YEAR 7
KNOWLEDGE ORGANISERS

ALGEBRA...

Sequences

What do I need to be able to do?

- Sequences of diagrams
- Continue number sequences
- Term-to-term rules
- Sequences from a written rule
- Linear and non-linear sequences

Keywords

Tier 2:

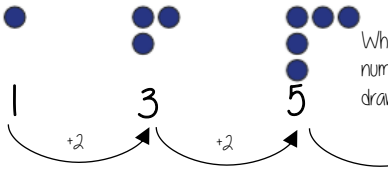
Sequence: items or numbers put in a pre-decided order
Position: the place something is located
Rule: instructions that relate two variables
Difference: the gap between two terms
Term: a single number or variable
Linear: the difference between terms increases or decreases by the same value each time
Non-linear: the difference between terms increases or decreases in different amounts

Tier 3:

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

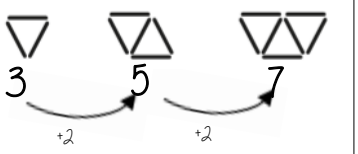
Describe and continue a sequence diagrammatically

Count the number of circles or lines in each image

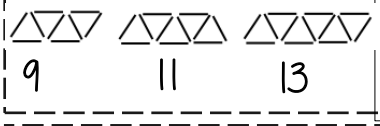


What will the next number be? Can you draw this?

Predict and check terms



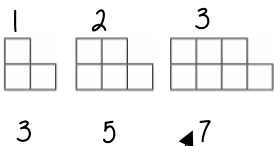
CHECK – draw the next terms



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"

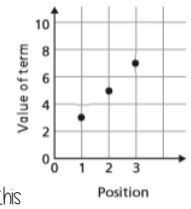
Term: the number or variable
(the number of squares in each image)

In a 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

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

ALGEBRA . Algebraic notation & substitution

What do I need to be able to do?

- 1-step function machines (number)
- 1-step function machines (algebra)
- Find a function (one step)
- Substitution (one step)
- 2-step function machines (number)
- 2-step function machines (algebra)
- Substitution (two step)

Keywords

Tier 2:

Operation: a mathematical process
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Evaluate: work out
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
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)
Linear: the difference between terms increases or decreases by the same value each time
Sequence: items or numbers put in a pre-decided order

Tier 3:

Commutative: the order of the operations do not matter

Single function machines

INPUT → [ ] → OUTPUT
The number that goes IN — 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
3 x 5
5 x 3

Addition and multiplication can be done in any order
Commutative calculations

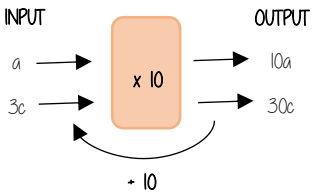
y + y + y + y
y x 4
4 x y
4y

4 lots of 'y'

20 ÷ h
$\frac{20}{h}$

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

INPUT 7x → ? → OUTPUT 14x

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

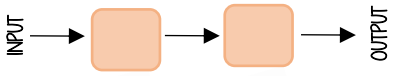
4y ← 4 lots of 'y'

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. $y - 2$
$= 7 - 2 = 5$

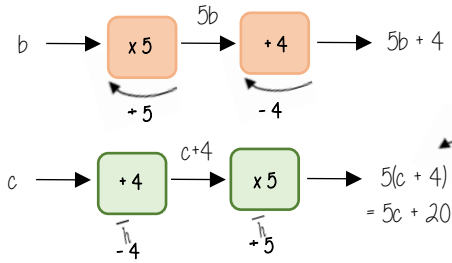
Two step function machines



Calculate the value at the end of each operation

For the input use the INVERSE operations

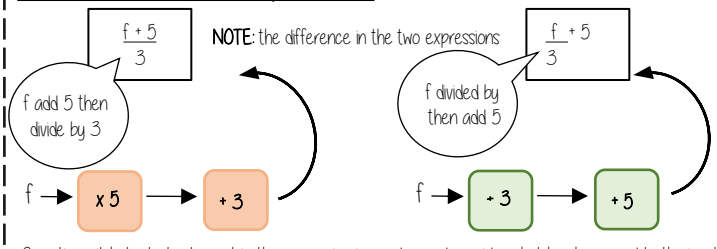
Two step function machines (algebra)



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)

