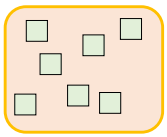
Term Term

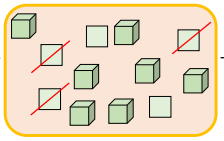
Expression



Each square represents x^2 and each cube represents x^4

Only similar terms can be simplified
If they have different powers, they are unlike terms

$5x^2 + 2x^2$ →  → $7x^2$

$5x^2 + 6x^4 - 3x^2 + x^4$ →  → $2x^2 + 7x^4$

Multiply expressions with indices

4b x 3a
≡ 4 x b x 3 x a
≡ 4 x 3 x b x a
≡ **12 ab**

5 t x 9 t
≡ 5 x t x 9 x t
≡ 5 x 9 x t x t
≡ **45 t^2**

$2b^4$ x $3b^2$
≡ 2 x b x b x b x b x 3 x b x b
≡ 2 x 3 x b x b x b x b x b x b
≡ **6 b^6**

There are often misconceptions with this calculation but break down the powers

Divide expressions with indices

$\frac{24}{36}$ → $\frac{2 \times 2 \times 2 \times 3}{2 \times 3 \times 2 \times 3}$ → $\frac{2}{3}$

$\frac{5\,a^3\,b^2}{15\,a\,b^6}$ → $\frac{5 \times a \times a \times a \times b \times b}{3 \times 5 \times a \times b \times b \times b \times b \times b \times b}$ → $\frac{a^2}{3b^4}$

Cross cancelling factors shows cancels the expression

$\frac{23\,a^7\,y^2}{5\,d\,b^6}$

This expression cannot be divided (cancelled down) because there are no common factors or similar terms

Addition/ Subtraction laws for indices

3^5 x 3^2
= (3 x 3 x 3 x 3 x 3) **x** (3 x 3) → **3^7**

The base number is all the same so the terms can be simplified

Addition law for indices

$$a^m \times a^n = a^{m+n}$$

$3^5 \div 3^2$ → **3^3**

$\frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3}$ → $\frac{3^3}{3^0}$ → $\frac{3^3}{1}$

Subtraction law for indices

$$a^m \div a^n = a^{m-n}$$

Indices

Question 1

Simplify

$2x^2 + 3x^2$

Question 2

Simplify

$2x \times 3x$

Question 3

Simplify $\frac{15x}{x}$

Question 4

Simplify

$x^5 \times x^8$

Question 5

Simplify $\frac{3^5}{3^2}$

Question 6

Simplify $\frac{15xy}{3y}$

Question 7

Simplify

$5m^2 + 7m^2 + 2m^2$

Question 8

Simplify

$4k^2 \times 3k^3$

Question 9

Simplify

$t \times t \times s \times s \times t$

Question 10

Simplify

$(a^6)^2$

Question 11

Simplify

$y^5 \times y^{-2}$

Question 12

Simplify $\frac{t^{12}}{t^9}$

Question 13

Simplify

$(t^{10})^3$

Question 14

Simplify

$2y^3 + 4y^3 - 5y^3$

Question 15

Simplify $y^8 \div y^4$

Question 16

Simplify $\frac{15x^2y}{5xy}$

Question 17

Simplify $\frac{6ab \times 4ac}{8a}$

Question 18

Simplify

x^0

Question 19

Find the value of x

$2^7 \times 2^x = 2^{12}$

Question 20

Simplify

$(5p^4)^2$

Answers: 1. $5x^2$ 2. $6x^2$ 3. 15 4. x^{13} 5. $3^3 = 27$ 6. $5x$ 7. $14m^2$ 8. $12k^5$ 9. s^2t^3 10. a^{12} 11. y^3 12. t^3 13. t^{30} 14. y^3 15. y^4 16. $3x$ 17. $3abc$ 18. 1 19. $x = 5$ 20. $25p^8$

Year 8 - algebraic techniques…

Sequences

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Generate a sequence from term to term or position to term rules
- Recognise arithmetic sequences and find the nth term
- Recognise geometric sequences and other sequences that arise

Keywords

Sequence: items or numbers put in a pre-decided order
Term: a single number or variable
Position: the place something is located
Linear: the difference between terms increases or decreases (+ or -) by a constant value each time
Non-linear: the difference between terms increases or decreases in different amounts, or by x or ÷
Difference: the gap between two terms
Arithmetic: a sequence where the difference between the terms is constant
Geometric: a sequence where each term is found by multiplying the previous one by a fixed non zero number

Linear and Non Linear Sequences

Linear Sequences – increase by addition or subtraction and the same amount each time

Non-linear Sequences – do not increase by a constant amount – quadratic, geometric and Fibonacci.

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division.

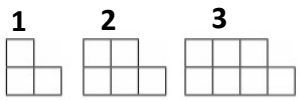
Fibonacci Sequence – look out for this type of sequence

0 1 1 2 3 5 8 …

Each term is the sum of the previous two terms.

Sequence in a table and graphically

Position: the place in the sequence



"The **term** in **position** 3 has 7 squares"

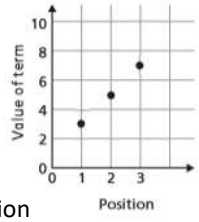
Term: the number or variable **(the number of squares in each image)**

In a table

Position	1	2	3
Term	3	5	7

+2 +2

Graphically



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Sequences from algebraic rules

This is substitution!

3n + 7

This will be linear - note the single power of n. The values increase at a constant rate

3n² + 7

This is not linear as there is a power for n

2n - 5 → Substitute the number of the term you are looking for in place of 'n'

e.g.
1st term = 2 **(1)** – 5 = -3
2nd term = 2 **(2)** – 5 = -1
100th term = 2 **(100)** – 5 = 195

Checking for a term in a sequence

Is 201 in the sequence 3n – 4?

Form an equation

Term to check

Algebraic rule → **3n – 4 = 201**

Solving this will find the position of the term in the sequence.
ONLY an integer solution can be in the sequence.

Complex algebraic rules

Misconceptions and comparisons

2n²

2 times whatever n squared is

e.g.
1st term = 2 x **1²** = 2
2st term = 2 x **2²** = 8
100th term = 2 x**100²** = 2000

(2n)²

2 times n then square the answer

e.g.
1st term = (2 x **1**)² = 4
2st term = (2 x **2**)² = 16
100th term = (2 x**100**)² = 40000

n (n + 5)

e.g.
1st term = **1** (**1** + 5) = 6
2st term = **2** (**2** + 5) = 14
100th term = **100** (**100** + 5) = 10500

You don't need to expand the expression

H Finding the algebraic rule

This is the 4 times table → **4, 8, 12, 16, 20…..**

4n

7, 11, 15, 19, 22

This has the same constant difference – but is 3 more than the original sequence

4n + 3

4n + 3

This is the constant difference between the terms in the sequence

This is the comparison (difference) between the original and new sequence

Sequences

Question 1

Write the first 5 terms of this sequence

"The first term is 3, then add 4 each time"

Question 2

List the first 5 square numbers

Question 3

Find the nth term rule:

4, 8, 12, 16, ...

Question 4

Write the first 5 terms of this sequence described by the rule:

$4n + 5$

Question 5

Find the nth term rule:

5, 9, 13, 17, ...

Question 6

Write the first 5 terms of this sequence described by the rule:

$10n - 6$

Question 7

Write the first 5 terms of this sequence

"The first term is 10, then subtract 3 each time"

Question 8

Find the nth term rule:

-3, 5, 13, 21, ...

Question 9

Write the first 5 terms of this sequence described by the rule:

$4(3n + 1)$

Question 10

Write the first 5 terms of this sequence

"The first term is 1, then double the number each time"

Question 11

Write the first 5 terms of this sequence described by the rule:

$11n - 20$

Question 12

Continue this Fibonacci sequence:

1, 1, 2, —, —, —, —, ...

Question 13

Describe this sequence using a term-to-term rule:

4, 7, 10, 13, 16, ...

Question 14

Find the nth term rule:

2, 6, 10, 14, ...

Question 15

List the first 5 prime numbers

Question 16

Find the nth term rule:

-7, -1, 5, 11, ...

Question 17

Write the first 5 terms of this sequence described by the rule:

n^3

Question 18

Find the nth term rule:

Question 19

Write the first 5 terms of this sequence

"The sequence is one less than the 5 times table"

Question 20

Does the number 1001 appear in the sequence:

-3, 5, 13, 21, ... ?

Answers: 1. 3, 7, 11, 15, 19 2. 1, 4, 9, 16, 25 3. $4n$ 4. 9, 13, 17, 21, 25 5. $4n+1$ 6. 4, 14, 24, 34, 44 7. 10, 7, 4, 1, -2 8. $8n-11$ 9. 16, 28, 40, 52, 64 10. 1, 2, 4, 8, 16 11. -9, 2, 13, 24, 35 12. 3, 5, 8, 13 13. First term 4, then add 3 14. $4n-2$ 15. 2, 3, 5, 7, 11 16. $6n-13$ 17. 1, 8, 27, 64, 125 18. $2n+1$ 19. 4, 9, 14, 19, 24 20. No

Year 8 - Developing number…

Fractions & Percentages

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Convert between FDP less than and more than 100.
- Increase or decrease using multipliers.
- Express an amount as a percentage.
- Find percentage change.

Keywords

Percent: parts per 100 – written using the % symbol.
Decimal: a number in our base 10 number system. Numbers to the right of the decimal place are called decimals.
Fraction: a fraction represents how many parts of a whole value you have.
Equivalent: of equal value.
Reduce: to make smaller in value.
Growth: to increase/ to grow.
Integer: whole number, can be positive, negative or zero.
Invest: use money with the goal of it increasing in value over time (usually in a bank).

Convert FDP

$\frac{70}{100}$ → This also means $70 \div 100$ → 70 out of 100 squares → **70 "hundredths" = 7 "tenths" 0.7** → 70 hundredths **= 70%**

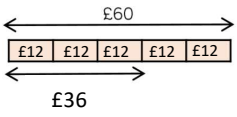
Using a **calculator**: ■/□ → S⇔D → This will give you the answer in the simplest form

Convert to a decimal: **100** converts to a percentage :

Be careful of recurring decimals
e.g $\frac{1}{3}$ **= 0.3333333**
$= 0.\dot{3}$
The dot above the 3

Fraction/ Percentage of amount

Find $\frac{3}{5}$ of £60

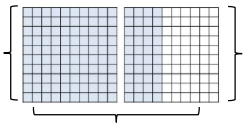


Remember $\frac{3}{5} = 60\% = 0.6$

10% of £60 = £6
50% of £60 = £30
60% of £60 = £36

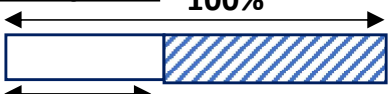
60% of £60 **= 0.6 x 60 = £36**

Convert FDP < and > 100%



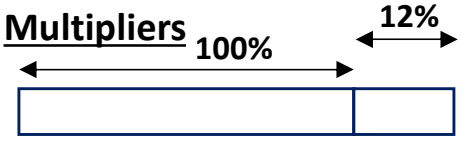
100%+40%
1 + 0.40
= 1.40

Percentage decrease: Multipliers



100% - 58% = 42%
1.00 – 0.58 = 0.42
Multiplier Less than 1

Percentage increase: Multipliers



100% + 12% = 112%
1.00 + 0.12 = 1.12
Multiplier More than 1

Express as a % - Non-calculator

Percent – per hundred

7 per every 10 are orange → $\frac{7}{10}$ → This means that 70 per every 100 are orange → $\frac{70}{100}$ → **70%**

27 per every 50 shaded → $\frac{27}{50}$ → 54 per every 100 shaded → $\frac{54}{100}$ → **54%**

Denominator 100 | Equivalent fractions

Express as a % - Calculator

$\frac{13}{30}$ → ■/□ → $\frac{13}{30}$ → × 100 → **43.3333….%** **43%**

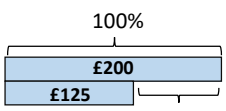
Can't use equivalence easily to find 'per hundred'

This the same as $13 \div 30$

Decimal percentages are still a percentage.

Percentage change

I bought a phone for £200. A year later I sold it for £125.

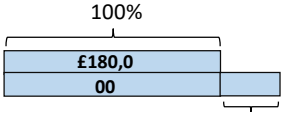


All values of change compare to the ORIGINAL value

Percentage loss
$\frac{75}{200} \times \frac{}{100} = 37.5\%$

Difference in value / Original value × 100

I bought a house for £180,000, I later sold it for £216,000.



Percentage profit
Money made (profit value) → $\frac{36000}{180000} \times 100 = 20\%$

Choose appropriate method

The language and wording of the question is the key.

Have you represented the question in a bar model? Can you use a calculator?

Question 1
Express 1 out of 20 as a percentage.

Question 2
Express 7% as a decimal

Question 3
What is the multiplier needed for a 25% increase?

Question 4
Express 2 out of 16 as a percentage.

Question 5
A car goes down in value from £12,500 to £9,000 in a year. Work out the percentage decrease.

Question 6
Write in descending order:
$\frac{19}{50}$, 0·4, 39%

Question 7
Use a calculator to convert $\frac{7}{45}$ to a decimal. Give your answer to 2 decimal places.

Question 8
What is 0·2 as a percentage?

Question 9
Find $\frac{3}{10}$ of £280

Question 10
What is the multiplier needed to work out an increase of 0·6%?

Question 11
Write in ascending order
$\frac{4}{25}$, 0·15, 17%

Question 12
Write $\frac{5}{100}$ as a decimal

Question 13
What is 120% as a fraction?

Question 14
20% of x is 20. What is x?

Question 15
What is 0·45 as a fraction in it's simplest form?

Question 16
The UK population was 67·33 million in 2021. It increased by 0·4% in 2022. What was the population in 2022?

Question 17
What is $\frac{4}{5}$ of 75?

Question 18
What is the multiplier needed for a 30% decrease?

Question 19
Maria spent £35 making a dog kennel and sold it for £55. Work out her percentage profit.

Question 20
If I use a multiplier of 1·08, will I get an increased amount or a decreased amount?

Q1) 5% Q2) 0·07 Q3) ×1·25 Q4) 12·5% Q5) 28% Q6) 0·4, 39%, $\frac{19}{50}$ Q7) 0·16 Q8) 20% Q9) £84 Q10) ×1·006 Q11) 0·15, $\frac{4}{25}$, 17% Q12) 0·05 Q13) $\frac{120}{100}$ or $\frac{12}{10}$ or $\frac{6}{5}$ Q14) 100 Q15) $\frac{9}{20}$ Q16) 67·60 million (2dp) Q17) 60 Q18) ×0·7 Q19) 57% Q20) Increased

Year 8 - Developing number…

Number Sense

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What do I need to be able to do?

By the end of this unit you should be able to:

- Round numbers to powers of 10 and 1 sf
- Round numbers to any dp
- Estimate solutions
- Calculate using order of operations
- Calculate with money, units of measurement and time

Keywords

Significant: Place value of importance
Round: Making a number simpler but keeping its value close to what it was.
Decimal: Place holders after the decimal point.
Overestimate: Rounding up – gives a solution higher than the actual value
Underestimate: Rounding down – gives a solution lower than the actual value.
Metric: A system of measurement.
Balance: The amount of money in a bank account
Deposit: Putting money into a bank account.

Round to powers of 10 and 1 sig. figure

R

If the number is halfway between we "**round up**"

5495 to the nearest 1000

5000 ⬆ 6000

5475 to the nearest 100

5400 ⬆ 5500

5475 to the nearest 10

5470 ⬆ 5480

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00037 to 1 significant figure is 0.0004

Round to the first non-zero number

Round to decimal places

2 • 46192

Focus on the numbers **after** the decimal point

2 • 46192 (to 1.d.p) - Is this closer to 2.4 or 2.5

2.4 ⬆ 2.5

2 • 4 6192

This shows the number is closer to 2.5

2 • 46192 (to 2d.p) - Is this closer to 2.46 or 2.47

2.46 ⬆ 2.47

2 • 46 192

This shows the number is closer to 2.46

Estimate the calculation

Round to 1 significant figure to estimate

$4 \bullet 2 + 6 \bullet 7 \approx 4 + 7 \approx 11$

This is an **overestimate** because the 6.7 was rounded up more

The equal sign changes to show it is an estimation

$21 \bullet 4 \times 3 \bullet 1 \approx 20 \times 3 \approx 60$

This is an **underestimate** because both values were rounded down

It is good to check all calculations with an estimate in all aspects of maths – it helps you identify calculation errors.

Order of operations

R

Brackets Operations in brackets are calculated first

Indices operations e.g. powers, roots,

Multiplication/ Division
They are carried out in the order from left to right in the question

Addition/ Subtraction
They are carried out in the order from left to right in the question

Calculations with money

Debit - You have £0 or more in an account

Credit - You have less than £0 in an account

Money calculations are to 2.d.p

Using a calculator – ensure you are working in the correct units.
£1.30 + 50p = 130 + 50 (in pence)
= 1.30 + 0.50 (in pounds)

£1 = 100p

Units are important:

Useful Conversions

mm ⟷ cm ⟷ m ⟷ km (×10, ×100, ×1000 / ÷10, ÷100, ÷1000)

g ⟷ kg ⟷ T (×1000 / ÷1000)

ml ⟷ L (×1000 / ÷1000)

Metric measures of length

Kilo = 1000 x meter Centi - $\frac{1}{100}$ x meter

Milli - $\frac{1}{1000}$ x meter

Units of weight/ capacity

Weight = g, kg, t
Capacity (volume of liquid) = ml, L

Time and the calendar

1 Year – the amount of time it takes Earth to go around the sun **365** (and a quarter) **days**

Leap Year – **366 days** (every 4 years)

12 Months = one year = 52 weeks

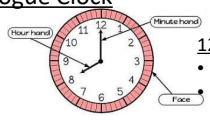
31 days – **Jan, March, May, July Aug, Oct, Dec**
30 days – **April, June, Sept, Nov**
28 days – **Feb** (29 leap year)

1 week – 7 days
Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday

1 day – 24 hours
1 hour - 60 minutes
1 minute – 60 seconds

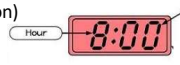
Use a number line for time calculations!

Analogue Clock



12-hour clock
- Use am (morning) and pm (afternoon)
- Only use hour times up to 12

Digital Clock (24-hour times)



24-hour clock
- 0-11 (morning hours)
- 12-23 (afternoon hours)

Question 1 Round 372 to the nearest ten.	**Question 2** The minimum recommended sleep time for teenagers is 8 hours. What percentage of a full day is this?	**Question 3** Work out $4+10\times6$	**Question 4** A coach journey starts at 9:15am and takes 2½ hours. At what time will it arrive?
Question 5 Convert 0.185 kg to grams.	**Question 6** Round 1,680 to the nearest hundred.	**Question 7** How many cm are in 4m?	**Question 8** Work out $33-4^2\times2$
Question 9 Estimate the answer to $\frac{21.6+18.9}{7.82}$ (What do you get on a calculator?)	**Question 10** Work out $5\times(21-11)$	**Question 11** Round 32.129 to 1 decimal place.	**Question 12** How many decimal places should we always use when working with money?
Question 13 Round 0.02845 to 1 significant figure.	**Question 14** Round 32.129 to 2 decimal places.	**Question 15** Nagindra takes his family out for a meal. The bill is £37.85. He pays with a £50 note. What change should he get?	**Question 16** Round 0.368 to the nearest tenth.
Question 17 Susan's bank account balance is £262.17. She pays a bill and the new balance is £178.30. How much was the bill for?	**Question 18** By rounding the numbers to 1 significant figure, estimate the answer to 12.2×4.8	**Question 19** Round 4214 to 1 significant figure.	**Question 20** How many days are there in November?

Answers: Q1) 370 Q2) 33.3% Q3) 64 Q4) 11:45am Q5) 185g Q6) 1,700 Q7) 400cm Q8) 1 Q9) 5 (5.179...) Q10) 50 Q11) 32.1 Q12) 2 Q13) 0.03 Q14) 32.13 Q15) £12.15 Q16) 0.4 Q17) £83.87 Q18) 40 Q19) 4000 Q20) 30

Year 8 - Developing number…

Standard Form

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What do I need to be able to do?

By the end of this unit you should be able to:

- Write numbers in standard form and as ordinary numbers
- Order numbers in standard form
- Add/ Subtract with standard from
- Multiply/ Divide with standard form
- Use a calculator with standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers
Commutative: an operation is commutative if changing the order does not change the result.
Base: The number that gets multiplied by a power
Power: The exponent – or the number that tells you how many times to use the number in multiplication
Exponent: The power – or the number that tells you how many times to use the number in multiplication
Indices: The power or the exponent.
Negative: A value below zero.

Positive powers of 10

1 billion – 1 000 000 000
10 x 10 x 10 x 10 x 10 x10 x 10 x10 x 10 x10 = 10^9

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers >1

Any integer

$A \times 10^n$

Any number between 1 and less than 10

Example

3.2×10^4
$= 3.2 \times 10 \times 10 \times 10 \times 10$
$= 32000$

Non-example

0.8×10^4

$5.3 \times 10^{0.7}$

Negative powers of 10

0.001	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
1 x $\frac{1}{1000}$	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
1 x 10^{-3}	0	0	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

$0.05.4$
$= 5.4 \times 10^{-2}$

1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^0	10^{-1}	10^{-2}	10^{-3}
0	0	5	4

A negative power does not mean a negative answer – it means a number closer to 0

Order numbers in standard form

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}

6.4×10^{-2} 2.4×10^2 3.3×10^0 1.3×10^{-1}

0.064 **240** **1** **0.13**

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$6.4 \times 10^2 \times 1000$
$= 6.4 \times 10^2 \times 10^3$
Use addition for indices rule
$= 6.4 \times 10^5$

Not in Standard Form

$8 \times 10^5 \times 3$
$= 24 \times 10^5$
Not in Standard Form
$= 2.4 \times 10^1 \times 10^5$
$= 2.4 \times 10^6$

$(2 \times 10^3) \div 4$
$= (2 \div 4) \times 10^3$ **Divide the values**
$= 0.5 \times 10^3$

Use addition for indices rule

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard from at the end.

$6 \times 10^5 + 8 \times 10^5$

Method 1
$= 600000 + 800000$
$= 1400000$
$= 1.4 \times 10^5$

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Method 2
$= (6 + 8) \times 10^5$
$= 14 \times 10^5$
This is not the final answer
$= 1.4 \times 10^1 \times 10^5$
$= 1.4 \times 10^5$

Only works if the powers are the same

Multiplication and division

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$ Division questions can look like this

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

For multiplication and division you can look at the values for **A** and the powers of 10 as two separate calculations

Revisit addition and subtraction laws for indices – they are needed for the calculations

Addition law for indices
$a^m \times a^n = a^{m+n}$

Subtraction law for indices
$a^m \div a^n = a^{m-n}$

Using a calculator

$1.4 \times 10^5 \times 3.9 \times 10^3$

Input 1.4 and pres [×10^x] hen press 5 (for the power)
Press [×]
Input 3.9 and pres: [×10^x] Then press 3 (for the power)
Press [=]

This gives you the solution

Answer: 5.5×10^8

Use a calculator to work out this question to a suitable degree of accuracy.

Question 1

Convert 2.5×10^4 to an ordinary number.

Question 2

Convert 478,250 into Standard Form.

Question 3

Which of these is in correct standard form?

A. 6×6^2 B. 3×10^4 C. 58×10^6

Question 4

Calculate

$2.6 \times 10^{-3} \times 6.8 \times 10^{-4}$

Give your answer in Standard Form

Question 5

Work out

$7 \times 10^3 \times 8 \times 10^2$

Give your answer in standard form.

Question 6

What is the value of 10^3?

Question 7

Convert 74,800 to standard form.

Question 8

Using the addition rule for indices, what is $10^6 \times 10^2$?

Question 9

Work out

$2.5 \times 10^3 \div 5 \times 10^6$

Give your answer in Standard Form.

Question 10

Which one of these is in correct standard form?

A: 32×10^{14} B: 8.9×10^{-3} C: 6.2×4^{10}

Question 11

What is 10^{-2} as an ordinary number?

Question 12

Work out

$7.5 \times 10^5 - 4.2 \times 10^3$

Give your answer as an ordinary number.

Question 13

Calculate

$3 \times 10^6 + 4.2 \times 10^7$

Give your answer in Standard form.

Question 14

Work out

$3 \times 10^2 + 5 \times 10^3$

Give your answer in Standard form.

Question 15

Which one of these numbers is a good estimate for the diameter of the earth?

A: 2.78×10^{-11} km B: 1.27×10^5 km

Question 16

Adjust 23×10^4 so that it is in correct standard form.

Question 17

One atom of iron (Fe) has a radius of 1.26×10^{-10} m.

Write this as an ordinary number.

Question 18

Use the subtraction rule for indices to work out

$$\frac{10^6}{10^4} = \square$$

Question 19

Work out

$$\frac{2.7 \times 10^4}{3 \times 10^2}$$

Give your answer in standard form.

Question 20

What is 1 million written as a power of 10?

ANSWERS: Q1) 25,000 Q2) 4.7825×10^5 Q3) B Q4) 1.768×10^{-6} Q5) 5.6×10^6 Q6) 1000 Q7) 7.48×10^4 Q8) 10^8 Q9) 5×10^{-4} Q10) B Q11) 0.01 or $\frac{1}{100}$ Q12) 745,800 Q13) 4.5×10^7 Q14) 5.3×10^3 Q15) B Q16) 2.3×10^5 Q17) 0.000000000126 (9 zeroes) Q18) 10^2 Q19) 9×10^1 Q20) 10^6

Year 8 - Developing geometry…

Angles in parallel lines and polygons

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

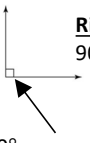
- Identify alternate angles
- Identify corresponding angles
- Identify co-interior angles
- Find the sum of interior angles in polygons
- Find the sum of exterior angles in polygons
- Find interior angles in regular polygons

Keywords

Parallel: Straight lines that never meet
Angle: The figure formed by two straight lines meeting (measured in degrees)
Transversal: A line that cuts across two or more other (normally parallel) lines
Isosceles: Two equal size lines and equal size angles (in a triangle or trapezium)
Polygon: A 2D shape made with straight lines
Sum: Addition (total of all the interior angles added together)
Regular polygon: All the sides have equal length; all the interior angles have equal size.

Basic angle rules and notation

Acute Angles
0°< angle <90°



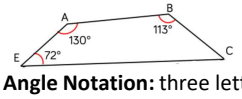
Right Angles
90°

Right angle notation

Obtuse
90°< angle <180°

Reflex
180°< angle <360°

Straight Line
180°



The letter in the middle is the angle
The arc represents the part of the angle

Angle Notation: three letters **ABC**
This is the angle at B = 113 °

Line Notation: two letters **EC**
The line that joins E to C.

Vertically opposite angles
Equal

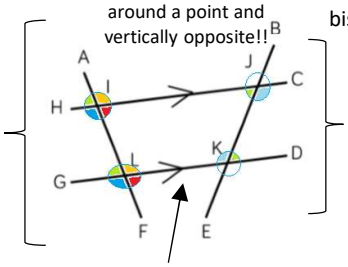
Angles around a point
360 °

Parallel lines

Still remember to look for angles on straight lines, around a point and vertically opposite!!

Lines AF and BE are **transversals** (lines that bisect the parallel lines)

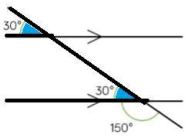
Corresponding angles often identified by their **"F shape"** in position.



Alternate angles often identified by their **"Z shape"** in position

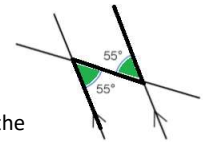
This notation identifies parallel lines

Alternate/ Corresponding angles

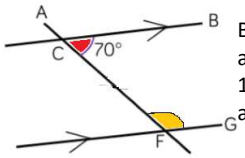


Because alternate angles are equal the highlighted angles are the same size

Because corresponding angles are equal the highlighted angles are the same size



Co-interior angles

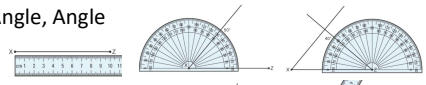


Because co-interior angles have a sum of 180° the highlighted angle is 110°

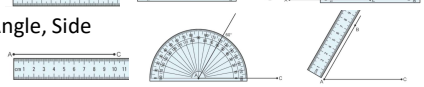
As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

Triangles & Quadrilaterals

Side, Angle, Angle



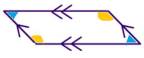
Side, Angle, Side



Side, Side, Side

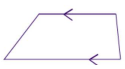
Properties of Quadrilaterals

Square
All sides equal size
All angles 90°
Opposite sides are parallel



Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Rectangle
All angles 90°
Opposite sides are parallel



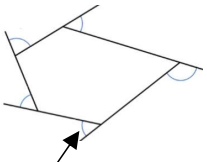
Trapezium
One pair of parallel lines

Rhombus
All sides equal size
Opposite angles are equal

Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

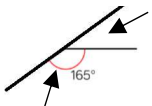
Sum of exterior angles

Exterior angles all add up to 360°



Exterior Angles
Are the angle formed from the straight-line extension at the side of the shape

Using exterior angles



Interior angle + Exterior angle = straight line = 180°

Exterior angle = 180 – 165 = **15°**

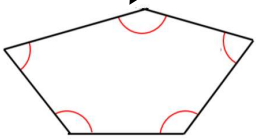
Number of sides = 360° ÷ exterior angle

Number of sides = 360 ÷ 15 = 24 sides

Sum of interior angles

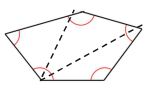
(number of sides – 2) x 180

Interior Angles
The angles enclosed by the polygon



This is an **irregular** polygon – the sides and angles are different sizes

Sum of the interior angles = (5 – 2) x 180

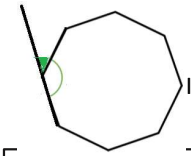


This shape can be made from three triangles
Each triangle has 180°

Sum of the interior angles = 3 x 180
= **540°**

Remember this is **all** of the interior angles added together

Missing angles in regular polygons



Exterior angle = 360 ÷ 8 = **45°**

Interior angle = $\frac{(8-2) \times 180}{8}$ = $\frac{6 \times 180}{8}$ = **135°**

Exterior angles in regular polygons = 360° ÷ number of sides

Interior angles in regular polygons = $\frac{(\text{number of sides} - 2) \times 180}{\text{number of sides}}$

Question 1

An angle of 28° is:

A) acute B) reflex C) obtuse

Question 2

Complete the sentence:

Alternate angles in parallel lines are ____.

Question 3

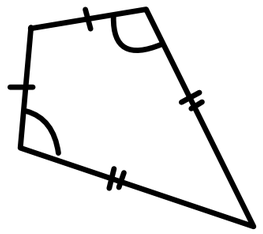
What is the sum of exterior angles of a 12 sided polygon?

Question 4

What is the sum of the interior angles of a nonagon?

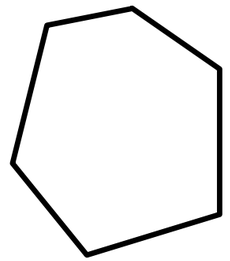
Question 5

What is the name of this quadrilateral?



Question 6

How many triangles can I draw inside a hexagon starting from the same vertex?



Question 7

What is the formula to calculate the sum of interior angles of any polygon?

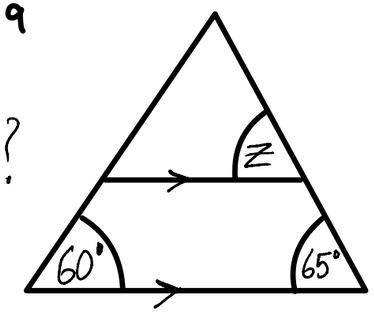
Question 8

Complete the sentence:

Corresponding angles in parallel lines are ____.

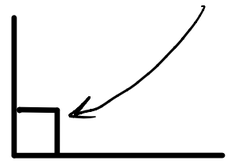
Question 9

What is angle z?



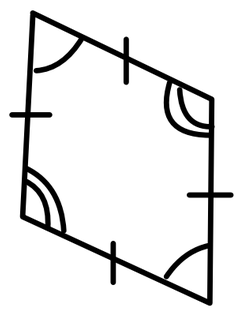
Question 10

What does this symbol mean?



Question 11

What is the name of this quadrilateral?



Question 12

How many sides does a <u>regular</u> polygon have if <u>one</u> of its exterior angles is 18°?

Question 13

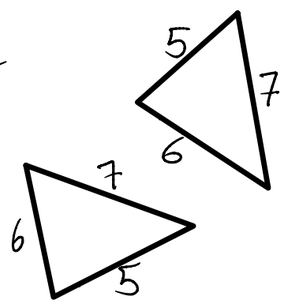
Complete the sentence:

Co-interior angles in parallel lines ____ ____ ____°.

Question 14

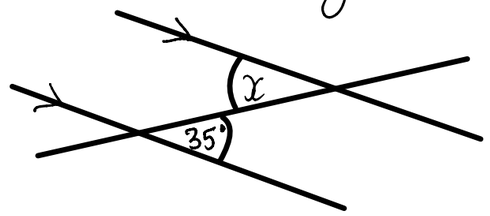
Which rule says that these two triangles are <u>congruent</u>?

(the same)



Question 15

What size is angle x?

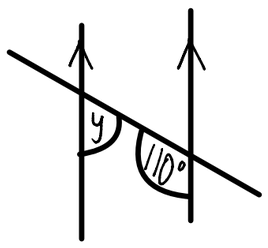


Question 16

The exterior angles of any polygon always add to ____.

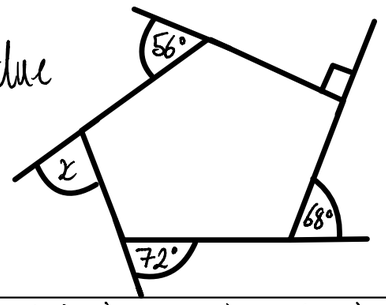
Question 17

What size is angle y?



Question 18

Find the value of x



Question 19

What is special about a "<u>regular</u>" polygon?

Question 20

Calculate the size of one interior angle of a regular octagon.

Answers: Q1) Acute Q2) equal Q3) 360° Q4) 1260° Q5) Kite Q6) 4 Q7) $(n-2)\times 180^\circ$ Q8) equal Q9) 65° Q10) 90° or Right Angle Q11) Rhombus Q12) 20 Q13) add to 180° Q14) SSS Q15) 35° Q16) 360° Q17) 70° Q18) 74° Q19) Sides and angles are the same Q20) 135°

Year 8 - Developing geometry…

Area of trapezia and Circles

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Recall area of basic 2D shapes
- Find the area of a trapezium
- Find the area of a circle
- Find the area of compound shapes
- Find the perimeter of compound shapes

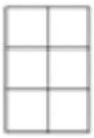
Keywords

Congruent: The same
Area: Space inside a 2D object
Perimeter: Length around the outside of a 2D object
Pi (π): The ratio of a circle's circumference to its diameter.
Perpendicular: At an angle of 90° to a given surface
Formula: A mathematical relationship/ rule given in symbols. E.g. b x h = area of rectangle/ square
Infinity (∞): A number without a given ending (too great to count to the end of the number) – never ends
Sector: A part of the circle enclosed by two radii and an arc.

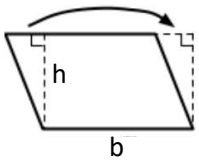
Area – rectangles, triangles, parallelograms

R

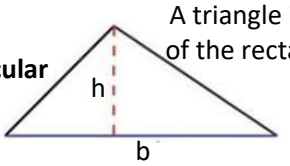
Rectangle
Base x Height



Parallelogram/ Rhombus
Base x Perpendicular height



Triangle
½ x Base x Perpendicular height

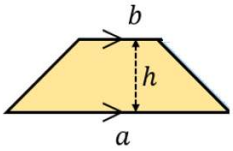


A triangle is half the size of the rectangle it would fit in

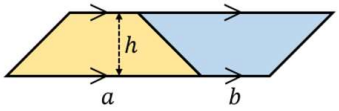
Area of a trapezium

Area of a trapezium

$$\frac{(a+b) \times h}{2}$$



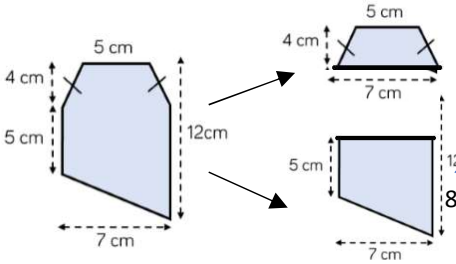
Why?



- Two congruent trapeziums make a parallelogram
- New length (a + b) x height
- Divide by 2 to find area of one

Compound shapes

To find the area compound shapes often need splitting into more manageable shapes first.
Identify the shapes and missing sides etc. first.



Shape A - Isosceles trapezium

Shape B- nonstandard trapezium

Shape A + Shape B = total area

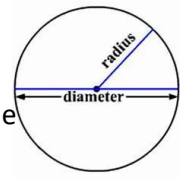
$$\frac{(5+7) \times 4}{2} + \frac{(5+8) \times 7}{2}$$

Units

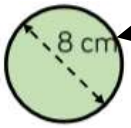
= 24 + 45 ● 5 = 69 ● 5cm²

Area of a circle (Non-Calculator)

Read the question – leave in terms of π or if $\pi \approx 3$ (provides an estimate for answers)



Area of a circle
π x radius²



Diameter = 8cm
∴ **Radius** = 4cm

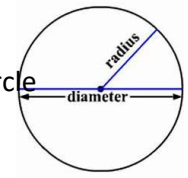
π x radius²
= π x 4²
= π x 16
= 16π cm²

Find the area of one quarter of the circle

Radius = 4cm

Circle Area = 16π cm²
Quarter= 4π cm²

Area of a circle (Calculator)



Area of a circle
π x radius²

How to get π symbol on the calculator

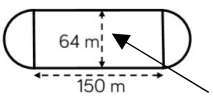
It is important to round your answer suitably – to significant figures or decimal places. This will give you a decimal solution that will go on forever!

Compound shapes including circles

Circumference
π x diameter

Compound shapes are not always area questions.
For Perimeter you will need to use the circumference

Spotting diameters and radii



This dimension is also the diameter of the semi circles.

Arc lengths = π x 64
= 64 π

Don't need to halve this because there are 2 ends which make the whole circle

Arc lengths + Straight lengths = total perimeter

= 64 π + 150 + 150
= (300 + 64 π) m
OR = 501.1 m

Still remember to split up the compound shape into smaller more manageable individual shapes first

Question 1

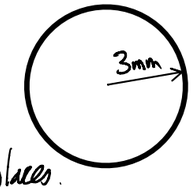
Look at the drawing of a trapezium on the K.O. Now complete the sentence: "A trapezium is a quadrilateral with one pair of _____ sides."

Question 2

What should you use as an approximation of π if you are working out an estimate of the area of a circle?

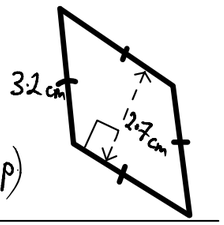
Question 3

Calculate the area of this circle. Give your answers to 2 decimal places.



Question 4

Work out the area of this rhombus. (Give your answers to 1 d.p)



Question 5

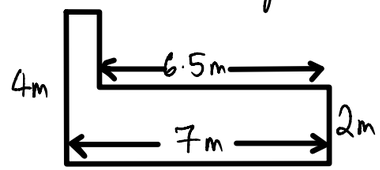
What is the formula for the area of a circle?

Question 6

A circle has a diameter of 14cm. What is it's radius?

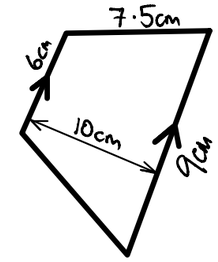
Question 7

Work out the area of this compound shape.

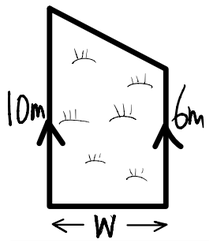


Question 8

Calculate the area of this trapezium. (Don't forget units)



Question 9



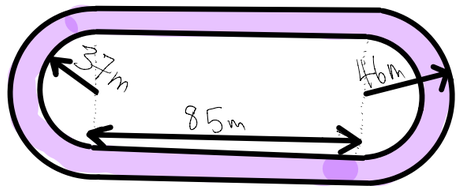
If the area of this lawn is $48m^2$, how wide must it be?

Question 10

A circular pond has an area of $78m^2$. How wide is the pond? Give your answer to the nearest integer.

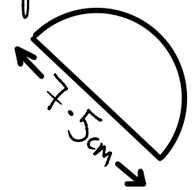
Question 11

What is the shaded area of this running track?



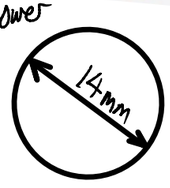
Question 12

What is the area of this semi-circle? (Round your answer to 3 sig figs)



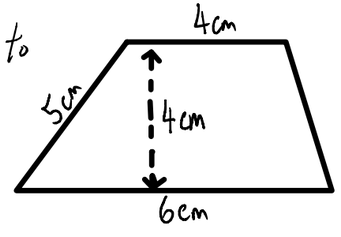
Question 13

Calculate the area of this circle. Leave your answer in terms of π. (Don't forget units).



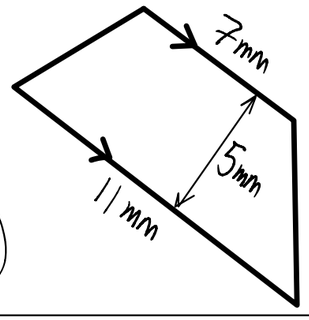
Question 14

Which of the dimensions on this trapezium is not needed to calculate its area?



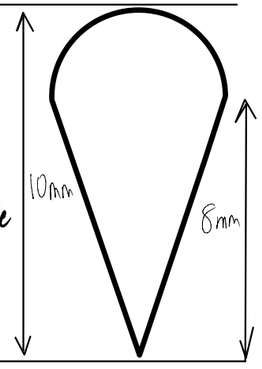
Question 15

Use the formula to work out the area of this trapezium. (Include correct units)



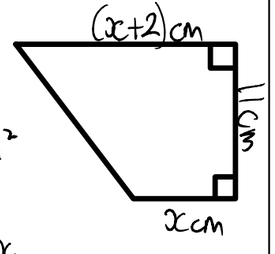
Question 16

Work out the area of this logo outline made from a triangle and a semi-circle.



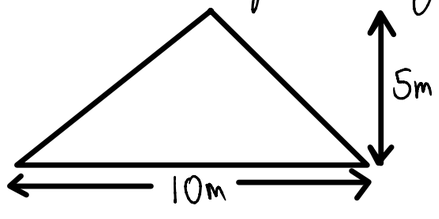
Question 17

The area of this trapezium is $55cm^2$. Set up an equation and solve it to find x.



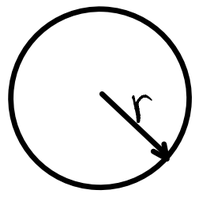
Question 18

What is the area of this triangle?



Question 19

This circle has an area of $78cm^2$. Find the radius, r. (Round to 2 sig. fig.)