Put the expression into a function machine

INPUT → + 3 → x 2 → OUTPUT

If x = 10
10 + 3 = 13.... 13 x 2 = 26

Forming a sequence

2(x + 3)

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 2(x + 3)

INPUT → + 3 → x 2 → OUTPUT

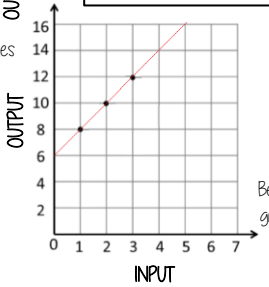
To represent graphically the input becomes x co-ordinates and the output becomes y co-ordinates

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

ALGEBRA... Expressions and equations

What do I need to be able to do?

- Like and unlike terms
- Collect like terms
- Solve 1-step equations (+/-)
- Solve 1-step equations (x/÷)
- Solve any 1-step equation

Keywords

Tier 2:

Equals: represented by '=' symbol – means the same
Equality: two expressions that have the same value
Solution: the set or value that satisfies the equation
Equation: a mathematical statement that two things are equal
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Like: variables that are the same are 'like'
Term: a single number or variable
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

Tier 3:

Coefficient: a multiplicative factor in front of a variable e.g. 5x (5 is the coefficient, x is the variable)
Solve: to find the solution

Equality

$2 + 14 = 5 + 5 + 6$

16 16

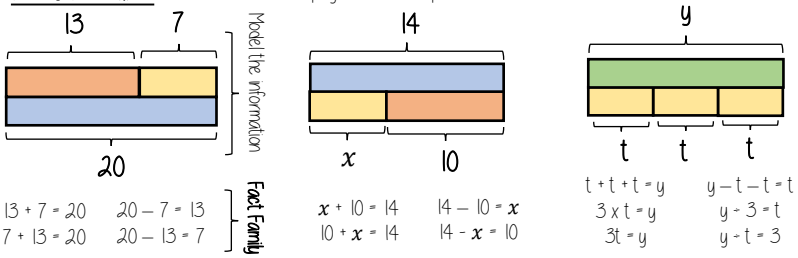
"Is equal to"

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



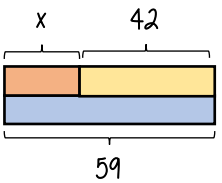
Solve one step equations (+/-)

There is more to this than just spotting the answer

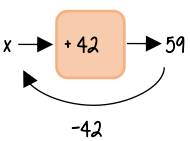
$x + 42 = 59$

$x + 42 = 59$
$42 + x = 59$

$59 - x = 42$
$59 - 42 = x$



Don't forget you know how to use function machines

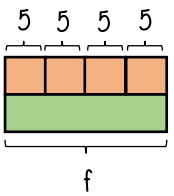


Solve one step equations (x/÷)

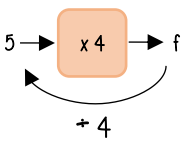
$\frac{f}{4} = 5$

$f \div 4 = 5$
$f \div 5 = 4$

$5 \times 4 = f$
$4 \times 5 = f$



Don't forget you know how to use function machines

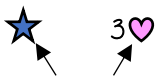


Like and unlike terms

Like terms are those whose variables are he same

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

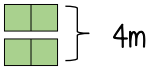
5m	2 x 2m	7m – 3m
5 x 10	2 x (2x 10)	(7x 10) – (3x 10)
= 50	= 2 x 20	= 70 – 30
	= 40	= 40

Equivalent expressions

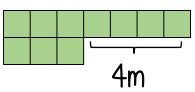
Repeat this with various values for m to check

5m

2 x 2m



7m – 3m



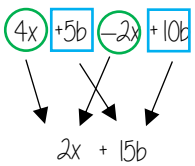
Collecting like terms ≡ symbol

The ≡ symbol means equivalent to.
It is used to identify equivalent expressions

Collecting like terms

Only **like terms** can be combined

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



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

NUMBER... Place value & ordering

What do I need to be able to do?