Question 20

What is the length of the inside lane of the running track in Question 11? (Give your answer to nearest 10m)

Q1) Parallel Q2) 3 Q3) $28.27mm^2$ Q4) $8.6cm^2$ Q5) $A=\pi r^2$ Q6) 7cm Q7) $15m^2$ Q8) $75cm^2$ Q9) 6m Q10) 10m Q11) 3110-3112m^2 Q12) $22.1cm^2$ Q13) $49\pi mm^2$ Q14) 5cm Q15) $45mm^2$ Q16) $22.28mm^2$ Q17) $x=4$ Q18) $25m^2$ Q19) 5.0cm Q20) 400m

Year 8 - Developing geometry…

Line symmetry and reflection

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

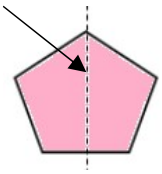
- Recognise line symmetry
- Reflect in a horizontal line
- Reflect in a vertical line
- Reflect in a diagonal line

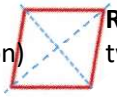
Keywords

Mirror line: a line that passes through the center of a shape with a mirror image on either side of the line
Line of symmetry: same definition as the mirror line
Reflect: mapping of one object from one position to another of equal distance from a given line.
Vertex: a point where two or more-line segments meet.
Perpendicular: lines that cross at 90°
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)

Lines of symmetry

Mirror line (line of reflection)



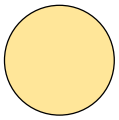


Rhombus
two lines of symmetry

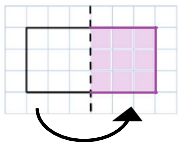
Parallelogram
No lines of symmetry

Shapes can have more than one line of symmetry….
This regular polygon (a regular pentagon has 5 lines of symmetry)

A circle has an infinite amount of lines of symmetry

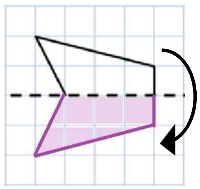


Reflect horizontally/ vertically (1)



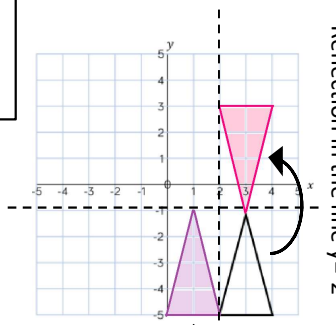
Note: a reflection doubles the area of the original shape

Reflection in a vertical line



Reflection in a horizontal line

Reflection on an axis grid

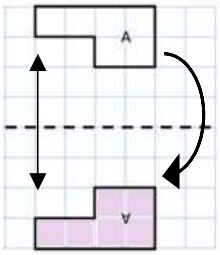


Reflection in the line y=-2

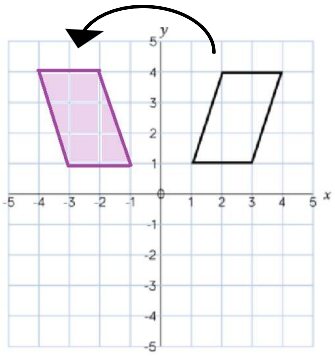
Reflection in the line x=2

Reflect horizontally/ vertically (2)

All points need to be the same distance away from the line of reflection



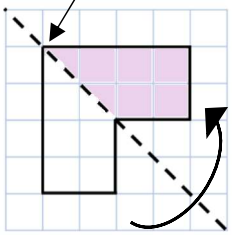
Reflection in the line y axis – this is also a reflection in the line x=0



Lines parallel to the x and y axis
REMEMBER
Lines parallel to the x-axis are y = ____
Lines parallel to the y-axis are x = ____

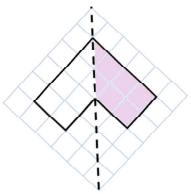
Reflect Diagonally (1)

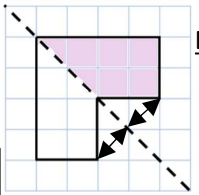
Points on the mirror line don't change position



Fold along the line of symmetry to check the direction of the reflection

Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)



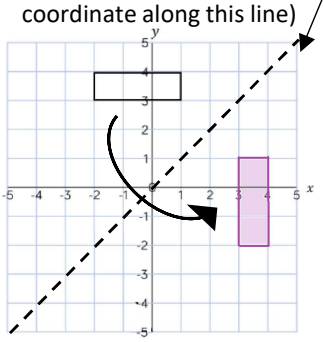


Drawing perpendicular lines

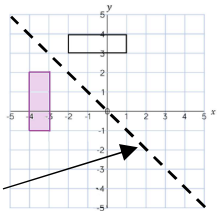
Perpendicular lines to and from the mirror line can help you to plot diagonal reflections

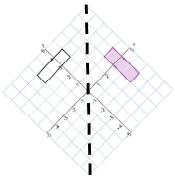
Reflect Diagonally (2)

This is the line **y = x** (every y coordinate is the same as the x coordinate along this line)



This is the line **y = - x**
The x and y coordinate have the same value but opposite sign

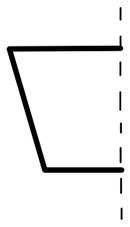




Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)

Question 1

Reflect this shape in the mirror line



Question 2

Straight lines parallel to the x-axis have equations of the form:

A) $x =$ (a constant) B) $y =$ (a constant)

Question 3

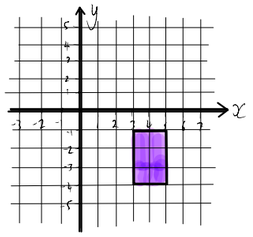
How many lines of symmetry does an equilateral triangle have?

Question 4

The line $x = 0$ is also called the ___-axis

Question 5

Reflect this shape in the line $y = 0$



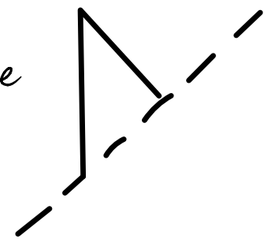
Question 6

Complete the sentence:

All points need to be the _____ _____ away from the line of _____.

Question 7

Reflect the shape in the mirror line



Question 8

"A hexagon has 6 lines of symmetry." Is this true:

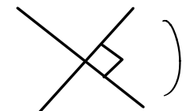
Always, Sometimes or Never?

Question 9

For Question 8, when is it certain to say that a hexagon has 6 lines of symmetry?

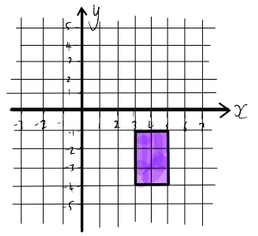
Question 10

The lines $y = x$ and $y = -x$ are _____ to each other.

(Hint: begins with "p" )

Question 11

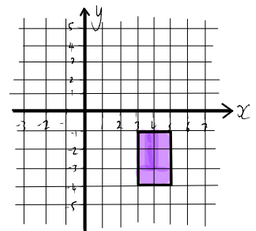
Reflect the shaded shape in the line $y = x$. Label the new shape R.



Question 12

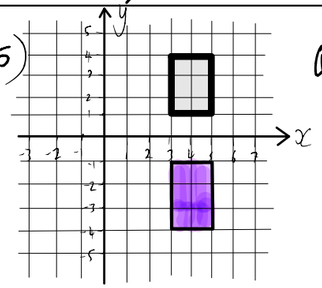
Reflect the shaded shape in the line $y = -x$.

Label the new shape S

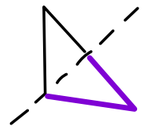


Q1)

Q2) B Q3) 3 Q4) the y-axis

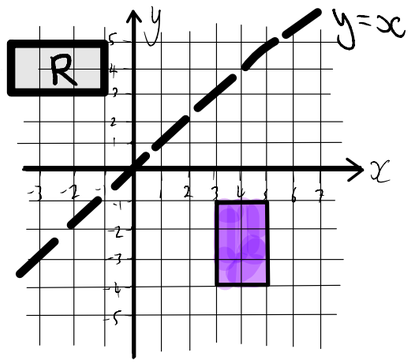
Q5) 

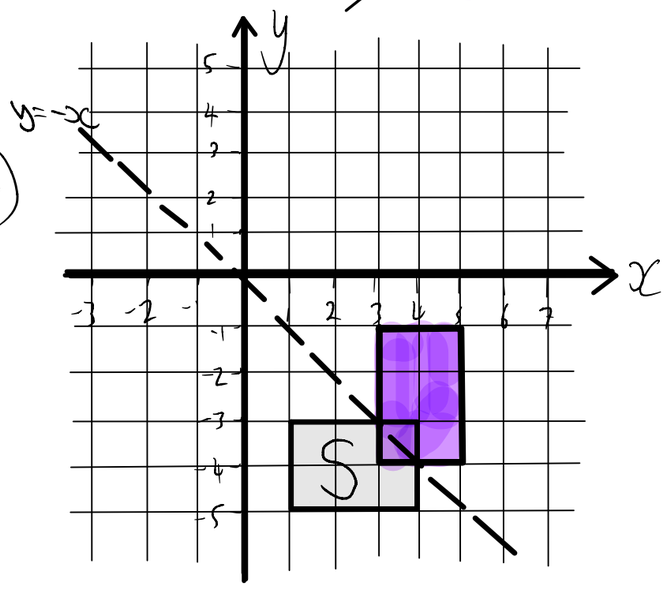
Q6) same distance symmetry

Q7) 

Q8) Sometimes Q9) Only for a regular hexagon.

Q10) perpendicular

Q11) 

Q12) 

Year 8 - Reasoning with data…

The data handling cycle

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Set up a statistical enquiry
- Design and criticise questionnaires
- Draw and interpret multiple bar charts
- Draw and interpret line graphs
- Represent and interpret grouped quantitative data
- Find and interpret the range
- Compare distributions

Keywords

Hypothesis: an idea or question you want to test
Sampling: the group of things you want to use to check your hypothesis
Primary Data: data you collect yourself
Secondary Data: data you source from elsewhere e.g. the internet/ newspapers/ local statistics
Discrete Data: numerical data that can only take set values
Continuous Data: numerical data that has an infinite number of values (often seen with height, distance, time)
Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Proportion: numerical relationship that compares two things

Set up a statistical enquiry

Write a suitable hypothesis → Design a data collection sheet → Pros/ Cons of sampling → Pros/ Cons primary or secondary data → Discrete or continuous data?

Features of a data collection sheet

Grouped or ungrouped categories →

Data Title	Tally	Frequency
	𝍸	

← Total number of that group observed

Design and criticise a questionnaire

The Question - be clear with the question - don't be too leading/ judgemental

e.g. How much pocket money do you get a week?

Responses – do you want closed or open responses? – do any options overlap? – Have you an option for all responses?

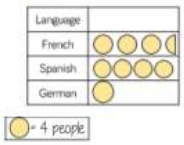
Zero option → ☐ £0 ☐ £0.01 - £2 ☐ £2.01 - £4 ☐ more than £4 ← More option

NOTE: For responses about continuous data include inequalities $< x \leq$

Pictograms, bar and line charts (R)

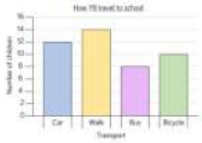
Represents quantitative data

Pictogram



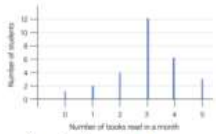
- Need to remember a key
- Visually able to identify mode

Bar Chart



- Gaps between the bars
- Clearly labelled axes
- Scale for the axes
- Title for the bar chart
- Discrete Data

Line Chart



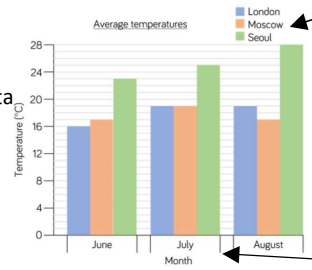
- Gaps between the lines
- Clearly labelled axes
- Scale for the axes
- Discrete Data

Multiple Bar chart

Compares multiple groups of data

- Clearly labelled axes
- Scale for axes
- Comparable data bars drawn next to each other

Key/ Colour code for separate groups of information



Gap between different categories of data

Draw and interpret Pie Charts (R)

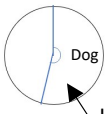
Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$ "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60} \times 360 = 192°$



Use a protractor to draw This is 192°

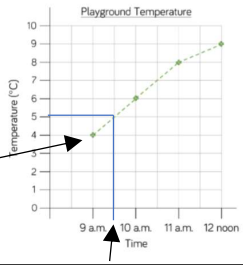
Multiple method
As 60 goes into 360 – 6 times.
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)

Represents quantitative, discrete data

Draw and interpret line graphs

- Commonly used to show changing over time
- The points are the recorded information and the lines join the points.

Line graphs do not need to start from 0



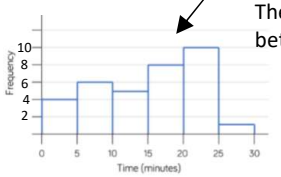
More than one piece of data can be plotted on the same graph to compare data

It is possible to make estimates from the line
e.g. temperature at 9.30am is 5°C

Grouped quantitative data

Time (minutes)	Frequency
$0 \leq t < 5$	4
$5 \leq t < 10$	6
$10 \leq t < 15$	5
$15 \leq t < 20$	8
$20 \leq t < 25$	10
$25 \leq t < 30$	1

"More than or equal to 25 and less than 30 minutes"



The use of inequalities shows that this will be a frequency diagram

This is a frequency diagram
There are no gaps between the bars

Grouping the data is useful if there is a large spread of data to begin with

Find and interpret the range

Difference between the biggest and smallest values

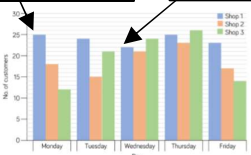
The range is a measure of **spread**

A smaller range means there is less variation in the results – it is more consistent data

A range of 0 means all the data is the same value

Shop 1 highest value

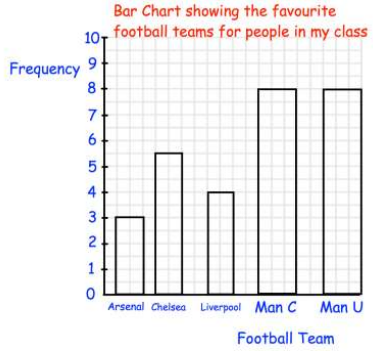
Shop 1 lowest value



Shop 1 has the smallest range – this indicates it has a more consistent flow of customers each week.

Range of customers = 25 – 22 = 3 (Shop 1)

Question 1



Write down two things that are wrong with this bar chart.

Question 2

Day	Tally	Frequency
Monday	𝍸 𝍸 II	12
Tuesday	III	
Wednesday		7
Thursday	𝍸 𝍸 𝍸 IIII	
Friday		10

Complete the Tally chart

Question 3

Give an example of discrete data.

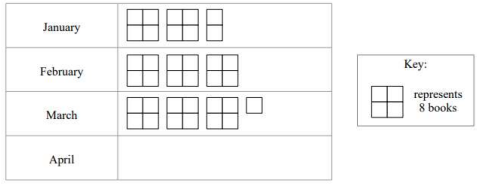
Question 4

How much time do you spend playing sport?

☐ 0 – 1 hours ☐ 1 – 2 hours ☐ 3 – 4 hours

Write down 2 things that are wrong with this question

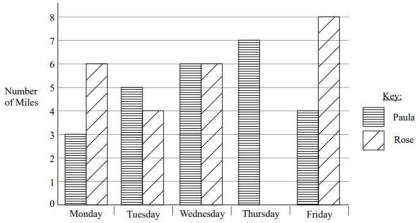
Question 5



14 books were sold in April. Show this information on the pictogram.

Question 6

The bar chart shows the number of miles Paula and Rose ran from Monday to Friday in a week.

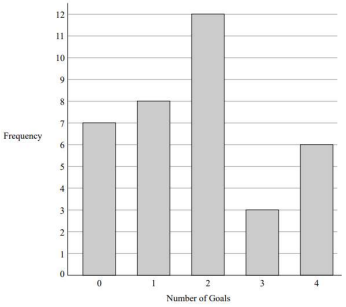


How much further does Rose run than Paula on Monday?

Question 7

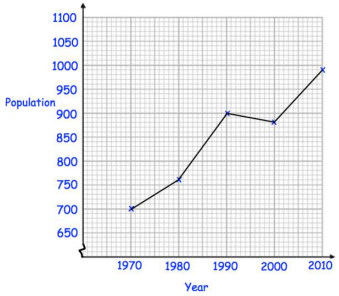
Give an example of continuous data.

Question 8



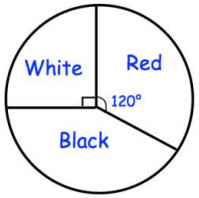
How many goals were scored in total?

Question 9



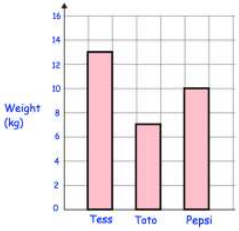
What was the population in 1980?

Question 10



A bag contains red, white and black counters.
If there are 24 counters in total how many black counters are there?

Question 11



The weights of 3 puppies are shown in the chart.
What is the range of their weights?

Question 12

The table below shows the favourite colours of 30 people. Complete the table to show the angles that would need to be calculated to construct a pie chart.

Colour	black	red	blue	green	pink
Frequency	3	2	2	8	15
Angle					

Bars different widths/gaps different widths, 3 𝍸 II 14 𝍸 𝍸, pupils in a class, no time frame/overlapping responses, 1 ½ squares, 3, weight, 33, 760, 10, 6, 36°24°24°96°180°

Year 8 - Reasoning with data…

Measures of location

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand and use mean, median and mode
- Choose the most appropriate average
- Identify outliers
- Compare distributions using averages and range

Keywords

Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Total: all the data added together
Frequency: the number of times the data values occur
Represent: something that show's the value of another
Outlier: a value that stands apart from the data set
Consistent: a set of data that is similar and doesn't change very much

Mean, Median, Mode

The Mean

A measure of average to find the central tendency… a typical value that represents the data **24, 8, 4, 11, 8,**

Find the sum of the data (add the values) **55**

Divide the overall total by how many pieces of data you have **55 ÷ 5**

Mean = 11

The Median

The value in the centre (in the middle) of the data **24, 8, 4, 11, 8,**

Put the data in order **4, 8, 8, 11, 24**

Find the value in the middle **4, 8, 8, 11, 24**

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical) **24, 8, 4, 11, 8,**

This can still be easier if it the data is ordered first **4, 8, 8, 11, 24**

Mode = 8

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

£240	£240	£240	£240	£240
£260	£260	£300	£350	£700

Which average best represents the weekly wage?

The Mean = £307
The Median = £250
The Mode = £240

Put the data back into context
Mean/Median – too high (most of this company earn £240)
Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Identify outliers

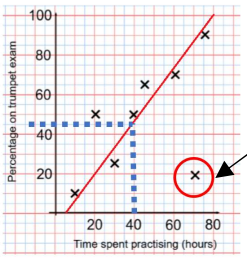
Outliers are values that stand well apart from the rest of the data

Outliers can have a big impact on range and mean.
They have less impact on the median

Sometimes it is best to not use an outlier in calculations

Height in cm
152 150 142 158 182 151 153 149 156 160 151 144

Where an outlier is identified try to give it some context. This is likely to be a taller member of the group. Could the be an older student or a teacher?



Outliers can also be identified graphically e.g. on scatter graphs

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency.

Here are the number of runs scored last month by Lucy and James in cricket matches

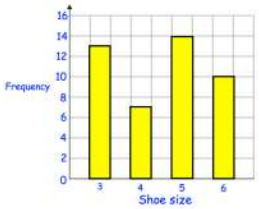
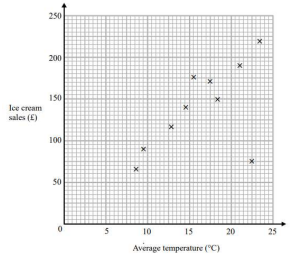
Lucy: **45, 32, 37, 41, 48, 35**
James: **60, 90, 41, 23, 14, 23**

James has two extreme values that have a big impact on the range

Lucy
Mean: 39.6 (1.d.p), **Median:** 38. **Mode:** no mode, **Range:** 16

James
Mean: 41.8 (1.d.p), **Median:** 32, **Mode:** 23, **Range:** 76

"James is less consistent than Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"

Question 1 Work out the mode for the following data: 5, 6, 6, 7, 8, 10	Question 2 Work out the mode for the following data: 5, 5, 7, 7, 7, 8, 8, 9	Question 3 Work out the mode for the following data: 5, 7, 3, 1, 8, 9, 10, 2	Question 4 Work out the mode for the following data: −2, −1, 5, 8, −2, 2, −1, 9, −1, 1, 2, −1	Question 5  What is the modal shoe size?
Question 6 Work out the median for the following data: 5, 1, 4, 6, 8	Question 7 Work out the median for the following data: 6.2, 6.8, 6.6, 7.2, 6.4, 7.4, 5.8	Question 8 Work out the median for the following data: 9, 8, 6, 6, 6, 7, 1, 2, 6, 8	Question 9 Work out the median for the following data: −4, 5, −7, −1, 2, 0, 9	Question 10 The height of some footballers are listed below: 1.81m, 1.78m, 1.88m, 1.79m, 1.86m, 1.85m, 1.78m, 1.93m Work out the median height.
Question 11 Find the mean of the following data: 4, 9, 7, 10, 5	Question 12 Find the mean of the following data: 3, 2, 1, 3, 2, 2, 1, 3, 1, 2, 3, 2, 1	Question 13 Find the mean of the following data: 9, −3, −6, 5, 0	Question 14 Find the mean of the following data: 1.4, 2.8, 2.4, 2.5, 2.8, 3.1, 1.1	Question 15 Five houses on a street are sold in 2016. They sell for £175,000 £184,000 £150,000 £201,000 £191,000 Calculate the mean price.
Question 16 Find the missing word: The mean, median and mode are known as measures of _ _ _ _ _ _ _ _ _	Question 17 Identify the outlier:  	Question 18 Which average does outliers affect most?	Question 19 Compare the distances travelled by snails and slugs over the duration of ten minutes. | | Median | Interquartile range | | Snails | 7.1 cm | 3.1 cm | | Slugs | 9.7 cm | 4.5 cm |	Question 20 A teacher asks a group of students how much pocket money they receive each week. They respond: £5 £8 £4 £50 £6 £8 £7.50 £10 £8 £7 Which average, the median or the mean, is most suitable for this data?

6, 7, no mode, - 1, 5, 5, 6.8, 6, - 4, 1.83, 7, 2, 1, 2.3, 180200, location, (22.5,75), mean, slugs move faster on average/snails move at more consistent pace, median

Year 9 – Reasoning with algebra…

Straight Line Graphs

@whisto_maths

What do I need to be able to do?

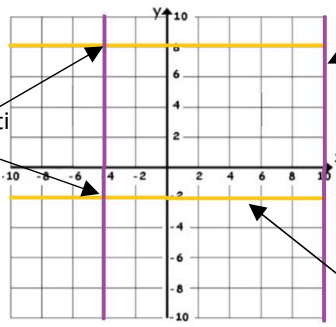
By the end of this unit you should be able to:

- Compare gradients
- Compare intercepts
- Understand and use y= mx + c
- Find the equation of a line from a graph
- Interpret gradient and intercepts of real-life graphs

Keywords

Gradient: the steepness of a line
Intercept: where two lines cross. The y-intercept: where the line meets the y-axis.
Parallel: two lines that never meet with the same gradient.
Co-ordinate: a set of values that show an exact position on a graph.
Linear: linear graphs (straight line) – linear common difference by addition/ subtraction
Asymptote: a straight line that a graph will never meet.
Reciprocal: a pair of numbers that multiply together to give 1.
Perpendicular: two lines that meet at a right angle.

Lines parallel to the axes



Intersection points

All the points on this line have a x coordinate of 10

'a' can be ANY positive or negative value including 0

Lines parallel to the **y axis** take the form **x = a** and are **vertical**

Lines parallel to the **x axis** take the form **y = a** and are **horizontal**

All the points on this line have a y coordinate of -2

e.g. (3, -2) (7, -2) (-2, -2) all lay on this line because the y coordinate is -2

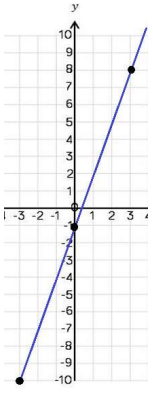
Plotting y = mx + c graphs

$y = 3x - 1$ → 3 x the x coordinate then – 1

x	-3	0	3
y	-10	-1	8

Draw a table to display this information

This represents a coordinate pair (-3, -10)



You only need two points to form a straight line

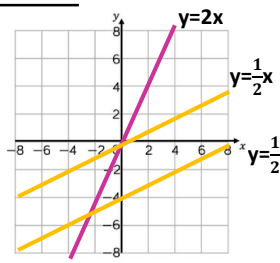
Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

Remember to join the points to make a line

Compare Gradients

$y = mx + c$

The **coefficient** of x (the number in front of x) tells us the gradient of the line



The **greater** the gradient – the **steeper** the line

Parallel lines have the **same** gradient

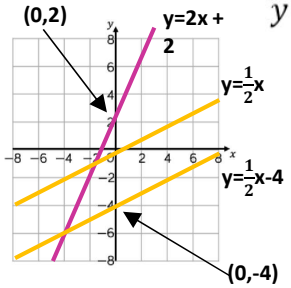
Positive gradients

Negative gradients

Compare Intercepts

$y = mx + c$

The value of **c** is the point at which the line crosses the y-axis. **Y intercept**



The coordinate of a y intercept will always be (0,c)

Lines with the **same** y-intercept cross in the **same** place

y = mx + c

The **coefficient** of x (the number in front of x) tells us the gradient of the line

$y = mx + c$

The value of **c** is the point at which the line crosses the y-axis. **Y intercept**

y and x are **coordinates**.

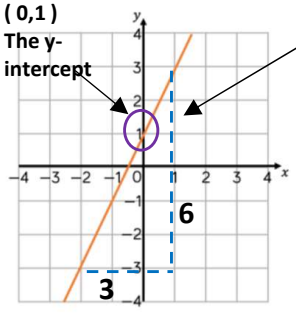
The equation of a line can be rearranged:. E.g:

y = c + mx

c = y – mx

Identify which coefficient you are identifying or comparing.

Find the equation from a graph



The Gradient. $\frac{6}{3} = 2$

$y = 2x + 1$

The direction of the line indicates a positive gradient

Positive gradients

Negative gradients

Real life graphs

A plumber charges a £25 callout fee, and then £12.50 for every hour. Complete the table of values to show the cost of hiring the plumber.

Time (h)	0	1	2	3	8
Cost (£)	£25				£125

The y-intercept shows the minimum charge. The gradient represents the price per mile

In real life graphs like this values will always be positive because they measure distances or objects which cannot be negative.

Direct Proportion graphs

When you have 0 pens this has 0 cost. The gradient shows the price per pen.

To represent direct proportion the graph must start at the origin.

A box of pens costs £2.30

Complete the table of values to show the cost of buying boxes of pens.

Boxes	0	1	2	3	8
Cost (£)		£2.30			

Question 1 Find the gradient of the line $2y - 10x = 6$	Question 2 Sketch the graph of $y = -x$	Question 3 What is the intercept of the Line y = 10x-1	Question 4 Does the point (3, -19) lie on the line Y = -6x-2
Question 5 What is the y-intercept of the line $y = 3x + 7$?	Question 6 What is the intercept Y = 2x-1	Question 7 The point $(4, y)$ lies on the line $y = 2x + 10$. Find y	Question 8 Find the value of 3x+1 When x = -1
Question 9 Sketch the graph of $y = 2x$	Question 10 What is the gradient Y = 2x-1	Question 11 Sketch the graph of $y = 2$	Question 12 Find an equation parallel to the line. Y = 2x-1
Question 13 Sketch the graph of $x = 2$	Question 14 What is the gradient? Y = 8x -10	Question 15 Sketch the graph of $y = -x + 2$	Question 16 What is this line on the graph
Question 17 The point $(3, y)$ lies on the line $y = 4x - 7$. Find y	Question 18 What is the intercept Y = 6-x	Question 19 Fiind the value of 3x -1 when x = 1	Question 20 Sketch the line X+y = 4

Year 9 – using number…

Indices & Roots

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify square and cube numbers
- Calculate higher powers and roots
- Understand powers of 10 and standard form
- Know the addition and subtraction rule for indices
- Understand power zero and negative indices
- Calculate with numbers in standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers
Commutative: an operation is commutative if changing the order does not change the result.
Base: The number that gets multiplied by a power
Power: The exponent – or the number that tells you how many times to use the number in multiplication
Exponent: The power – or the number that tells you how many times to use the number in multiplication
Indices: The power or the exponent.
Negative: A value below zero..
Coefficient: The number used to multiply a variable

Square and cube numbers

R

Square numbers

1, 4, 9 ,16…

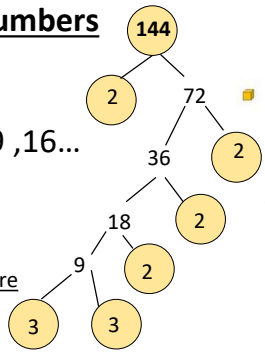
144 = 2 x 2 x 2 x 2 x 3 x 3

2 x 2 x 3 x 2 x 2 x 3

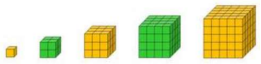
12 x 12

Prime factors can find square roots

$\sqrt{144} = 12$



Cube



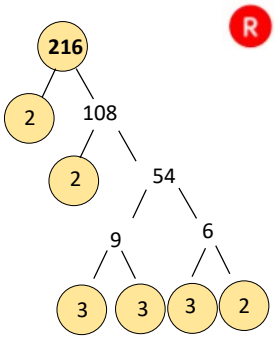
1, 8, 27, 64, 125…

216 = 2 x 2 x 2 x 3 x 3 x 3

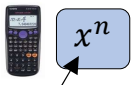
2 x 3 x 2 x 3 x 2 x 3

6 x 6 x 6

$\sqrt[3]{216} = 6$

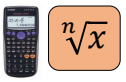


Higher powers and roots



x^n – power (number of times multiplied by itself)

x – the base number.



$\sqrt[n]{x}$ – Finding the nth root of any value

Other mental strategies for square roots

$\sqrt{810000} = \sqrt{81} \times \sqrt{10000}$

$= 9 \times 100$

$= 900$

Standard form

R

Any number between 1 and less than 10

$A \times 10^n$

Any integer

0.001

1 x $\frac{1}{1000}$

1 x 10^{-3}

10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^1	10^0	10^{-1}	10^{-2}	10^{-3}
10	1	0.1	0.01	0.001

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Example

3.2×10^4

= 3.2 x 10 x 10 x 10 x 10

= 32000

Numbers in standard form with negative powers will be less than 1

$3.2 \times 10^{-4} = 3.2 \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} = 0.00032$

Addition/ Subtraction Laws

$a^m \times a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

Zero and negative indices

$x^0 = 1$

Any number divided by itself = 1

$\frac{a^6}{a^6} = a^6 \div a^6$

$= a^{6-6} = a^0 = 1$

Negative indices do not indicate negative solutions

$2^2 = 4$
$2^1 = 2$
$2^0 = 1$
$2^{-1} = \frac{1}{2}$
$2^{-2} = \frac{1}{4}$

Looking at the sequence can help to understand negative powers

Powers of powers

$(x^a)^b = x^{ab}$

$(2^3)^4 = 2^3 \times 2^3 \times 2^3 \times 2^3$

The same base and power is repeated. Use the addition law for indices

$(2^3)^4 = 2^{12}$ ← $a \times b = 3 \times 4 = 12$

NOTICE the difference

$(2x^3)^4 = 2x^3 \times 2x^3 \times 2x^3 \times 2x^3$

The addition law applies ONLY to the powers. The integers still need to be multiplied

$(2x^3)^4 = 16x^{12}$

Standard form calculations

R

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard from at the end.

Method 1

6 x 10^5 + 8 x 10^5

= 600000 + 800000

= 1400000

= 1.4 x 10^5

Method 2

= (6 + 8) x 10^5

= 14 x 10^5

This is not the final answer

= $1.4 \times 10^1 \times 10^5$

= 1.4 x 10^5

Multiplication and division

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$

Division questions can look like this

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

= 5 x 10^2

For multiplication and division you can look at the values for **A** and the powers of 10 as two separate calculations

Question 1 Evaluate 6^0	**Question 2** Work out $(2 \times 10^4) \times (7.8 \times 10^4)$	**Question 3** Express the reciprocal of 16 as a fraction	**Question 4** Simplify $(\mathbf{7^4})^{\mathbf{9}}$
Question 5 Calculate $\sqrt{\mathbf{81}}$	**Question 6** Work out $(1 \times 10^9) \div (5 \times 10^5)$	**Question 7** **Simplify $\mathbf{2^3 \times 2^6}$**	**Question 8** Simplify $(\mathbf{2^3})^{\mathbf{5}}$
Question 9 Evaluate 2^{-2}	**Question 10** Work out $(4 \times 10^2) \times (8.5 \times 10^2)$	**Question 11** Evaluate 5^1	**Question 12** Calculate $\sqrt[3]{\mathbf{64}}$
Question 13 Simplify $(\mathbf{4^2})^{\mathbf{6}}$	**Question 14** Express the reciprocal of $\frac{3}{10}$ as a fraction.	**Question 15** Work out $(8.1 \times 10^8) \div (9 \times 10^2)$	**Question 16** Calculate $\sqrt{\mathbf{169}}$
Question 17 Work out $(4 \times 10^6) \times (1.5 \times 10^2)$	**Question 18** Express the reciprocal of 2 as a decimal.	**Question 19** **Simplify $\mathbf{3^3 \div 3^6}$**	**Question 20** Work out $(9 \times 10^7) \div (6 \times 10^4)$

1, 1.56 x 10^9, $\frac{1}{6}$, 7^{36}, 9, 2 x 10^3, 2^9, 2^{15}, $\frac{1}{4}$, 3.4 x 10^5, 5, 4, 4^{12}, $\frac{10}{3}$, 9 x 10^5, 13, 6 x 10^8, 3^{-3}, 1.5 x 10^3

Year 9 – reasoning with geometry…

Solving ratio & proportion problems

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with direct proportion
- Use conversion graphs
- Solve problems with inverse proportion
- Solve ratio problems
- Solve 'best buy' problems

Keywords

Proportion: a comparison between two numbers
Ratio: a ratio shows the relative size of two variables
Direct proportion: as one variable is multiplied by a scale factor the other variable is multiplied by the same scale factor.
Inverse proportion:: as one variable is multiplied by a scale factor the other is divided by the same scale factor.

Direct Proportion

As one variable changes the other changes at the same rate.

4 cans of pop = £2.40

4 cans of pop = £2.40

2 cans of pop = £1.20

×0.5 ×0.5

This multiplier is the same
In the same way that this would be for ratio

This is a multiplicative change

4 cans of pop = £2.40

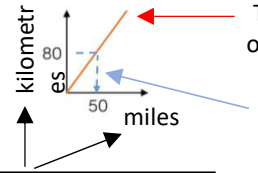
×3 ×3

12 cans of pop = £7.20

Sometimes this is easiest if you work out how much one unit is worth first
e.g. **1 can of pop = £0.60**

Conversion Graphs

Compare two variables



This is always a straight line because as one variable increases so does the other at the same rate

Labelling of both axes is vital

To make conversions between units you need to find the point to compare – then find the associated point by using your graph.
Using a ruler helps for accuracy
Showing your conversion lines help as a "check" for solutions

Inverse Proportion

Examples of inversely proportional relationships

Time taken to fill a pool and the number of taps running.

Time taken to paint a room and the number of workers

As one variable is multiplied by a scale factor the other is divided by the same scale factor

T is inversely proportional to G. When T=2 then G=20

÷ 2 × 4

T	1	**2**	8
G	40	**20**	5

× 2 ÷ 4

Best Buys

Have a directly proportional relationship

To calculate best buys you need to be able to compare the cost of one unit or units of equal amounts

	Shop A	**Shop B**
	4 cans for £1.20	3 cans for 93p
	£1.20 ÷ 4	£0.93 ÷ 3
Cost per item	1 can is £0.30 Or 30p	1 can is £0.31 Or 31p

Shop A is the best value as it is 1p cheaper per can of pop

	Shop A	
	4 cans for £1.20	3 cans for 93p
	4 ÷ £1.20	3 ÷ £0.93
Cost per pound	£1 buys 3.333 cans of pop	£1 buys 3.23 cans of pop

Shop A is still shown as being the best value but pay attention to the unit you are calculating, per item or per pound.

Best value is the most product for the lowest price per unit

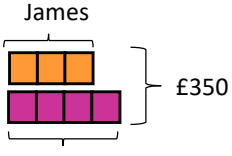
Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

James: Lucy

3 : 4



Find the value of one part

Whole £350
7 parts to share between
(3 James, 4 Lucy)

£350 ÷ 7 = £50

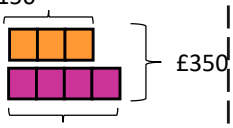
□ = one part
= **£50**

Put back into the question

James: Lucy

3 : 4
×50 ×50
£150:£200

James = 3 x £50 = £150



Lucy = 4 x £50 = £200

Finding a value given 1:n (or n:1)

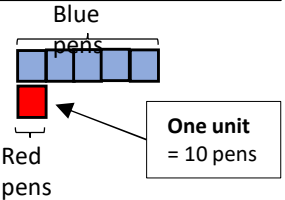
Inside a box are blue and red pens in the ratio 5:1.
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red

5 : 1

□ = one part
= **10 pens**



Put back into the question

Blue : Red

5 : 1
×10 ×10
50: 10

Blue pens = 5 x 10 = 50 pens

Red pens = 1 x 10 = 10 pens

There are 50 Blue Pens

Question 1

Simplify the ratio

27 : 45

Question 2

Write the ratio in the form 1:n

12 : 18

Question 3

Divide £24 in the ratio 1:3

Question 4

3 boxes of pencils contain 150 pencils altogether.

How many pencils are there in 9 boxes?

Question 5

Which is the better value for money?

A : 2 erasers for 57p

B : 3 erases for 90p

Question 6

It takes 8 people 12 hours to build a wall.

How long would it take 16 people?

Question 7

Jack runs 1·6km in 2 hours.

What is his speed in km/h?

Question 8

Work out the density in kg/m^3 for a mass of 640kg and a volume of $0·8m^3$.

Question 9

Sally drives at 34mph for 0·8 hours.

How far does she travel in miles?

Question 10

3 boxes of pencils contain 150 pencils altogether.

How many pencils are there in 27 boxes?

Question 11

Work out the volume in m^3 for a density of $2·5kg/m^3$ and a mass of 0·675kg.

Question 12

Which is the better value for money?

A : 2kg of potatoes for £1·60

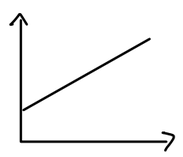
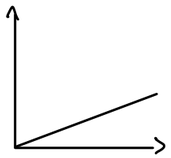
B : 7kg of potatoes for £5·53

Question 13

Work out the mass in kg for a density of $9kg/m^3$ and a volume of $72m^3$.

Question 14

Which graph shows a direct proportion relationship?

A  or B 

Question 15

Simplify the ratio

120 : 720

Question 16

Divide 96 in the ratio 7:1:4

Question 17

Write the ratio in the form 1:n

2 : 5

Question 18

It takes 8 people 12 hours to build a wall.

How long would it take 1 person?

Question 19

3 boxes of pencils contain 150 pencils altogether.

How many boxes do you need to have 1500 pencils?

Question 20

Tom travels 3·8km at 20km/h.

For how long was he travelling? (in hours)

Answers : 1. 3:5 2. 1:1·5 3. £6, £18 4. 450 5. A 6. 6 hours 7. 0·8 km/h 8. $800 kg/m^3$ 9. 27·2 miles 10. 1350 11. $0·27m^3$ 12. B 13. 648kg 14. B 15. 1:6 16. 56, 8, 32 17. 1:2·5 18. 96 hours 19. 30 20. 0·19 hours (11mins 24 secs)

Year 9 - algebraic techniques…

Brackets, Equations & Inequalities

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Form Expressions
- Expand and factorise single brackets
- Form and solve equations
- Solve equations with brackets
- Represent inequalities
- Form and solve inequalities

Keywords

Simplify: grouping and combining similar terms
Substitute: replace a variable with a numerical value
Equivalent: something of equal value
Coefficient: a number used to multiply a variable
Product: multiply terms
Highest Common Factor (HCF): the biggest factor (or number that multiplies to give a term)
Inequality: an inequality compares who values showing if one is greater than, less than or equal to another

Form expressions

More than – **ADD**
Less than/ difference – **SUBTRACT**

For unknown variables, a letter is normally used in its place

e.g. 4 more than t → **t + 4**
8 less than k → **k - 8**

Only similar terms can be grouped together

e.g. Find the perimeter of this shape (Perimeter = length around outside of shape)

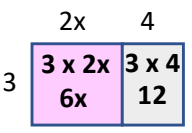
t + 2t + 1 + t + 2t + 1 → **6t + 2**

Directed numbers

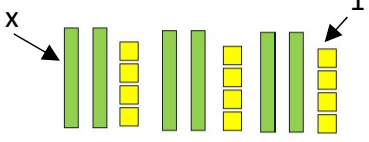
+ + → **+**
- - → **+**
+ - → **-**
- + → **-**

e.g. a = -5 and b = 2
a^2 = a x a = -5 x – 5 = **25**
b + a = 2 + - 5 = **-3**

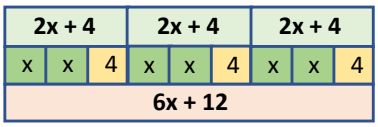
Multiply single brackets 3 (2x + 4)



6x + 12

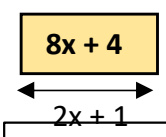


6x + 12



Different representations of 3(2x+4) = 6x + 12

Factorise into a single bracket



8x + 4

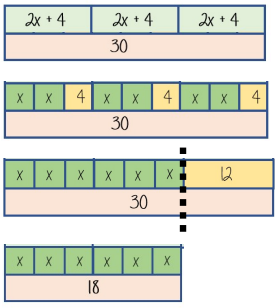
Try and make this the **highest common factor**

The two values **multiply** together (also the area) of the rectangle

8x + 4 ≡ 4 (2x + 1)

Note:
8x + 4 ≡ 2(4x + 2)
This is factorised but the HCF has not been used

Solve equations with brackets 3 (2x + 4) = 30



3 (2x + 4) = 30

Expand the brackets

6x + 12 = 30

-12 -12

6x = 18

÷ 6 ÷ 6

x = 3

Substitute to check your answer.
This could be negative or a fraction or decimal

Simple Inequalities

< less than
≤ Less than or equal to
> More than
≥ More than or equal to

x < 10
Say this out loud "x is a value less than 10"

10 > x
Say this out loud "10 is more than the value"

Note:
x<10 and 10>x represent the same values

x + 2 ≤ 20
"my value + 2 is less than or equal to 20"
x ≤ 18
The biggest the value can be is 18

Form and solve inequalities

Two more than treble my number is greater than 11

Find the possible range of values

Form
x → x3 → +2 → 11

3x + 2 > 11

Solve
x ← ÷3 ← -2 ← 11

x > 3

Check
This would suggest any value bigger than 3 satisfies the statement
3 x 3 + 2 = 11 ✓ 10 x 3 + 2 = 32 ✓

Algebraic constructs

Expression
A sentence with a minimum of two numbers and one maths operation

Equation
A statement that two things are equal

Term
A single number or variable

Identity
An equation where both sides have variables that cause the same answer
includes ≡

Formula
A rule written with all mathematical symbols
e.g. area of a rectangle A = b x h

Algebraic Expressions

Question 1

If $a = 12$,

Work out $2a$

Question 2

Simplify $3a + 2a - 4a$

Question 3

Simplify $3a \times a$

Question 4

Factorise fully

$3x + 12$

Question 5

Simplify $4a \times 2b$

Question 6

Expand $2(x+3)$

Question 7

Expand and Simplify

$(x-3)(x+6)$

Question 8

Simplify $6x + 3y + 4x - y$

Question 9

Factorise fully

$3x^2 - 6x$

Question 10

If $a = 12$ and $b = 3$

Work out $a \times b$

Question 11

Factorise fully

$15x^3 + 80x$

Question 12

Expand $4(x-3)$

Question 13

Simplify $5p^2 + 10p + 4p^2 - 2p$

Question 14

Expand and simplify

$5(x+1) + 3(x-3)$

Question 15

Simplify $-v \times v$

Question 16

If $a = 12$ and $b = 3$,

Work out $a^2 - 2b$

Question 17

Expand and Simplify

$(2x+5)(x-3)$

Question 18

If $a = 7$ and $b = -3$

Work out $3a - 2b$

Question 19

Expand and simplify

$7(x+4) - 3(x-3)$

Question 20

Simplify $4t \times 2q$

Answers: 1. 24 2. a 3. $3a^2$ 4. $3(x+4)$ 5. $8ab$ 6. $2x+6$ 7. $x^2+3x-18$ 8. $10x+2y$ 9. $3x(x-2)$ 10. 36 11. $5x(3x^2+16)$ 12. $4x-12$ 13. $9p^2+8p$ 14. $8x-4$ 15. $-v^2$ 16. 138 17. $2x^2-x-15$ 18. 27 19. $4x+27$ 20. $8qt$

Year 9 – Reasoning with algebra…

Forming and Solving Equations

@whisto_maths

What do I need to be able to do?

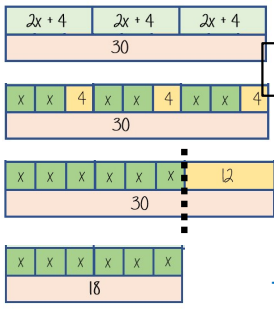
By the end of this unit you should be able to:

- Solve inequalities with negative numbers
- Solve equations with unknowns on both sides
- Solve inequalities with unknowns on both sides
- Substitute into formulae and equations
- Rearrange formulae

Keywords

Inequality: an inequality compares who values showing if one is greater than, less than or equal to another
Variable: a quantity that may change within the context of the problem
Rearrange: Change the order
Inverse operation: the operation that reverses the action
Substitute: replace a variable with a numerical value
Solve: find a numerical value that satisfies an equation

Solve equations with brackets (R)



3 (2x + 4) = 30

Expand the brackets

6x + 12 = 30

-12 -12

6x = 18

÷6 ÷6

x = 3

Form and solve inequalities (R)

Two more than treble my number is greater than 11

Find the possible range of values

3x + 2 > 11

Solve

x ← ÷3 ← -2 ← 11

x > 3

Inequalities with negatives

Method 1: Make x positive first

2 – 3x > 17

+ 3x + 3x

2 > 17 + 3x

-17 -17

-15 > 3x

÷3 ÷3

-5 > x

x is true for any value smaller than -5

Small … Bigger

-7 -5 -3

CHECK IT!
2 – 3(-6) = 20
TRUE/ CORRECT

Method 2 Keep the negative x

2 – 3x > 17

-2 -2

– 3x > 15

÷-3 ÷-3

x > -5

x is true for any value bigger than -5

This cannot be true…

x < -5

When you multiply or divide x by a negative you need to reverse the inequality

Equations with unknown on both sides

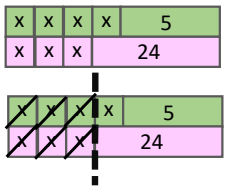
4x + 5 = 3x + 24

-3x -3x

x + 5 = 24

-5 -5

x = 19



Inequalities with unknown on both sides

Solving inequalities has the same method as equations

Check it!