- Read and write integers to 10 000
- Understand the place value of a digit in an integer to 10 000
- Compare integers to 10 000
- Order integers to 10 000
- Work out intervals on a number line
- Position integers on a number line
- Place value for decimals
- Compare and order decimals

Keywords

Tier 2:

Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with
Interval: between two points or values
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
Standard (index) Form: A system of writing very big or very small numbers
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

Tier 3:

Integer: a whole number that is positive or negative
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

Integer Place Value

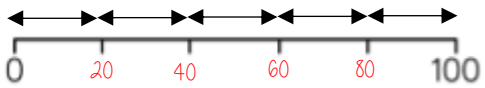
Billions			Millions			Thousands			Ones		
H	T	O	H	T	O	H	T	O	H	T	O
		3	1	4	8	0	3	3	0	2	9

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



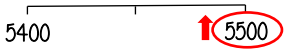
Divide the difference by the number of intervals (gaps).
E.g 100 ÷ 5 = 20

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

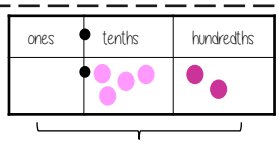


5475 to the nearest 10

Decimals

We say "nought point five two"

Five tenths and two hundredths



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

Compare integers using <, >, =, ≠

< less than
> greater than
= equal to
≠ not equal to

Two and a half million = 2 500 000
300 000 000 = Three billion
Six thousand and eighty < 68 000

Positive powers of 10

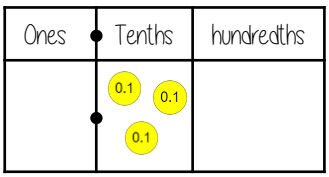
1 billion – 1 000 000 000
10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 = 10^9

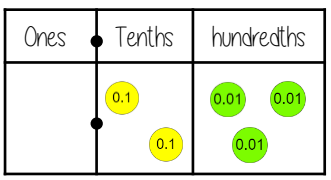
Addition rule for indices $10^a \times 10^b = 10^{a+b}$

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

Comparing decimals

Which the largest of **0.3** and **0.23**?





0.3 > 0.23

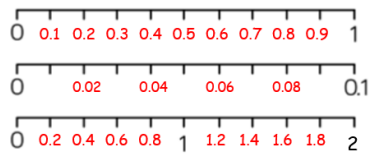
"There are more counters in the furthest column to the left"

0.30
0.23

Comparing the values both with the same number of decimal places is another way to compare the number of tenths and hundredths

Decimal intervals on a number line

One whole spit into 10 parts makes tenths = 0.1
One tenth split into 10 parts makes hundredths = 0.01



Negative powers of 10

0.001

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

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Standard form with numbers > 1

Any number between 1 and less than 10 → $A \times 10^n$ ← Any integer

Example

3.2 x 10^4
= 3.2 x 10 x 10 x 10 x 10
= 32000

Non-example

0.8 x 10^4

5.3 x $10^{0.7}$

Numbers between 0 and 1

0.054
= 5.4 x 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

NUMBER...

Four Operations

What do I need to be able to do?

- Add and subtract integers
- Add and subtract decimals
- Multiply and divide by 10, 100 and 1000
- Multiply by 0.1 and 0.01 (E)
- Multiply integers
- Divide integers
- Multiply decimals
- Divide decimals by integers
- Divide by a decimal (E)
- Order of operations

Keywords

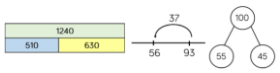
Tier 2:

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
Quotient: the result of a division
Dividend: the number being divided

Tier 3:

Divisor: the number we divide by
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

Addition/ Subtraction with integers



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

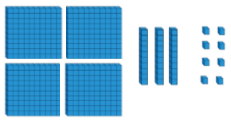
Remember the place value of each column
You may need to move 10 ones to the ones column to be able to subtract

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

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

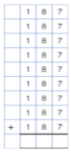
Multiplication methods

	H	T	O
	1	8	7
×			9

Long multiplication (column)

×	100	80	7
9			

Grid method



Repeated addition

Less effective method especially for bigger multiplication

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 = 0.06

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

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

Division methods

3584 ÷ 7 = 512

Short division

$$\begin{array}{r} 5\ 1\ 2 \\ 7\overline{)\ 3\ {}^{3}5\ \ 8\ {}^{1}4} \end{array}$$

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

24 ÷ 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

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

1.2 × 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+24

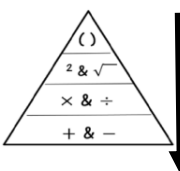
2 + 2 = 4
0.3 + 0.4 = 0.7
4 + 0.7 = 4.7

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

Order of operations



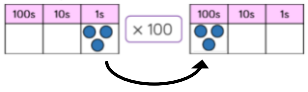
Brackets
Indices or roots
Multiplication or division
Addition or subtraction

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

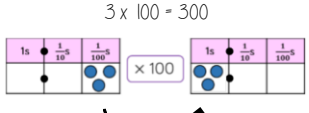
e.g 10 – 3 + 5 → 10 - 3 → 7 + 5

6 x 4 + 8 x 2
24 + 16 = 40

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

STATISTICS... Averages & Range

What do I need to be able to do?