5 (x + 4) < 3 (x + 2)

5x + 20 < 3x + 6

2x + 20 < 6

2x < - 14

x < - 7

5 (-8 + 4) < 3 (-8 + 2) 5 (-4) < 3 (-6)

-20 < -18

20 IS smaller than -18

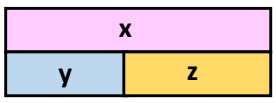
Formulae and Equations

Formulae – all expressed in symbols

Substitute in values

Equations – include numbers and can be solved

Rearranging Formulae (one step)



x = y + z

Rearrange to make y the **y = x - z** subject.

y →+z→ **x**

y ←-z← **x**

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution.

Language of rearranging…

Make XXX the subject

Change the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

4x – 3 = 9

+3 +3

4x = 12

÷ 4 ÷ 4

x = 3

In a formula (make x the subject)

xy – s = a

+ s + s

xy = a + s

÷ y ÷ y

$x = \frac{a + s}{y}$

The steps are the same for solving and rearranging

Rearranging is often needed when using y = mx + c

e.g. Find the gradient of the line 2y -4x = 9

Make y the subject first $y = \frac{4x + 9}{2}$

Gradient = $\frac{4}{2} = 2$

Equations and Rearranging

Question 1

Solve

$4x = 12$

Question 2

Solve

$3(x+4) = 27$

Question 3

Solve $x+6 > 2$

Question 4

An approximate formula for converting Celsius to Fahrenheit is

$F = 2C + 30$

Find F when $C = 17$

Question 5

Solve

$5x - 8 > 56$

Question 6

Solve $w - 12 \leq 2$

Question 7

Solve $p + 11 = 23$

Question 8

Solve

$5(5x+1) = 105$

Question 9

Solve

$6(3x+6) = 4(5x-2)$

Question 10

Solve $2a + 5 = 13$

Question 11

Solve

$2p \geq 8$

Question 12

Solve

$4x - 7 > 35$

Question 13

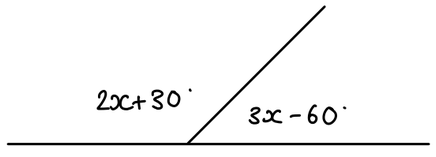
An approximate formula for converting Celsius to Fahrenheit is

$F = 2C + 30$

Find C when $F = 78$

Question 14

Use angle facts to solve:



Question 15

Solve

$3(2x+1) + 2(4x+2) = 35$

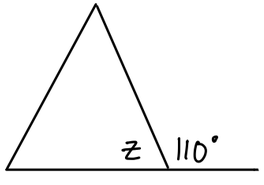
Question 16

Solve

$3b - 4 = 17$

Question 17

Use angle facts to solve:



Question 18

Solve

$5d - 1 = 9$

Question 19

Solve

$4(x+2) = 40$

Question 20

Solve

$40 - 3x \leq 10$

Answers: 1. $x=3$ 2. $x=5$ 3. $x>-4$ 4. $F=64$ 5. $x>12.8$ 6. $w \leq 14$ 7. $p=12$ 8. $x=4$ 9. $x=22$ 10. $a=4$ 11. $p \geq 4$ 12. $x>10.5$ 13. 24 14. $x=42$ 15. $x=2$ 16. $b=7$ 17. $z=40$ 18. $d=2$ 19. $x=8$ 20. $x \geq 10$

Year 9 – Reasoning with algebra…

Testing conjectures

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

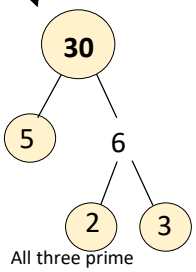
- Use factors, multiples and primes
- Reason True or False
- Reason Always, sometimes never true
- Show that reasoning
- Make conjectures about number
- Expand binomials
- Make conjectures with algebra
- Explore the 100 grid

Keywords

Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number.
Prime: an integer with only 2 factors.
HCF: highest common factor (biggest factor two or more numbers share)
LCM: lowest common multiple (the first time the times table of two or more numbers match)
Verify: the process of making sure a solution is correct
Proof: logical mathematical arguments used to show the truth of a statement
Binomial: a polynomial with two terms
Quadratic: a polynomial with four terms (often simplified to three terms)

Factors, Multiples and Primes

Multiplication part-whole models



All three prime factor trees represent the same decomposition

HCF – Highest common factor

HCF of18 and 30

18 1, 2, 3, 6, 9, 18

30 1, 2, 3, 5, 6, 10, 15, 30

Common factors are factors two or more numbers share

LCM – Lowest common multiple

LCM of 9 and 12

9 9, 18, 27, 36, 45, 54

12 12, 24, 36, 48, 60

Common multiples are multiples two or more numbers share

True or False?

Conjecture

A pattern that is noticed for many cases

1, 2, 4…..
The numbers in the sequence are doubling each time.

Counterexamples

This sequence isn't doubling it is adding 2 each time

Only **one** counterexample is needed to disprove a conjecture

Always, Sometimes, Never true.

Always Every value always supports the statement

Sometimes Examples show the statement being true and counter examples to show when it is false.

Never No example supports the statement

Examples to try
- 0 and 1
- Fractions
- Negative numbers

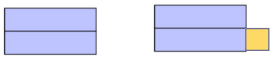
Show that

Numerical verification
Algebraic verification
Proof

Show the stages to a solution with numerical values
Show algebraic properties of the solution
You may want to use pictorial images to support this
Simple proofs using algebra

Compare the left hand side of an equation with the right hand side – are they the same or different?

Conjectures



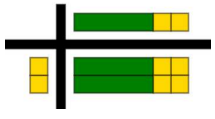
Even $(2n)$ Multiple of 2

Odd $(2n+1)$ One more than any even

Use numerical verification first
Use pictorial verification – the representations of numbers of odd and even

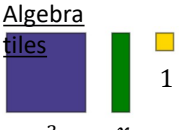
Expanding binomials

$2(x+2) \equiv 2x+4$



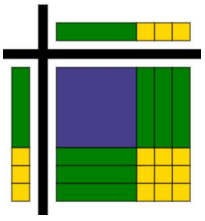
Algebra tiles can represent a binomial expansion
Has two terms

Algebra tiles



Positive values

$(x+3)(x+3) \equiv x^2+6x+9$



This is a quadratic.
It has four terms which simplified to three terms

The order of the binomial has no impact on the outcome.
e.g. $(x+3)(3+x)$

Exploring the 100 square

In terms of 'n' is used to make generalisations about relationships between numbers

Positions of numbers in relation to n form expressions.

E.g. one space to the right of n $n+1$

E.g. One row below n $n+10$

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The size of the grid for generalisation changes the relationship statements

Proof

Question 1 List the first six multiples of 8	**Question 2** Express 80 as a product of prime factors	**Question 3** Scott rolls a fair dice numbered 1-6 What is the probability that it lands on a prime number?	**Question 4** True or False : All prime numbers are odd
Question 5 $450 = 2 \times 3 \times 3 \times 5 \times 5$ Use this fact to write 900 as a product of prime factors	**Question 6** Liam says "the angles in this triangle are $80°$, $80°$ and $70°$" How do you know that he is wrong?	**Question 7** List the first six multiples of 15	**Question 8** Show that $x = 6$ is a solution to the equation $7x + 43 = 85$
Question 9 True or False : 10 is a factor of 5	**Question 10** $450 = 2 \times 3 \times 3 \times 5 \times 5$ Use this fact to write 225 as a product of prime factors	**Question 11** Express 68 as a product of prime factors	**Question 12** True or False : The angles in a triangle sum to $180°$

Answers :

1. 8, 16, 24, 32, 40, 48
2. $80 = 2 \times 2 \times 2 \times 2 \times 5 = 2^4 \times 5$
3. $3/6$ or $1/2$
4. False. 2 is the only even prime number.
5. $900 = 2 \times 2 \times 3 \times 3 \times 5 \times 5$
6. $80 + 80 + 70 = 230°$, angles in a triangle sum to $180°$
7. 15, 30, 45, 60, 75, 90
8. $7 \times 6 = 42$, $42 + 43 = 85$
9. False. 10 is a multiple of 5
10. $225 = 3 \times 3 \times 5 \times 5$
11. $68 = 2 \times 2 \times 17 = 2^2 \times 17$
12. True

Year 9 – constructing in 2D/3D…

3D Shapes

@whisto_maths

What do I need to be able to do?

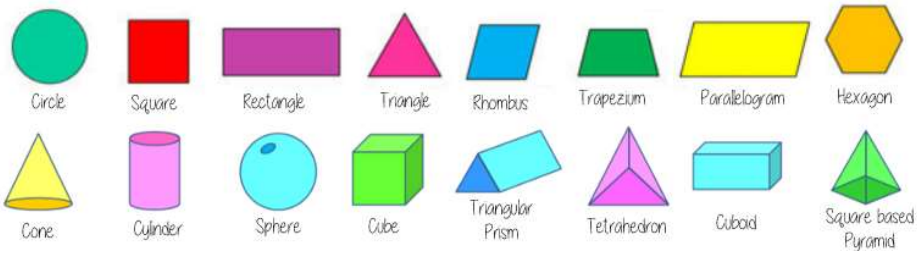
By the end of this unit you should be able to:

- Name 2D & 3D shapes
- Recognise Prisms
- Sketch and recognise nets
- Draw plans and elevations
- Find areas of 2D shapes
- Find Surface area for cubes, cuboids, triangular prisms and cylinders
- Find the volume of 3D shapes

Keywords

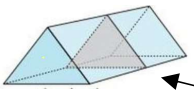
2D: two dimensions to the shape e.g. length and width
3D: three dimensions to the shape e.g. length, width and height
Vertex: a point where two or more line segments meet
Edge a line on the boundary joining two vertex
Face: a flat surface on a solid object
Cross-section: a view inside a solid shape made by cutting through it
Plan: a drawing of something when drawn from above (sometimes birds eye view)
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

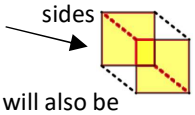
Name 2D & 3D shapes



Recognise prisms

A solid object with two identical ends and flat sides

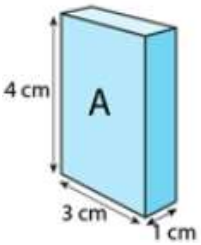


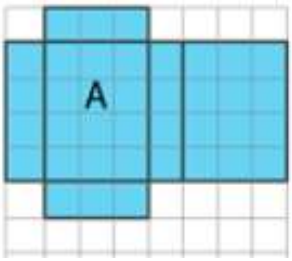


The cross section will also be identical to the end faces.

A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

Nets of cuboids

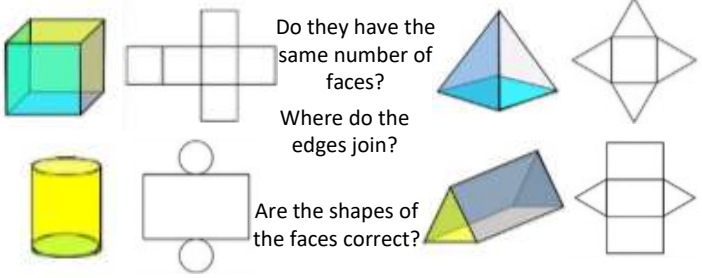




1cm grids help to draw accurately

Visualise the folding of the net.
Will it make the cuboid with all sides touching

Sketch and recognise nets

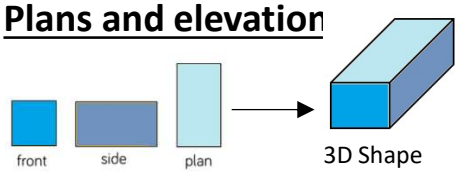


Do they have the same number of faces?

Where do the edges join?

Are the shapes of the faces correct?

Plans and elevation



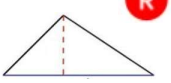
The direction you are considering the shape from determines the front and side views

Area of 2D shapes

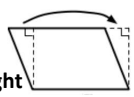
R

Rectangle
Base x Height

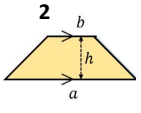
Triangle
½ x Base x Perpendicular height



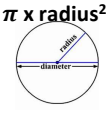
Parallelogram/ Rhombus
Base x Perpendicular height



Area of a trapezium
$\frac{(a+b) \times h}{2}$

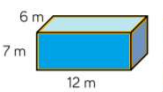


Area of a circle
π x radius^2

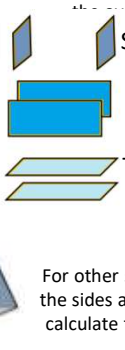


Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area



For cubes and cuboids you can also find one of each face and

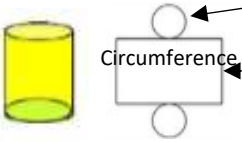


Sides **6 x 7** **6 x 7**
Front and back **12 x 7** **12 x 7**
Top and Bottom **12 x 6** **12 x 6**

Sum of all sides is surface area

For other shapes = not all the sides are the same, so calculate the individually

Surface area - cylinders



The area of the circle
π x radius^2

Circumference

The width of this face is the same as the circumference
π x diameter x height

2 x π x radius^2 + π x diameter x height

Volumes

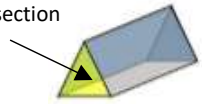
Volume is the 3D space it takes up – also known as capacity if using liquids to fill the space

Counting cubes
Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape.

Cubes/ Cuboids = base x width x height

Remember multiplication is commutative

Cross section



Cross section

Prisms and cylinders = area cross section x height

Height can also be described as depth

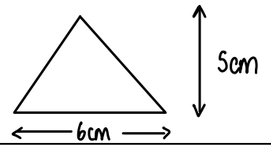
Areas – square units
Volumes – cube units

Areas and volumes can be left in terms of pi π

Area and Shape Properties

Question 1

Find the area of this shape:



Question 2

The height of a cube is 5cm.

Find the volume of the cube.

Question 3

Find the circumference of a circle with radius 9 cm. Give your answer in terms of π.

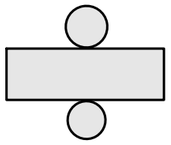
Question 4

The volume of a cube is $343cm^3$.

Find the height of the cube.

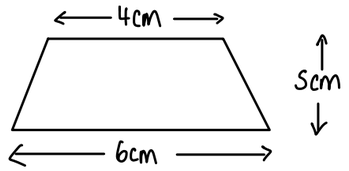
Question 5

This is a net for which 3D shape?



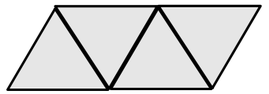
Question 6

Find the area of this shape:



Question 7

This is a net for which 3D shape?

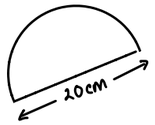


Question 8

Find the circumference of a circle with diameter 5cm. Give your answer in terms of π.

Question 9

Find the area of this shape. Give your answer in terms of π:

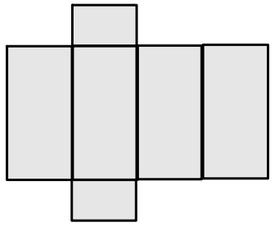


Question 10

Find the volume of the cuboid with length 10cm, width 4cm and height 5cm.

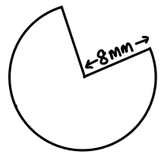
Question 11

This is a net for which 3D shape?



Question 12

Find the area of this shape. Give your answer in terms of π:



Question 13

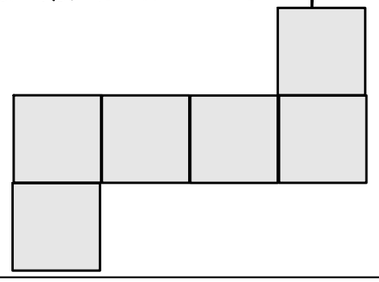
The volume of a cuboid is $192cm^3$.

The length is 8cm and the width is 4cm.

Calculate the height.

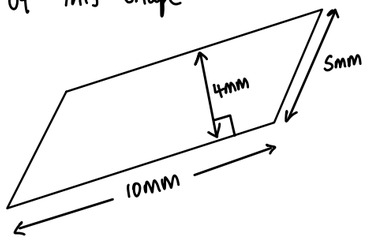
Question 14

This is a net for which 3D shape?



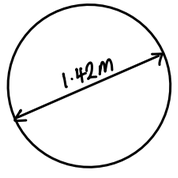
Question 15

Find the area of this shape:



Question 16

Find the area of this shape. Give your answer in terms of π:



Question 17

Find the area of this shape. Give your answer in terms of π:

Question 18

A cube has side lengths of 5cm.

Calculate its surface area.

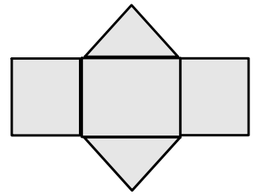
Question 19

A cuboid has height 30cm, width 6cm and length 20cm.

Calculate its surface area.

Question 20

This is a net for which 3D shape?



Answers: 1. $15cm^2$ 2. $125cm^3$ 3. 18π cm 4. 7cm 5. Cylinder 6. $25cm^2$ 7. Tetrahedron 8. 5π cm 9. $50\pi cm^2$ 10. $200cm^3$ 11. Cuboid 12. $48\pi mm^2$ 13. 6cm 14. Cube 15. $40mm^2$ 16. $0.71\pi m^2$ 17. $25\pi mm^2$ 18. $150cm^2$ 19. $1800cm^2$ 20. Triangular Prism

Year 9 - Developing geometry…

Angles in parallel lines and polygons

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What do I need to be able to do?

By the end of this unit you should be able to:

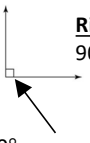
- Identify alternate angles
- Identify corresponding angles
- Identify co-interior angles
- Find the sum of interior angles in polygons
- Find the sum of exterior angles in polygons
- Find interior angles in regular polygons

Keywords

Parallel: Straight lines that never meet
Angle: The figure formed by two straight lines meeting (measured in degrees)
Transversal: A line that cuts across two or more other (normally parallel) lines
Isosceles: Two equal size lines and equal size angles (in a triangle or trapezium)
Polygon: A 2D shape made with straight lines
Sum: Addition (total of all the interior angles added together)
Regular polygon: All the sides have equal length; all the interior angles have equal size.

Basic angle rules and notation

Acute Angles
0°< angle <90°



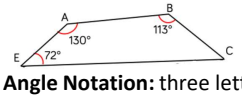
Right Angles
90°

Right angle notation

Obtuse
90°< angle <180°

Reflex
180°< angle <360°

Straight Line
180°



The letter in the middle is the angle
The arc represents the part of the angle

Angle Notation: three letters **ABC**
This is the angle at B = 113 °

Line Notation: two letters **EC**
The line that joins E to C.

Vertically opposite angles
Equal

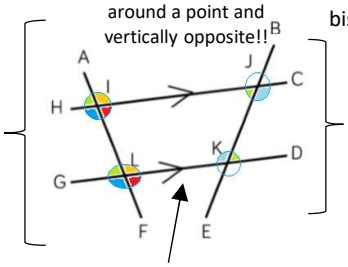
Angles around a point
360 °

Parallel lines

Still remember to look for angles on straight lines, around a point and vertically opposite!!

Lines AF and BE are **transversals** (lines that bisect the parallel lines)

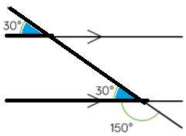
Corresponding angles often identified by their **"F shape"** in position.



Alternate angles often identified by their **"Z shape"** in position

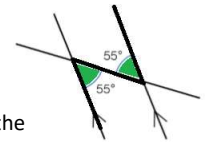
This notation identifies parallel lines

Alternate/ Corresponding angles

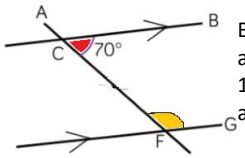


Because alternate angles are equal the highlighted angles are the same size

Because corresponding angles are equal the highlighted angles are the same size



Co-interior angles

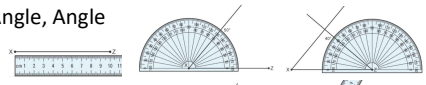


Because co-interior angles have a sum of 180° the highlighted angle is 110°

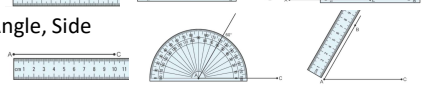
As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

Triangles & Quadrilaterals

Side, Angle, Angle



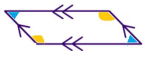
Side, Angle, Side



Side, Side, Side

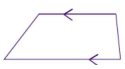
Properties of Quadrilaterals

Square
All sides equal size
All angles 90°
Opposite sides are parallel



Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Rectangle
All angles 90°
Opposite sides are parallel



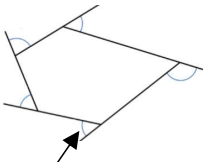
Trapezium
One pair of parallel lines

Rhombus
All sides equal size
Opposite angles are equal

Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

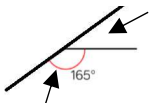
Sum of exterior angles

Exterior angles all add up to 360°



Exterior Angles
Are the angle formed from the straight-line extension at the side of the shape

Using exterior angles



Interior angle + Exterior angle = straight line = 180°

Exterior angle = 180 – 165 = **15°**

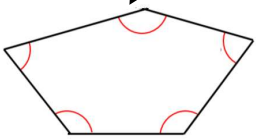
Number of sides = 360° ÷ exterior angle

Number of sides = 360 ÷ 15 = 24 sides

Sum of interior angles

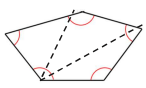
(number of sides – 2) x 180

Interior Angles
The angles enclosed by the polygon



This is an **irregular** polygon – the sides and angles are different sizes

Sum of the interior angles = (5 – 2) x 180

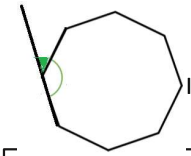


This shape can be made from three triangles
Each triangle has 180°

Sum of the interior angles = 3 x 180
= **540°**

Remember this is **all** of the interior angles added together

Missing angles in regular polygons



Exterior angle = 360 ÷ 8 = **45°**

Interior angle = $\frac{(8-2) \times 180}{8} = \frac{6 \times 180}{8}$ = **135°**

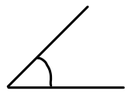
Exterior angles in regular polygons = 360° ÷ number of sides

Interior angles in regular polygons = $\frac{\text{(number of sides – 2) x 180}}{\text{number of sides}}$

Angles

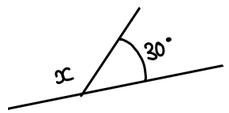
Question 1

What type of angle is this?



Question 2

Find the size of the missing angle:

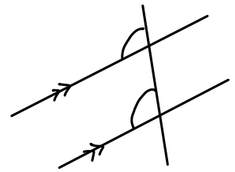


Question 3

What is the sum of the interior angles of a 10-sided polygon?

Question 4

These angles are equal. State the angle fact that this is showing.

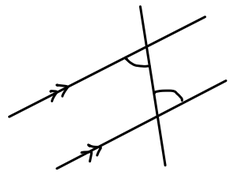


Question 5

A regular polygon has an exterior angle size of 18°. How many sides does the polygon have?

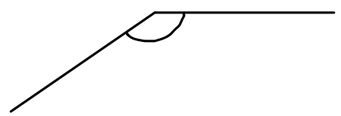
Question 6

These angles are equal. State the angle fact that this is showing.



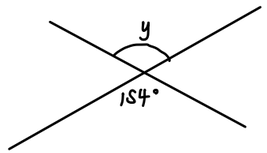
Question 7

What type of angle is this?



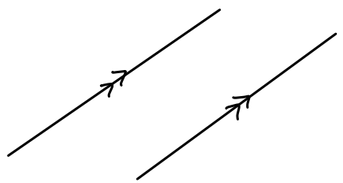
Question 8

Find the size of the missing angle:



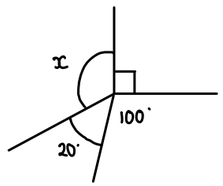
Question 9

Are these lines parallel or perpendicular?



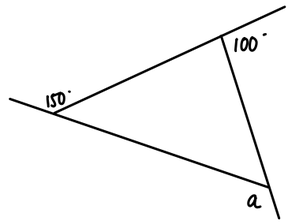
Question 10

Find the size of the missing angle:



Question 11

Find the size of the missing angle:

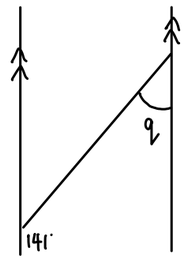


Question 12

What is the sum of the interior angles of a 12-sided polygon?

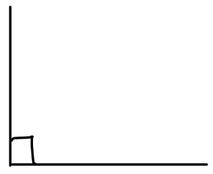
Question 13

Find the size of the missing angle:



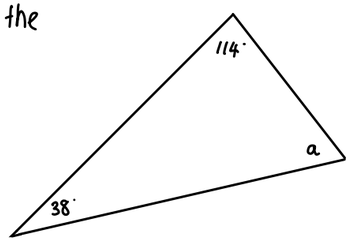
Question 14

What type of angle is this?



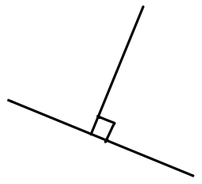
Question 15

Find the size of the missing angle:



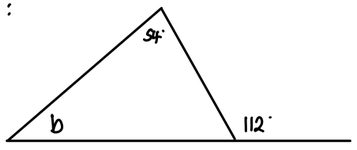
Question 16

Are these lines parallel or perpendicular?



Question 17

Find the size of the missing angle:

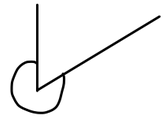


Question 18

A regular polygon has an exterior angle size of 30°. How many sides does the polygon have?

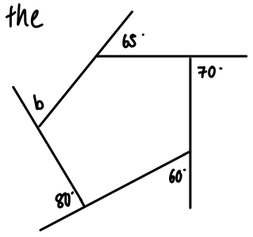
Question 19

What type of angle is this?



Question 20

Find the size of the missing angle:



Answers: 1. Acute 2. 150° 3. 1440° 4. Corresponding 5. 20 6. Alternate 7. Obtuse 8. 154° 9. Parallel 10. 150° 11. 110° 12. 1800° 13. 39° 14. Right-angle 15. 28° 16. Perpendicular 17. 58° 18. 12 19. Reflex 20. 85°

Year 9 – constructing in 2D/3D…

Constructions & congruency

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw and measure angles
- Construct scale drawings
- Find locus of distance from points, lines, two lines
- Construct perpendiculars from points, lines, angles
- Identify congruence
- Identify congruent triangles

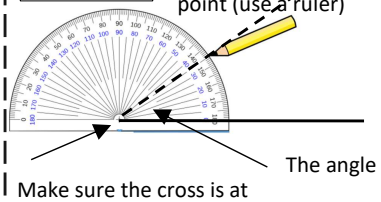
Keywords

Protractor: piece of equipment used to measure and draw angles
Locus: set of points with a common property
Equidistant: the same distance
Discorectangle: (a stadium) – a rectangle with semi circles at either end
Perpendicular: lines that meet at 90°
Arc: part of a curve
Bisector: a line that divides something into two equal parts
Congruent: the same shape and size

Draw and measure angles (R)

Draw a 35° angle

Make a mark at 35° with a pencil
And join to the angle point (use a ruler)



The angle

Make sure the cross is at the end of the line (where you want the angle)

Scale drawings (R)

A picture of a car is drawn with a scale of 1:30

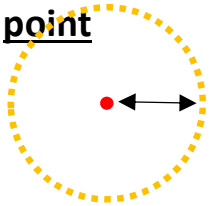
For every 1cm on my image is 30cm in real life

The car image is 10cm

Image : Real life
1cm : 30cm
10cm : 300cm

× 10 × 10

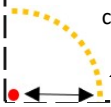
Locus of a distance from a point



All points are equidistant (the same distance) from the fixed point in the mic

Equipment needed
The radius is the distance from the fixed point

If the point is in the corner it can only make a quarter circle



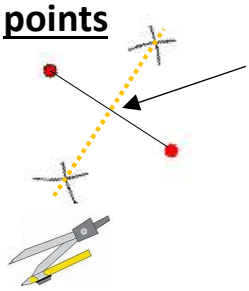
Locus of a distance from a straight line

All points are equidistant (the same distance) from line

The ends of the line are fixed points

Equipment needed
The line is straight so a ruler is used for the straight lines parallel to your original line

Locus equidistant from two points

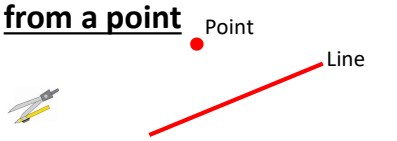


Also a perpendicular bisector
Because if the points are joined, this new line intersects it at a 90°

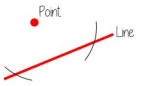
Keep the compass the same size and draw two arcs from each point

Join the intersections with a ruler.
All points on this line are equidistant from both points

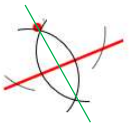
Construct a perpendicular from a point



Use a compass and draw an arc that cuts the line. Use the point to place the compass



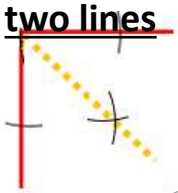
Keep the compass the same distance and now use your new points to make new inter ting arcs



Connecting the arcs makes the bisector

If P is a point on the line the steps are the same

Locus of a distance from two lines



Also an angle bisector
This cuts the angle in half

From the angle vertex draw two arcs that cut the lines forming the angle

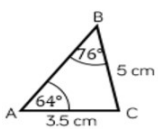
Keep the compass the same size and use the new arcs as centres to draw intersecting arcs in the middle

Join the vertex to the intersection

Congruent figures

Congruent figures are identical in size and shape – they can be reflections or rotations of each other

Congruent shapes are identical – all corresponding sides and angles are the same

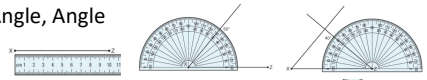


$A\hat{C}B = K\hat{M}L$

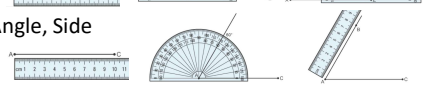
Because all the angles are the same and AC=KM BC=LM triangles ABC and KLM are **congruent**

Constructing Triangles

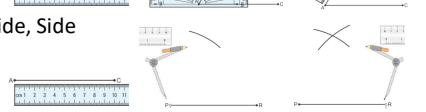
Side, Angle, Angle



Side, Angle, Side



Side, Side, Side



Congruent triangles

Side-side-side

All three sides on the triangle are the same size

Angle-side-angle

Two angles and the side connecting them are equal in two triangles

Side-angle-side

Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

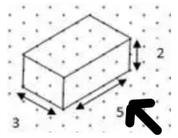
Right angle-hypotenuse-side

The triangles both have a right angle, the hypotenuse and one side are the same

Constructions and Loci

Question 1

For this 3D Solid, draw the plan:

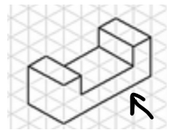


Question 2

Which congruency condition can be used to show that these triangles are congruent?

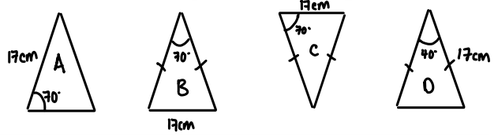
Question 3

For this 3D Solid, draw the front elevation:



Question 4

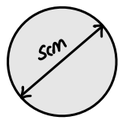
Which two triangles are congruent?

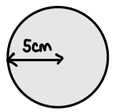


Question 5

Here are two circles.

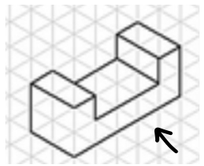
Are they congruent?





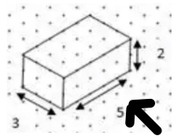
Question 6

For this 3D Solid, draw the side elevation:



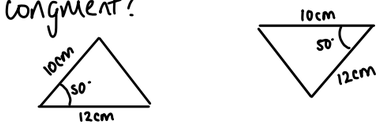
Question 7

For this 3D Solid, draw the front elevation:



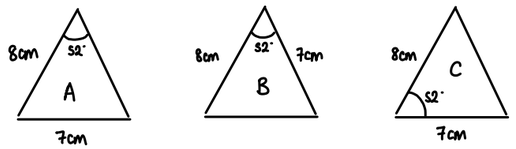
Question 8

Which congruency condition can be used to show that these triangles are congruent?



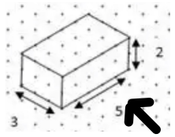
Question 9

Which two triangles are congruent?



Question 10

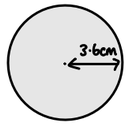
For this 3D Solid, draw the side elevation:

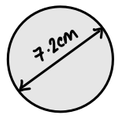


Question 11

Here are two circles.

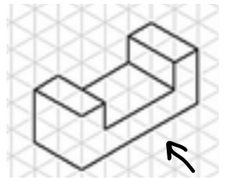
Are they congruent?

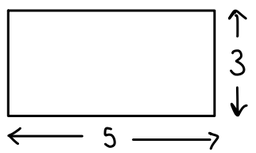




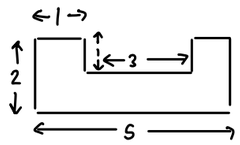
Question 12

For this 3D Solid, draw the plan:



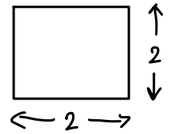
1. 

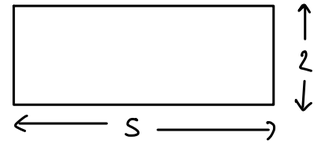
2. Side, side, side

3. 

4. A and D

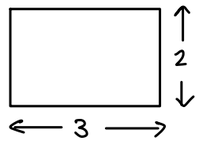
5. No

6. 

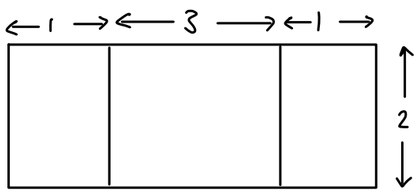
7. 

8. Side, angle, side

9. B and C

10. 

11. Yes

12. 

Year 9 – reasoning with number…

Maths & Money

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with bills and bank statements
- Calculate simple interest
- Calculate compound interest
- Calculate wages and taxes
- Solve problems with exchange rates
- Solve unit pricing problems

Keywords

Credit: money being placed into a bank account
Debit: money that leaves a bank account
Balance: the amount of money in a bank account
Expense: a cost/ outgoing.
Deposit: an initial payment (often a way of securing an item you will later pay for)
Multiplier: a number you are multiplying by. (Multiplier more than 1 = increasing, less than 1 = decreasing)
Per Annum: each year
Currency: the type of money a country uses.
Unitary: one – the cost of one.

Bills and Bank Statements

Bills – tell you the amount items cost and can show how much money you need to pay.

Look for different units (Is it in pence or pounds)

Menu	Price
Milk	89p
Tea	£1.50

Bank Statements

Bank statement can have negative balances if the money spent is higher than the money coming into the account

Date	Description	Credit	Debit	Balance
19th Sept	Salary	£1500		£1500
19th Sept	Mortgage		£600	£900
25th Sept	Gift	£15		£915

Simple Interest

For each year of investment the interest remains the same

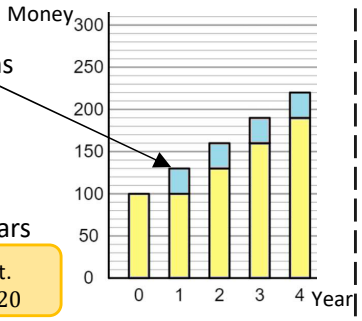
$$\frac{\text{Principal amount} \times \text{Interest Rate} \times \text{Years}}{100}$$

Principal amount is the amount invested in the account.

e.g. Invest £100 at 30% simple interest for 4 years

$\frac{100 \times 30 \times 4}{100} = £120$

This account earned £120 interest.
At the end of year 4 they have £220



Compound Interest

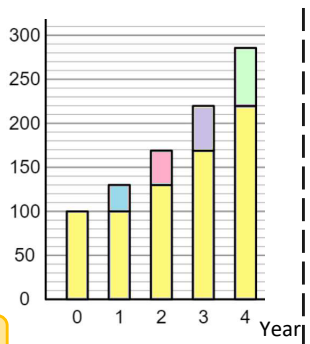
Interest is added to the current value of investment at the end of each year so the next year's interest is greater.

$$\text{Principal amount} \times \text{Multiplier}^{\text{Years}}$$

e.g. Invest £100 at 30% compound interest for 4 years

$100 \times 1.3^4 = £285.61$

This account has £285.61 in total at the end of the 4 years.



Value Added Tax (VAT)

VAT is payable to the government by a business. In the UK VAT is 20% and added to items that are bought.

Essential items such as food do not include VAT.

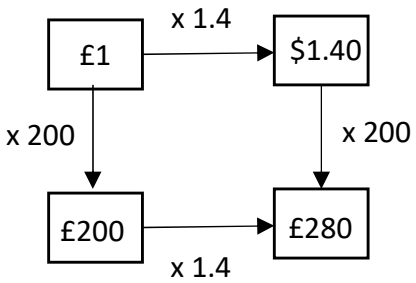
Wages and Taxes

Salaries fall into tax brackets – which means they pay this much each month from their salary.

Taxable Income	Tax Rate
£12 501 to £50 000	20%
£50 001 to £150 000	40%
over £150 000	45%

Over time:
Time and a half – means 1.5 times their hourly rate
Double – 2 times their hourly rate

Exchange Rates



When making estimates it is also useful to use estimates to check if our solution is reasonable.

Use inverse operations to reverse the exchange process

Common Currencies

United Kingdom	£	Pounds
United States of America	$	Dollars
Europe	€	Euros

Unit Pricing

4 Oranges £1	5 cupcakes £1.20

$4 = £1.00 \div 2$
$2 = £0.50 \div 2$
$1 = £0.25$

$5 = £1.20 \div 5$
$1 = £0.20$

Cost per Unit

To calculate unit per cost you divide by the cost.

Cupcakes are the best value as one item has the cheapest value

There is a directly proportional relationship between the cost and number of units.

Money and Maths

Question 1

Calculate

50% of £40

Question 2

144 trees were left standing out of 180 in an orchard.

Calculate the percentage change.

Question 3

Work out the cost of an item after VAT is added

Cost: £6,700

Question 4

A handbag costs £138 including VAT.

How much does it cost without VAT?

Question 5

£2000 is deposited into an account that pays 5% simple interest.

How much would be in the account after 1 year?

Question 6

$1 = £0.55

How many pounds can you buy with 20 dollars?

Question 7

Calculate

65% of £20

Question 8

£2000 is deposited into an account that pays 5% compound interest.

How much would be in the account after 5 years?

Question 9

Hannah is paid £11.70 an hour after tax is deducted.

How much does she earn if she works for 10 hours?

Question 10

What is the multiplier for increasing an amount by 30%?

Question 11

John takes a loan of £12,000 over 3 years. He is charged compound interest at 4.2% per annum.

How much interest will be charged over the 3 years?

Question 12

Hannah is paid £11.70 an hour after tax is deducted.

She works 37.5 hours a week.

How much does she earn in a week?

Question 13

Work out the cost of an item after VAT is added

Cost: £899

Question 14

£2000 is deposited into an account that pays 5% simple interest.

How much would be in the account after 2 years?

Question 15

A javelin thrower has a throw of 60m. Her next throw is 72m.

What is her percentage increase?

Question 16

What is the multiplier for decreasing an amount by 30%?

Question 17

What does a negative account balance mean?

(e.g. Account Balance -£215.70)

Question 18

A desk costs £180 after VAT has been added. What is the cost before VAT is added?

Question 19

£2000 is deposited into an account that pays 5% compound interest.

How much would be in the account after 2 years?

Question 20

$1 = £0.55

How many dollars can you buy with £33?

Answers: 1. £20 2. 20% 3. £8040 4. £115 5. £2100 6. £11 7. £13 8. £2252.56 9. £117 10. 1.3 11. £1576.39 12. £438.75 13. £1078.80 14. £2200 15. 20% 16. 0.7 17. Overdrawn Spent more money than you have! 18. £150 19. £2205 20. $60

Year 10 – developing algebra…

Simultaneous Equations

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Determine whether (x,y) is a solution
- Solve by substituting a known variable
- Solve by substituting an expression
- Solve graphically
- Solve by subtracting/ adding equations
- Solve by adjusting equations
- Form and solve linear simultaneous equations

Keywords

Solution: a value we can put in place of a variable that makes the equation true
Variable: a symbol for a number we don't know yet.
Equation: an equation says that two things are equal – it will have an equals sign =
Substitute: replace a variable with a numerical value
LCM: lowest common multiple (the first time the times table of two or more numbers match)
Eliminate: to remove
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)
Coordinate: a set of values that show an exact position.
Intersection: the point two lines cross or meet.

Is (x, y) a solution?

x and y represent values that can be substituted into an equation

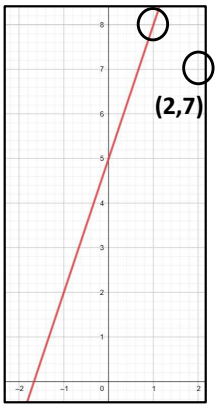
Does the coordinate (1,8) lie on the line y=3x+5?

This coordinate represents x=1 and y=8

$y = 3x + 5$

$8 = 3(1) + 5$

As the substitution makes the equation correct the coordinate (1,8) **IS** on the line y=3x+5



s (2,7) on the same line?

$7 \neq 3(2) + 5$

No 7 does NOT equal 6+5

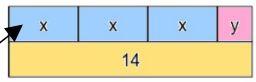
Substituting known variables

A line has the equation 3x + y = 14

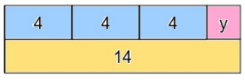
Two different variables, two solutions

Stephanie knows the point x = 4 lies on that line. Find the value for y.

$3x + y = 14$



$3(4) + y = 14$



$12 + y = 14$

$-12 \quad -12$

$y = 2$

$x = 4$

Substituting in an expression

Substitute 2y in place of the x variable as they represent the same value

x = 2y

x + y = 30

Pair of simultaneous equations (two representations)

$x = 2y$

$x + y = 30$

$3y = 30$

$3y = 30$

$\div 3 \quad \div 3$

$y = 10$

$x = 2y$

$x = 20$

Solve graphically

x + y = 6

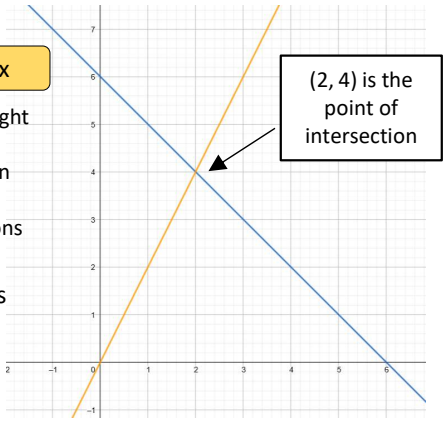
y = 2x

Linear equations are straight lines

The point of intersection provides the x and y solution for both equations

The solution that satisfies both equations is

$x = 2$ and $y = 4$



Solve by subtraction

$x = 4$

$y = 3$

$3x + 2y = 18$

$-\quad x + 2y = 10$

$2x = 8$

$\div 2 \quad \div 2$

$x = 4$

$x + 2y = 10$

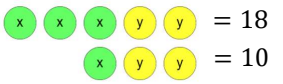
$(4) + 2y = 10$

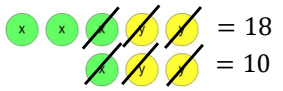
$-4 \quad -4$

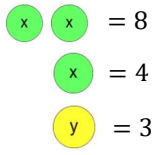
$2y = 6$

$\div 2 \quad \div 2$

$y = 3$







Solve by addition

Addition makes zero pairs

$3x + 2y = 16$

$+\ 6x - 2y = 2$

$9x = 18$

$\div 9 \quad \div 9$

$x = 2$

$3x + 2y = 16$

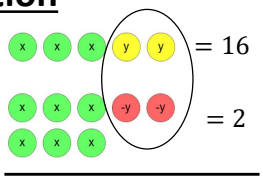
$3(2) + 2(y) = 16$

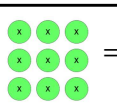
$6 + 2y = 16$

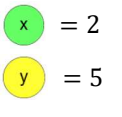
$-6 \quad -6$

$2y = 10$

$y = 5$





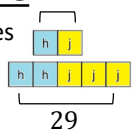


Solve by adjusting one

No equivalent values

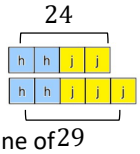
$h + j = 12$

$2h + 2j = 29$



$2h + 2j = 24$

$2h + 2j = 29$

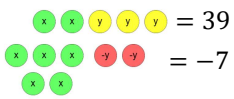


By proportionally adjusting one of the equations – now solve the simultaneous equations choosing an addition or subtraction method

Solve by adjusting both

$2x + 3y = 39$

$5x - 2y = -7$

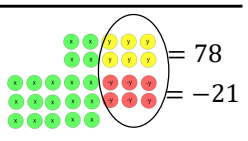


Use LCM to make equivalent x OR y values. Because of the negative values using zero pairs and y values is chosen choice

$4x + 6y = 78$

$15x - 6y = -21$

Now solve by addition



Addition makes zero pairs

Rearranging and Simultaneous Equations

Question 1

Make x the subject of

$$x + b = c$$

Question 2

Solve simultaneously:

$$2x - y = 1$$

$$3x + y = 9$$

Question 3

Make x the subject of

$$3x = d$$

Question 4

Solve simultaneously:

$$5x + y = 17$$

$$3x + y = 11$$

Question 5

Solve simultaneously:

$$2x + 3y = 9$$

$$2x + y = 7$$

Question 6

Make x the subject of

$$ax + b = c$$

Question 7

Solve simultaneously:

$$4x - 3y = 14$$

$$2x + 3y = 16$$

Question 8

Make x the subject of

$$a = x^2 + 8$$

Question 9

Solve simultaneously:

$$3x + y = 10$$

$$5x + 2y = 17$$

Question 10

Make x the subject of

$$c = \frac{x}{a}$$

Question 11

Solve simultaneously:

$$4x - 2y = 8$$

$$3x + 6y = 21$$

Question 12

Make x the subject of

$$x - c = f$$

Question 13

Make x the subject of

$$t = \sqrt{x} + 8$$

Question 14

Solve simultaneously:

$$3x + 7y = 26$$

$$5x + 2y = 24$$

Question 15

Make x the subject of

$$\frac{x+3}{2} = a$$

Question 16

Solve simultaneously:

$$3x - 2y = 7$$

$$5x + 3y = 37$$

Question 17

Solve simultaneously:

$$5x + 3y = 41$$

$$2x + 3y = 20$$

Question 18

Make x the subject of

$$2x + 4 = f$$

Question 19

Solve simultaneously:

$$5x + y = 11$$

$$3x - y = 9$$

Question 20

Make y the subject of

$$x = \frac{y+3}{9}$$

Answers: 1. $x = c - b$ 2. $x = 2$, $y = 3$ 3. $x = \frac{d}{3}$ 4. $x = 3$, $y = 2$ 5. $x = 3$, $y = 1$ 6. $x = \frac{c-b}{a}$ 7. $x = 5$, $y = 2$ 8. $x = \pm\sqrt{a-8}$ 9. $x = 3$, $y = 1$ 10. $x = ac$ 11. $x = 3$, $y = 2$ 12. $x = f + c$ 13. $x = (t-8)^2$ 14. $x = 4$, $y = 2$ 15. $x = 2a - 3$ 16. $x = 5$, $y = 4$ 17. $x = 7$, $y = 2$ 18. $x = \frac{f-4}{2}$ 19. $x = 2.5$, $y = -1.5$ 20. $y = 9x - 3$

Year 9 – reasoning with geometry…

Pythagoras' theorem

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Use square and cube roots
- Identify the hypotenuse
- Calculate the hypotenuse
- Find a missing side in a Right angled triangle
- Use Pythagoras' theorem on axes
- Explore proofs of Pythagoras' theorem.