- Mode
- Mean
- Median
- Range
- Solve problems with averages and range

Keywords

Tier 2:

Mode: This is the number OR the item that occurs the most

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

Mean: A measure of average to find the central tendency

Range: The difference between the largest and smallest numbers in a set

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 $55 \div 5$

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

Range *Spread of the values*

Difference between the biggest and smallest

3, 9, 8, 12

Range: Biggest value – Smallest value 12 – 3 = 9 Range = 9

NUMBER... Rounding & Estimation

What do I need to be able to do?

- Round to 1 significant figure
- Round to 2 or more significant figures
- Estimate answers to calculations
- Solve problems with estimation
- Understand and use error interval notation (E)

Keywords

Tier 2:

Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with

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 is the first non-zero number after the decimal point.

Interval: between two points or values

Tier 3:

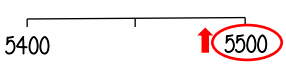
Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right

Round to powers of 10 and 1 sig. figure

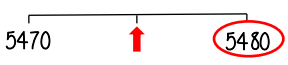
If the number is halfway between we "**round up**"

5495 to the nearest 1000

5475 to the nearest 100



5475 to the nearest 10



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

Estimate the calculation

Round to 1 significant figure to estimate

$4.2 + 6.7 \approx 4 + 7 \approx 11$ This is an **overestimate** because the 6.7 was rounded up more

The equal sign changes to show it is an estimation

$21.4 \times 3.1 \approx 20 \times 3 \approx 60$ 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.

Error Intervals

A width w has been rounded to 6.4cm correct to 1dp

< 6.35 the values would round to 6.3

Error interval

≥ 6.45 the values would round to 6.5

The error interval

$6.35 \leq w < 6.45$

Any value within these limits would round to 6.4 to 1dp

STATISTICS...

Graphing Data

What do I need to be able to do?

- Pictograms
- Bar charts
- Dual bar charts
- Composite bar charts
- Coordinates in the first quadrant
- Scatter graphs
- Correlation
- Lines of best fit
- Time series graphs
- Non-linear relationships

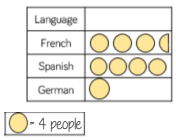
Keywords

Tier 2:

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)
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.
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
Quadrant: four quarters of the coordinate plane
Coordinate: a set of values that show an exact position

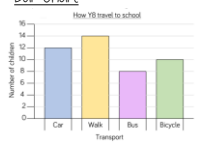
Pictograms, bar and line charts

Pictogram



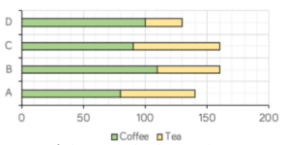
- Need to remember a key
- Visually able to identify mode

Bar Chart



- Gaps between the bars
- Clearly labelled axes
- Scale for the axes
- Title for the bar chart
- Discrete Data

Composite bar charts



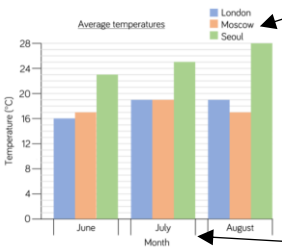
Categories clearly indicated

Compare the bars green compared to yellow.
The size of each bar is the frequency
Overall total easily comparable

Dual Bar chart

Compares multiple groups of data

- Clearly labelled axes
- Scale for axes
- Comparable data bars drawn next to each other



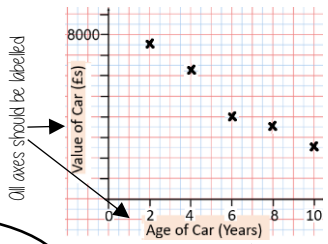
Key/ Colour code for separate groups of information