Keywords

Square number: the output of a number multiplied by itself
Square root: a value that can be multiplied by itself to give a square number
Hypotenuse: the largest side on a right angled triangle. Always opposite the right angle.
Opposite: the side opposite the angle of interest
Adjacent: the side next to the angle of interest

Squares and square roots

This can also be written as 6^2

$\sqrt{\ }$ is the square root symbol

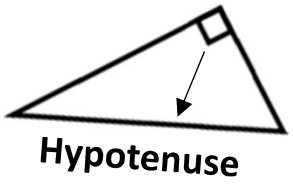
e.g. $\sqrt{64} = 8$

Because 8 × 8 = 64

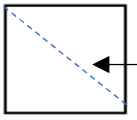
1 × 1	2 × 2	3 × 3	4 × 4	5 × 5	6 × 6	7 × 7	8 × 8	9 × 9	10 × 10
1	4	9	16	25	36	49	64	81	100

Square numbers

Identify the hypotenuse

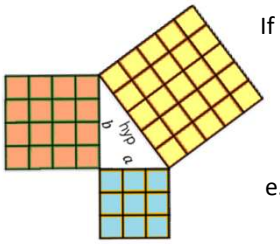


The hypotenuse is always the longest side on a triangle because it is opposite the biggest angle.



Polygons can still have a hypotenuse if it is split up into triangles and opposite a right angle

Determine if a triangle is right-angled.



a = 3 b = 4 c = 5

If a triangle is right-angled, the sum of the squares of the shorter sides will equal the square of the hypotenuse.

$a^2 + b^2 = \text{hypotenuse}^2$

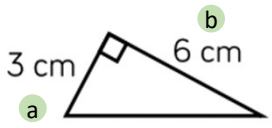
e.g $a^2 + b^2 = hypotenuse^2$

$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

Substituting the numbers into the theorem shows that this is a right-angled triangle

Calculate the hypotenuse



Hypotenuse

Either of the short sides can be labelled a or b

$a^2 + b^2 = \text{hypotenuse}^2$

1. Substitute in the values for a and b

$3^2 + 6^2 = \text{hypotenuse}^2$

$9 + 36 = \text{hypotenuse}^2$

$45 = \text{hypotenuse}^2$

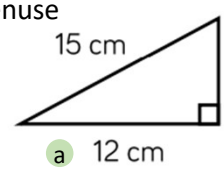
2. To find the hypotenuse square root the sum of the squares of the shorter sides.

$\sqrt{45} = \text{hypotenuse}$

$6.71cm = \text{hypotenuse}$

Calculate missing sides

Hypotenuse



Either of the short sides can be labelled a or b

$a^2 + b^2 = \text{hypotenuse}^2$

$12^2 + b^2 = 15^2$

1. Substitute in the values you are given

$144 + b^2 = 225$

$-144 \quad -144$

Rearrange the equation by subtracting the shorter square from the hypotenuse squared

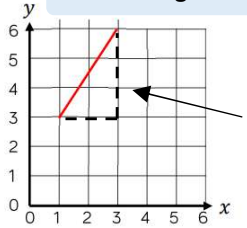
Square root to find the length of the side

$b^2 = 111$

$b = \sqrt{111} = 10.54\ cm$

Pythagoras' theorem on a coordinate axis

Find the **length** of the line segment



The segment can be made into a right-angled triangle by adding the sides on the diagram.

The line segment is the **hypotenuse**

$a^2 + b^2 = \text{hypotenuse}^2$

The lengths of a and b are the sides of the triangle.

Be careful to check the scale on the axes

Pythagoras

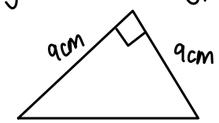
Question 1

True or False:

$2.1^2 = \sqrt{4.2}$

Question 2

Calculate the length of the hypotenuse to 1 decimal place.



Question 3

True or False:

The hypotenuse of a right-angled triangle is always opposite the right angle.

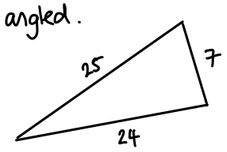
Question 4

Calculate the distance between the coordinates:

(0,0) (6,8)

Question 5

Use Pythagoras' theorem to determine whether this triangle is right-angled.



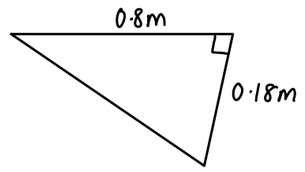
Question 6

Calculate the distance between the coordinates:

(8,6) (7,5)

Question 7

Calculate the length of the hypotenuse to 1 decimal place.



Question 8

True or False:

$\sqrt{0.09} = 0.3$

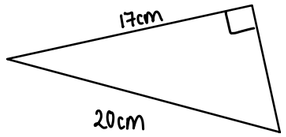
Question 9

Calculate the distance between the coordinates:

(1,3) (4,7)

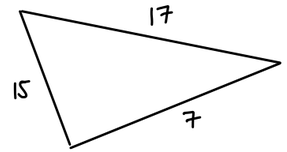
Question 10

Calculate the unknown length to 1 decimal place.



Question 11

Use Pythagoras' theorem to determine whether this triangle is right-angled.



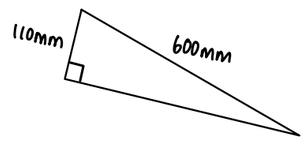
Question 12

Calculate the distance between the coordinates:

(10,1) (5,3)

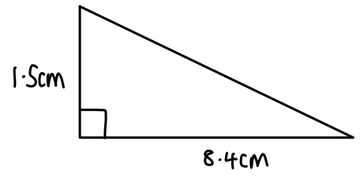
Question 13

Calculate the unknown length to 1 decimal place.



Question 14

Calculate the length of the hypotenuse to 1 decimal place.



Question 15

Calculate the distance between the coordinates:

(-5,5) (-1,3)

Question 16

True or False:

The hypotenuse is the largest side of any triangle.

Question 17

True or False:

Only right-angled triangles have a hypotenuse.

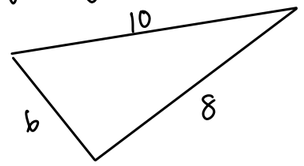
Question 18

Calculate the distance between the coordinates:

(-3,-2) (2,1)

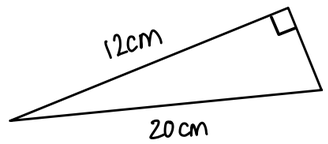
Question 19

Use Pythagoras' theorem to determine whether this triangle is right-angled.



Question 20

Calculate the unknown length to 1 decimal place.



Answers: 1. False 2. 12.7cm 3. True 4. 10 5. True 6. 1.41 7. 0.82m 8. True 9. 5 10. 10.5cm 11. False 12. 4.58 13. 589.83mm 14. 8.53cm 15. 4.47 16. false 17. True 18. 5.83 19. True 20. 16cm

Year 9 – reasoning with geometry…

Enlargement & Similarity

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Recognise enlargement and similarity
- Enlarge a shape by a positive SF
- Enlarge a shape from a point
- Enlarge a shape by a fractional SF
- Work out missing sides and angles in a pair of similar shapes.

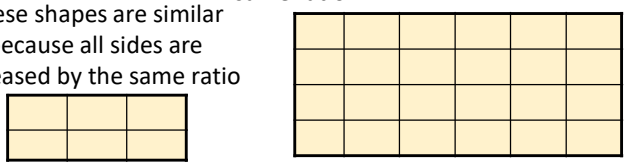
Keywords

Similar Shapes: shapes of different sizes that have corresponding sides in equal proportion and identical corresponding angles.
Scale Factor: the multiple describing how much a shape has been enlarged
Enlarge: to change the size of a shape (enlargement is not always making a shape bigger)
Corresponding: objects (or sides) that appear in the same place in two similar situations.
Image: the picture or visual representation

Recognise enlargement & similarity

Shapes are similar if all pairs of corresponding sides are in the same ratio

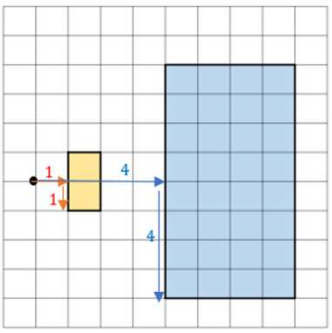
These shapes are similar because all sides are increased by the same ratio



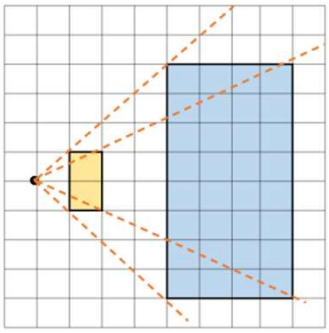
Enlargements are similar shapes with a ratio other than 1

Enlarge a shape from a point

Scaled distances method | Rays method



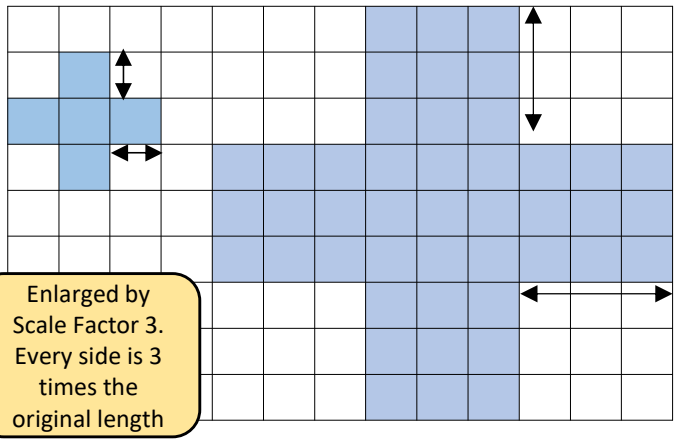
Scale the distance between the point of enlargement and each corresponding vertices



Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Enlarge by a positive scale factor

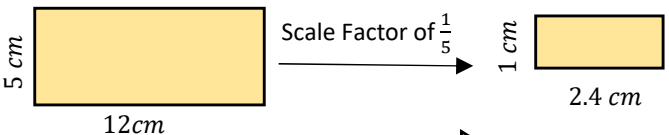
With a scale factor larger than 1 it makes the shape **bigger**

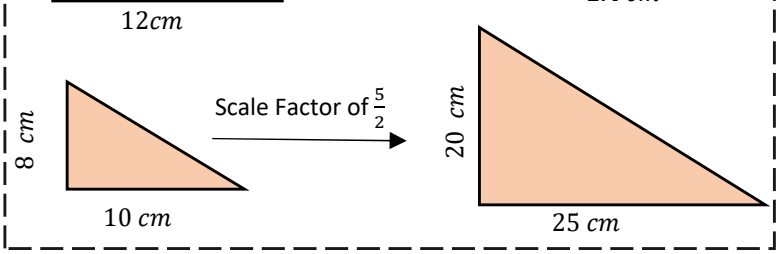


Enlarged by Scale Factor 3. Every side is 3 times the original length

Positive fractional scale factor

With a scale factor between 0 and 1 it makes the shape **smaller**

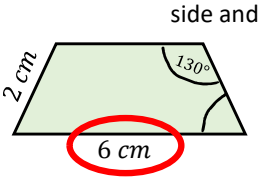


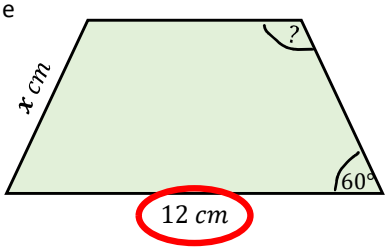


Calculations in similar shapes

Don't forget that properties of shapes don't change with enlargements or in similar shapes

The two trapezium are similar find the missing side and angle





Corresponding sides identify the scale factor $\frac{12}{6} = 2$ Scale Factor = **2**

Calculate the missing side Length (corresponding side) x scale factor

$2cm \times 2$

$x = 4cm$

Enlargement does not change angle size

Calculate the missing angle Corresponding angles remain the same $130°$

Year 9 – reasoning with geometry…

Rotation & Translation

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

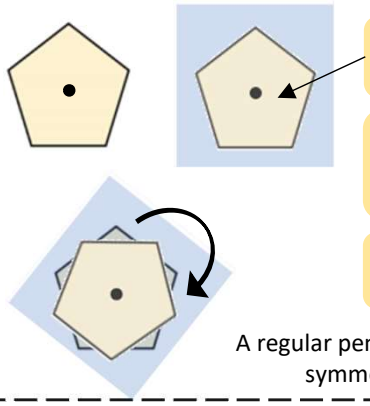
- Identify the order of rotational symmetry
- Rotate a shape about a point on the shape
- Rotate a shape about a point not on a shape
- Translate by a given vector
- Compare rotations and reflections

Keywords

Rotate: a rotation is a circular movement.
Symmetry: when two or more parts are identical after a transformation.
Regular: a regular shape has angles and sides of equal lengths.
Invariant: a point that does not move after a transformation.
Vertex: a point two edges meet.
Horizontal: from side to side
Vertical: from up to down

Rotational Symmetry

Tracing paper helps check rotational symmetry.



1. Trace your shape (mark the centre point)
2. Rotate your tracing paper on top of the original through 360º
3. Count the times it fits back into itself

A regular pentagon has rotational symmetry of order 5

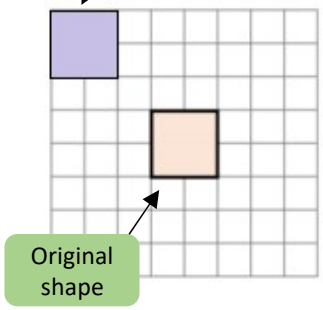
Translation and vector notation

Vector Notation → $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$

How far left or right to move
Negative value (left)
Positive value (right)

How far up or down to move
Negative value (down)
Positive value (up)

Translation $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

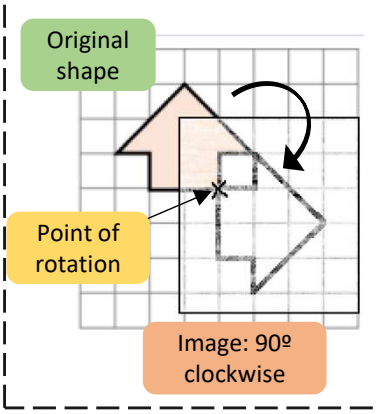


Every vertex has been translated by the same amount

$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

The image has been moved 3 squares to the left and 3 squares up

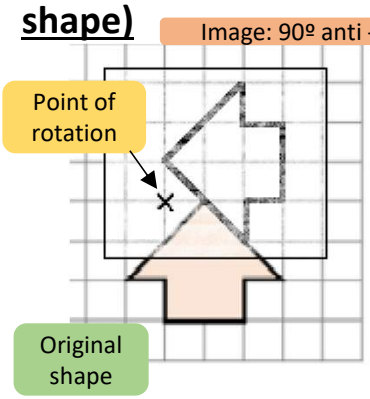
Rotate from a point (in a shape)



1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

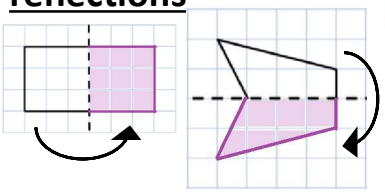
Clockwise Anti-Clockwise

Rotate from a point (outside a shape)



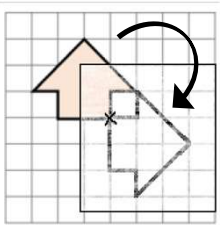
1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

Compare rotations and reflections



Reflections are a mirror image of the original shape.

Information needed to perform a reflection:
- Line of reflection (Mirror line)



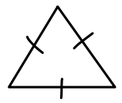
Rotations are the movement of a shape in a circular motion

Information needed to perform a rotation:
- Point of rotation
- Direction of rotation
- Degrees of rotation

Transformations

Question 1

State the order of rotational symmetry

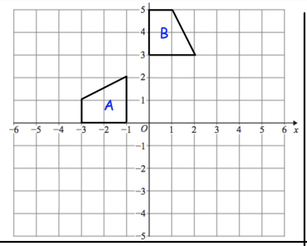


Question 2

What is the key information you must include when describing a rotation?

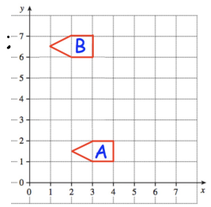
Question 3

Describe the transformation : from A to B



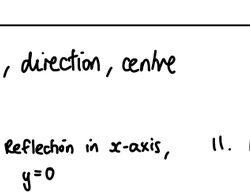
Question 4

Describe the transformation : from A to B



Question 5

Describe the transformation : from A to B

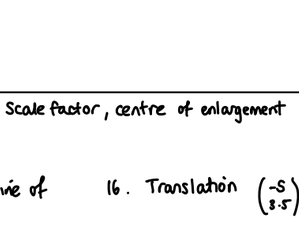


Question 6

What is the key information you must include when describing a translation?

Question 7

What is the scale factor of the enlargement?



Question 8

What is the key information you must include when describing an enlargement?

Question 9

Describe the transformation : from A to B

Question 10

Describe the transformation from A to B

Question 11

State the order of rotational symmetry

Question 12

Describe the transformation : from A to B

Question 13

Describe the transformation : from B to A

Question 14

Describe the transformation : from A to B

Question 15

What is the key information you must include when describing a reflection?

Question 16

Describe the transformation : from A to B

Answers : 1. 3 2. Angle, direction, centre 3. Rotation 90° clockwise through (1, 1) 4. Translation $\begin{pmatrix} -1 \\ 5 \end{pmatrix}$ 5. Rotation, 180° through (2, 0) 6. Column vector 7. sf 3 8. Scale factor, centre of enlargement

9. Reflection in $y = x$ 10. Reflection in x-axis, $y = 0$ 11. 1 12. Enlargement, sf 2 through (7, 6) 13. Enlargement, sf 2 through (1, 5) 14. Translation $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$ 15. Equation of line of reflection 16. Translation $\begin{pmatrix} -5 \\ 3.5 \end{pmatrix}$

Year 9 – similarity…

Trigonometry

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

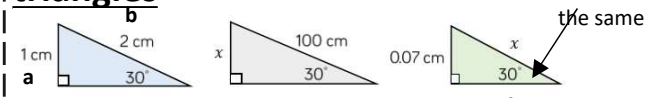
- Work fluently with hypotenuse, opposite and adjacent sides
- Use the tan, sine and cosine ratio to find missing side lengths
- Use the tan, sine and cosine ratio to find missing angles
- Calculate sides using Pythagoras' Theorem

Keywords

Enlarge: to make a shape bigger (or smaller) by a given multiplier (scale factor)
Scale Factor: the multiplier of enlargement
Constant: a value that remains the same
Cosine ratio: the ratio of the length of the adjacent side to that of the hypotenuse. The sine of the complement.
Sine ratio: the ratio of the length of the opposite side to that of the hypotenuse.
Tangent ratio: the ratio of the length of the opposite side to that of the adjacent side.
Inverse: function that has the opposite effect.
Hypotenuse: longest side of a right-angled triangle. It is the side opposite the right-angle.

Ratio in right-angled triangles

When the angle is the same the ratio of sides a and b will also remain the same



a : b
1 : 2

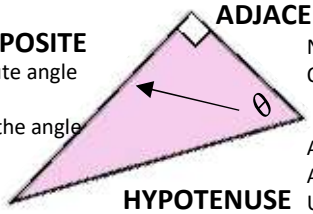
$\frac{a}{b} = \frac{1}{2}$

a : b
x : 100
50 : 100

a : b
0.07 : x
0.07 : 0.14

Hypotenuse, adjacent and opposite

ONLY right-angled triangles are labelled in this way



OPPOSITE
Always opposite an acute angle
Useful to label second
Position depend upon the angle in use for the question

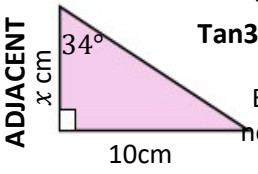
ADJACENT
Next to the angle in question
Often labelled last

Always the longest side
Always opposite the right angle
Useful to label this first

Tangent ratio: side lengths

$\text{Tan}\theta = \frac{\text{opposite side}}{\text{adjacent side}}$

Substitute the values into the tangent formula



$\text{Tan}34 = \frac{10}{x}$

Equations might need rearranging to solve

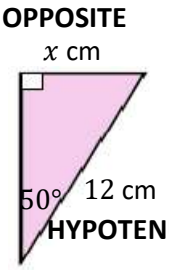
$x \times \text{Tan}34 = 10$

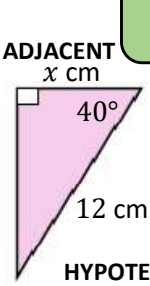
$x = \frac{10}{\text{Tan}34} = 14.8\text{cm}$

Sin and Cos ratio: side lengths

$\text{Sin}\theta = \frac{\text{opposite side}}{\text{hypotenuse side}}$

$\text{Cos}\theta = \frac{\text{adjacent side}}{\text{hypotenuse side}}$





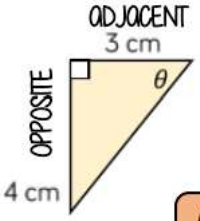
Substitute the values into the ratio formula

Equations might need rearranging to solve

NOTE
The Sin(x) ratio is the same as the Cos(90-x) ratio

Sin, Cos, Tan: Angles

Inverse trigonometric functions



Label your triangle and choose your trigonometric ratio

Substitute values into the ratio formula

$\text{Tan}\theta = \frac{3}{4}$

$\theta = \text{Tan}^{-1}\frac{3}{4}$

$\theta = 36.9°$

$\theta = \text{Tan}^{-1}\frac{\text{opposite side}}{\text{adjacent side}}$

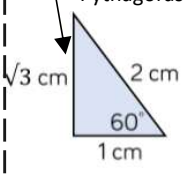
$\theta = \text{Sin}^{-1}\frac{\text{opposite side}}{\text{hypotenuse side}}$

$\theta = \text{Cos}^{-1}\frac{\text{adjacent side}}{\text{hypotenuse side}}$

Key angles

Because trig ratios remain the same for similar shapes you can generalise from the following statements.

This side could be calculated using Pythagoras



$\text{Tan}30 = \frac{1}{\sqrt{3}}$

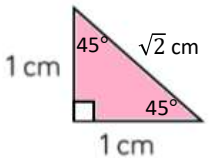
$\text{Tan}60 = \sqrt{3}$

$\text{Cos}30 = \frac{\sqrt{3}}{2}$

$\text{Cos}60 = \frac{1}{2}$

$\text{Sin}30 = \frac{1}{2}$

$\text{Sin}60 = \frac{\sqrt{3}}{2}$



$\text{Tan}45 = 1$

$\text{Cos}45 = \frac{1}{\sqrt{2}}$

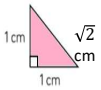
$\text{Sin}45 = \frac{1}{\sqrt{2}}$

Key angles 0° and 90°

$\text{Tan}0 = 0$

~~$\text{Tan}90$~~

This value cannot be defined – it is impossible as you cannot have two 90° angles in a triangle



$\text{Sin}0 = 0$

$\text{Sin}90 = 1$

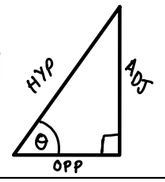
$\text{Cos}0 = 1$

$\text{Cos}90 = 0$

Trigonometry

Question 1

True or False:
This triangle is labelled correctly

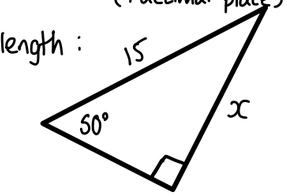


Question 2

What is the exact value of $\sin 30$?

Question 3 (1 decimal place)

Calculate the missing side length:

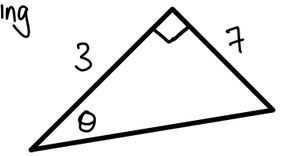


Question 4

What is the exact value of $\sin 90$?

Question 5 (1 decimal place)

Calculate the missing angle:

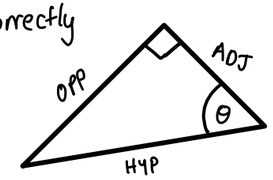


Question 6

What is the exact value of $\cos 30$?

Question 7

True or False:
This triangle is labelled correctly



Question 8

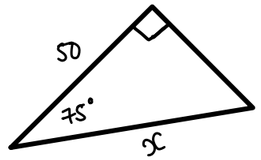
What is the exact value of $\sin 60$?

Question 9

What is the exact value of $\cos 45$?

Question 10 (1 decimal place)

Calculate the missing side length:



Question 11

What is the exact value of $\tan 30$?

Question 12

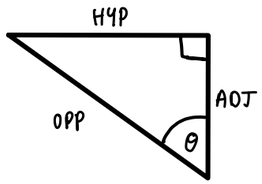
What is the exact value of $\cos 0$?

Question 13

What is the exact value of $\tan 45$?

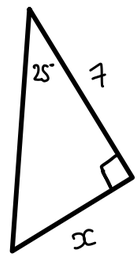
Question 14

True or False:
This triangle is labelled correctly



Question 15 (1 decimal place)

Calculate the missing side length:



Question 16

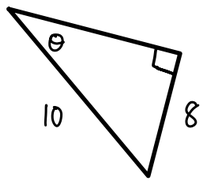
What is the exact value of $\cos 60$?

Question 17

What is the exact value of $\sin 0$?

Question 18 (1 decimal place)

Calculate the missing angle

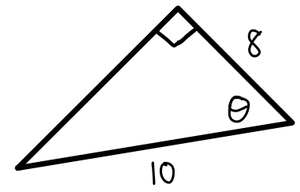


Question 19

What is the exact value of $\tan 60$?

Question 20 (1 decimal place)

Calculate the missing angle



Answers: 1. False 2. $\frac{1}{2}$ 3. 11.5 4. 1 5. 66.8° 6. $\frac{\sqrt{3}}{2}$ 7. True 8. $\frac{\sqrt{3}}{2}$ 9. $\frac{1}{\sqrt{2}}$ 10. 193.2 11. $\frac{1}{\sqrt{3}}$ 12. 1 13. 1 14. False 15. 3.3 16. $\frac{1}{2}$ 17. 0 18. 53.1 19. $\sqrt{3}$ 20 36.9

Year 9 - Reasoning with data…

Measures of location

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand and use mean, median and mode
- Choose the most appropriate average
- Identify outliers
- Compare distributions using averages and range

Keywords

Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Total: all the data added together
Frequency: the number of times the data values occur
Represent: something that show's the value of another
Outlier: a value that stands apart from the data set
Consistent: a set of data that is similar and doesn't change very much

Mean, Median, Mode

The Mean

A measure of average to find the central tendency… a typical value that represents the data **24, 8, 4, 11, 8,**

Find the sum of the data (add the values) **55**

Divide the overall total by how many pieces of data you have **55 ÷ 5**

Mean = 11

The Median

The value in the centre (in the middle) of the data **24, 8, 4, 11, 8,**

Put the data in order **4, 8, 8, 11, 24**

Find the value in the middle **4, 8, 8, 11, 24**

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical) **24, 8, 4, 11, 8,**

This can still be easier if it the data is ordered first **4, 8, 8, 11, 24**

Mode = 8

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

£240	£240	£240	£240	£240
£260	£260	£300	£350	£700

Which average best represents the weekly wage?

The Mean = £307
The Median = £250
The Mode = £240

Put the data back into context
Mean/Median – too high (most of this company earn £240)
Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Identify outliers

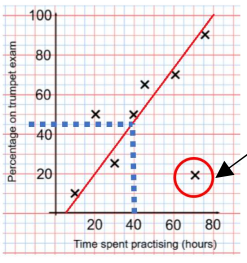
Outliers are values that stand well apart from the rest of the data

Outliers can have a big impact on range and mean.
They have less impact on the median

Sometimes it is best to not use an outlier in calculations

Height in cm
152 150 142 158 182 151 153 149 156 160 151 144

Where an outlier is identified try to give it some context. This is likely to be a taller member of the group. Could the be an older student or a teacher?



Outliers can also be identified graphically e.g. on scatter graphs

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency.

Here are the number of runs scored last month by Lucy and James in cricket matches

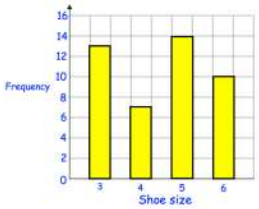
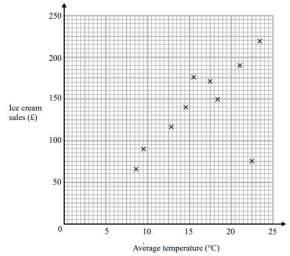
Lucy: **45, 32, 37, 41, 48, 35**
James: **60, 90, 41, 23, 14, 23**

James has two extreme values that have a big impact on the range

Lucy
Mean: 39.6 (1.d.p), **Median:** 38. **Mode:** no mode, **Range:** 16

James
Mean: 41.8 (1.d.p), **Median:** 32, **Mode:** 23, **Range:** 76

"James is less consistent than Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"

Question 1 Work out the mode for the following data: 5, 6, 6, 7, 8, 10	Question 2 Work out the mode for the following data: 5, 5, 7, 7, 7, 8, 8, 9	Question 3 Work out the mode for the following data: 5, 7, 3, 1, 8, 9, 10, 2	Question 4 Work out the mode for the following data: −2, −1, 5, 8, −2, 2, −1, 9, −1, 1, 2, −1	Question 5  What is the modal shoe size?
Question 6 Work out the median for the following data: 5, 1, 4, 6, 8	Question 7 Work out the median for the following data: 6.2, 6.8, 6.6, 7.2, 6.4, 7.4, 5.8	Question 8 Work out the median for the following data: 9, 8, 6, 6, 6, 7, 1, 2, 6, 8	Question 9 Work out the median for the following data: −4, 5, −7, −1, 2, 0, 9	Question 10 The height of some footballers are listed below: 1.81m, 1.78m, 1.88m, 1.79m, 1.86m, 1.85m, 1.78m, 1.93m Work out the median height.
Question 11 Find the mean of the following data: 4, 9, 7, 10, 5	Question 12 Find the mean of the following data: 3, 2, 1, 3, 2, 2, 1, 3, 1, 2, 3, 2, 1	Question 13 Find the mean of the following data: 9, −3, −6, 5, 0	Question 14 Find the mean of the following data: 1.4, 2.8, 2.4, 2.5, 2.8, 3.1, 1.1	Question 15 Five houses on a street are sold in 2016. They sell for £175,000 £184,000 £150,000 £201,000 £191,000 Calculate the mean price.
Question 16 Find the missing word: The mean, median and mode are known as measures of _ _ _ _ _ _ _ _ _	Question 17 Identify the outlier:  	Question 18 Which average does outliers affect most?	Question 19 Compare the distances travelled by snails and slugs over the duration of ten minutes. | | Median | Interquartile range | | Snails | 7.1 cm | 3.1 cm | | Slugs | 9.7 cm | 4.5 cm |	Question 20 A teacher asks a group of students how much pocket money they receive each week. They respond: £5 £8 £4 £50 £6 £8 £7.50 £10 £8 £7 Which average, the median or the mean, is most suitable for this data?

6, 7, no mode, - 1, 5, 5, 6.8, 6, - 4, 1.83, 7, 2, 1, 2.3, 180200, location, (22.5,75), mean, slugs move faster on average/snails move at more consistent pace, median

Year 9 – reasoning with number…

Numbers

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify integers, real and rational numbers
- Work with directed number
- Solve problems with number
- Find HCF/ LCM
- Add/ Subtract fractions
- Multiply/ Divide fractions
- Write numbers in standard form

Keywords

Integer: a whole number that is positive or negative
Rational: a number that can be made by dividing two integers
Irrational: a number that cannot be made by dividing two integers
Inverse operation: the operation that reverses the action
Quotient: the result of a division
Product: the result of a multiplication.
Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number

Integers, real and rational numbers

Rational – root word: ratio

Real numbers: $\frac{2}{3}$ stems from 2:1 ($\frac{2}{3}$ of the whole)

Irrational numbers: $\sqrt{2}$ the solution is a decimal that never ends and does not repeat.

The square root of a negative is not a real number and cannot be found.

HCF/LCM

1 is a common factor of all numbers

Common factors are factors two or more numbers share

HCF – Highest common factor

HCF of18 and 30

18	1, 2, 3, 6, 9, 18
30	1, 2, 3, 5, 6, 10, 15, 30

HCF = 6

LCM – Lowest common multiple

LCM of 9 and 12

9	9, 18, 27, 36, 45, 54
12	12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

Standard form

Any number between 1 and less than 10 × 10^{n} (n: any integer)

$6 \times 10^5 + 8 \times 10^5$

$= 600000 + 800000$

$= 1400000$

$= 1 \bullet 4 \times 10^5$

$(1 \bullet 5 \times 10^5) \times (0 \bullet 3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

Directed number

Addition

2 + - 4 = -2

Generalisation: + - = -

Zero pair (-1 + 1 = 0)

Two " – 1 " left = =2

Subtraction

Generalisation: - - = +

Representation for calculation = 2

"Subtract" – means take away or remove

2 - - 1 = 3

Take away

Start with the representation of 2

= 3

Multiplication

= −1
= 1

The act of making counters into their negative is turning them over

-2 x -3 = 6

Divisions are the inverse operations

a = 5

b = -4

Brackets around negative substitutions helps remove calculation errors

2a – b = 2 x 5 – (-4) = 10 + 4 = 14

Addition/ Subtraction of fractions

$\frac{4}{5} - \frac{2}{3}$ = $\frac{12}{15} - \frac{10}{15}$ = $\frac{2}{15}$

Use equivalent fractions to find a common multiple for both denominators

Multiplication/ Division of fractions

$\frac{3}{4} \times \frac{2}{3}$

Shade in 3 parts

Repeat it on this many rows

This many columns

This many rows

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

Parts shaded

Total number of parts in the diagram

Modelled:

3 × 4

Remember to use reciprocals

$\frac{2}{5} \div \frac{3}{4}$

Multiplying by a reciprocal gives the same outcome

$\frac{2}{5} \times \frac{4}{3}$

Represented

$= \frac{8}{15}$

Number Sense

Question 1

what is $2+(-4)$?

Question 2

Calculate

$$\frac{3}{5} \times \frac{11}{12}$$

Question 3

Find the HCF of 30 and 40

Question 4

Give your answer in standard form

Calculate

$$(8 \times 10^3) \times (2 \times 10^5)$$

Question 5

Write this number in correct standard form:

0.000314

Question 6

Calculate

$$(-5)-(-7)$$

Question 7

Give your answer in standard form

Calculate

$$(9.2 \times 10^4) - (3.7 \times 10^2)$$

Question 8

Calculate

$$\frac{1}{4} + \frac{2}{7}$$

Question 9

Find the LCM of 16 and 24

Question 10

Calculate

$$\frac{8}{9} - \frac{2}{5}$$

Question 11

Examples: 2, 20, 100, -7, 63

Non-examples: 21.6, $\frac{2}{3}$, 82.5, $-\frac{6}{7}$

What are these examples/non-examples of?

Question 12

Calculate

$$2 \times (-5)$$

Question 13

Calculate

$$(-7) \times (-4)$$

Question 14

Calculate

$$20 \div (-4)$$

Question 15

Calculate

$$(1.4 \times 10^5) \div (7 \times 10^3)$$

Question 16

Calculate

$$(-4)+(-3)$$

Question 17

Calculate

$$\frac{2}{3} \div \frac{4}{9}$$

Question 18

Give your answer in standard form

Calculate

$$(2.3 \times 10^5) + (4.7 \times 10^4)$$

Question 19

Calculate

$$5 - (-4)$$

Question 20

Write this number in correct standard form:

82350000

Answers: 1. -2 2. $\frac{11}{20}$ 3. 10 4. 1.6×10^9 5. 3.14×10^{-4} 6. 2 7. 9.168×10^4 8. $\frac{15}{28}$ 9. 48 10. $\frac{22}{45}$ 11. Integers 12. -10 13. 28 14. -5 15. 20 16. -7 17. $\frac{3}{2}$ 18. 2.77×10^5 19. 9 20. 8.235×10^7

Year 9 – representations…

Probability

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Find single event probability
- Find relative frequency
- Find expected outcomes
- Find independent events
- Use diagrams to work out probabilities

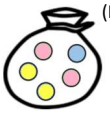
Keywords

Probability: the chance that something will happen
Relative Frequency: how often something happens divided by the outcomes
Independent: an event that is not effected by any other events.
Chance: the likelihood of a particular outcome.
Event: the outcome of a probability – a set of possible outcomes.
Biased: a built in error that makes all values wrong by a certain amount.

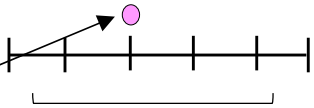
The probability scale

Impossible **0 or 0%** — Even chance **0.5, $\frac{1}{2}$ or 50%** — Certain **1 or 100%**

The more likely an event the further up the probability it will be in comparison to another event (It will have a probability closer to 1)



There are 2 pink and 2 yellow balls, so they have the same probability



There are 5 possible outcomes
So 5 intervals on this scale, each interval value is $\frac{1}{5}$

Single event probability

Probability is always a value between 0 and 1

The probability of getting a blue ball is $\frac{1}{5}$
∴The probability of **NOT** getting a blue ball is $\frac{4}{5}$
The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(white chocolate) = 1 – 0.15 – 0.35
= 0.5

Relative Frequency

$$\frac{\text{Frequency of event}}{\text{Total number of outcomes}}$$

Remember to calculate or identify the overall number of outcomes!

Colour	Frequency	Relative Frequency
Green	6	0.3
Yellow	12	0.6
Blue	2	0.1
	20	

Relative frequency can be used to find expected outcomes

e.g. Use the relative probability to find the expected outcome for green if there are 100 selections.

Relative frequency x Number of times

$$0.3 \times 100 = 30$$

Expected outcomes

Expected outcomes are estimations. It is a long term average rather than a prediction.

Dark	Milk	White
0.15	0.35	0.5

The sum of the probabilities is 1

An experiment is carried out 400 times.
Show that dark chocolate is expected to be selected 60 times

$$0.15 \times 400 = 60$$

Independent

The rolling of one dice has no impact on the rolling of the other. The individual probabilities should be calculated separately.

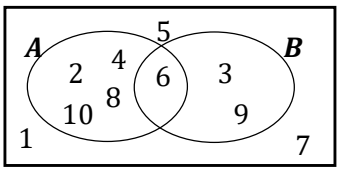
Probability of event 1 × Probability of event 2

$P(5) = \frac{1}{6}$ $P(R) = \frac{1}{4}$

Find the probability of getting a 5 and a red

$$P(5 \text{ and } R) = \frac{1}{6} \times \frac{1}{4} = \frac{1}{24}$$

Using diagrams



	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	21	47
Total	21	44	35	100

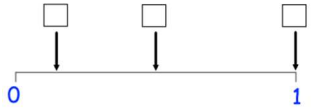
The possible outcomes from tossing a coin

The possible outcomes from rolling a dice

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

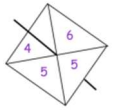
Question 1

A fair six-sided die is thrown. Mark the probability of each event on the diagram:
A: A number less than 7 is thrown.
B: A "6" is thrown.
C: An odd number is thrown.

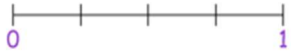


Question 2

A fair 4-sided spinner is spun once.



On the probability scale, mark with a letter A, the probability that the spinner will land on the number 4.



Question 3

A bag contains 10 discs. Each disc is labelled with a different number from 1 to 10. A disc is chosen from the bag at random. Write down the probability that the chosen disc is a square number.

Question 4

Elizabeth has a bunch of red, yellow and white roses. She chooses a rose at random.
The probability that she chooses a yellow rose is 0.1
The probability that she chooses a white rose is 0.2.
What is the probability that Elizabeth chooses a rose that is either yellow or white?

Question 5

There are 12 red roses, 5 yellow roses and 3 white roses in a vase.
Felix takes a rose, at random, from the vase.
Write down the probability that Felix takes a rose that is not red.

Question 6

A die is rolled 30 times:

3 4 4 4 6 5 4 5 6 4
1 3 2 4 4 5 6 4 4 2
4 5 6 3 2 3 5 6 2 3

Complete the relative frequency table:

Number on dice	1	2	3	4	5	6
Relative frequency						

Question 7

The table shows the probability that a counter taken at random from a bag will be pink, green or blue.

Colour	Pink	Yellow	Green	Blue
Probability	0.5		0.1	0.2

Find the probability of the counter will be yellow.

Question 8

The probability that Ben wins at rugby is 25%.
If Ben plays rugby 136 times, how many games can Ben expect not to win?

Question 9

Esme takes the bus to university 40 times during a term.
The relative frequency of the bus being late is 0.3.
How many times was the bus late?

Question 10

Jack sows 300 wildflower seeds. The probability of a seed flowering is 0.7.
Work out an estimate for the number of these seeds that will flower.

Question 11

Gary is playing cricket.
When attempting to catch the ball, the probability Gary is successful is ¾
During the game, Gary attempts two catches.
Find the probability Gary is successful with both catches.

Question 12

A fair six sided dice is rolled three times.
Find the probability of getting no sixes.

Question 13

Harry gets the train to work in the morning. He works Monday to Friday.
The probability the train is late is 0.2.
Find the probability the train is late exactly once.

Question 14

Two bags, 1 and 2, each contain three counters. In bag 1, the counters are labelled 1, 2 and 5. In bag 2, the counters are labelled 2, 3 and 4.

Bag 2 \ Bag 1	1	2	5
2			
3			
4			

Complete the two-way table.

Question 15

Two fair six sided dice are rolled.
The numbers on the two dice are added together to give a score.
Find the probability of scoring a 7.

Question 16

The two-way table shows information about the students in a class:

		Hair colour		
		Brown	Blonde	Red
Glasses	Yes	3	6	3
	No	5	4	1

Find the probability that the student does not wear glasses.

Question 17

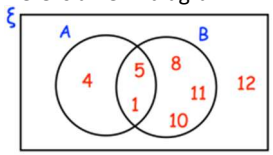
80 students visited the library over three days.

	Monday	Tuesday	Wednesday	Total
Year 7			13	38
Year 8	14			
Total		33	26	80

Complete the two way table.

Question 18

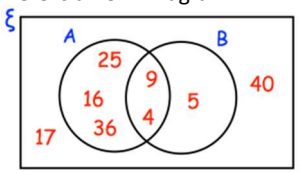
Here is a Venn diagram:



Write down P (A ∩ B')

Question 19

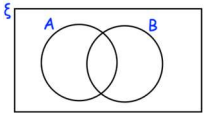
Here is a Venn Diagram:



Write down the numbers in A'.

Question 20

ξ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}
A = multiples of 3
B = multiples of 5
Complete the Venn diagram.



BAC, at 1/4 , 3/10, 0.3, ¾, o.i3/0.16/0.3/0.16/0.16, 0.3, 102, 12, 210,9/16, 125/216, 4/625, 2 4 10/3 6 15/4 8 20, 1/6, 10/22, 7 18/15 13 42/21, 1/7, 5 17 40, 3 6 9 12/15/5 10/1 2 4 7 8 11 13 14 16