Gap between different categories of data

Draw and interpret 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

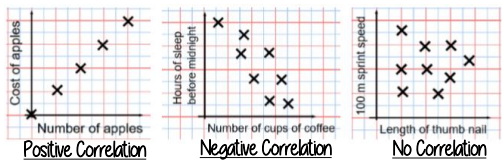


"This scatter graph show as the age of a car increases the value decreases"

The link between the data can be explained verbally

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

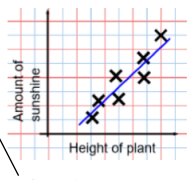
No Correlation
There is no relationship between the two variables

The line of best fit

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

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



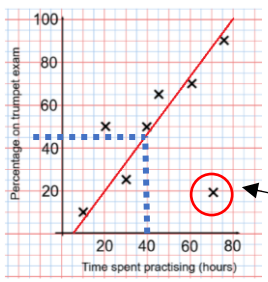
It is only an estimate because the line is designed to be an average representation of the data

It is always a **straight line.**

Using a line of best fit

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

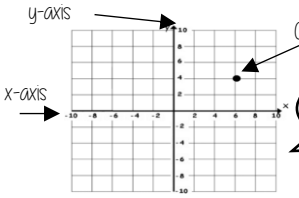
e.g. 4.0 hours revising predicts a percentage of 45.



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

Coordinates in four quadrants



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

(x, y)

Always the position on the x axis first

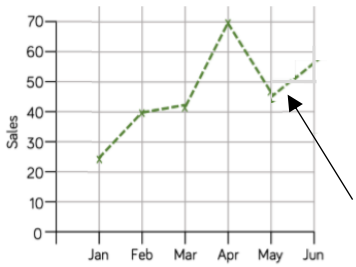
Always the position on the y axis second

(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)

Time-Series

This time-series graph shows the total number of car sales in £1000 over time



Look for general trends in the data. Some data shows a clear increase or a clear decrease over time.

Readings in-between points are estimates (on the dotted lines). You can use them to make assumptions.

NUMBER... Fractions, decimals & percentages

What do I need to be able to do?

- Represent tenths and hundredths
- Number lines with fractions and decimals
- Tenths, hundredths, fifths and quarters
- Eighths and thousandths
- Understand percentages
- Convert simple fractions, decimals and percentages
- Fractions as diagrams
- Fractions on a number line
- Equivalent fractions
- Fractions as division
- Convert fractions, decimals and percentages
- Fractions, decimals and percentages greater than 1 (E)

Keywords

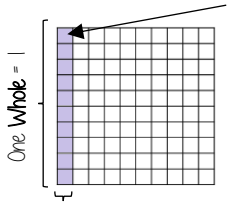
Tier 2:

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
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

Tier 3:

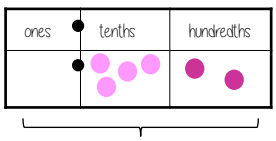
Place value: the numerical value that a digit has decided by its position in the number

Tenths and hundredths



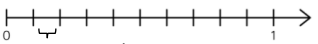
One **hundredth** (one whole split into 100 equal parts) = $\frac{1}{100}$ = 0.01

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



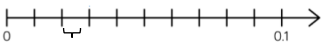
0 ones, 5 tenth and 2 hundredths
0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.001 + 0.001
= 0 + 0.5 + 0.02
= 0.52

On a number line



One whole – split into 10 equal parts

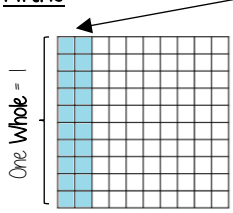
One tenth = $\frac{1}{10}$ = 0.1

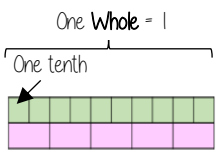


One tenth – split into 10 equal parts

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

Fifths

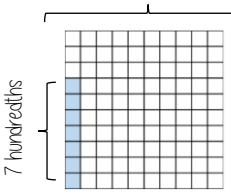


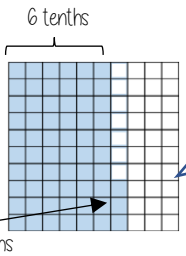


One **fifth** (one whole split into 5 equal parts) = $\frac{1}{5}$ = 0.2

Percentages on a hundred grid

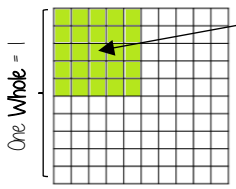
100% = a whole = 100 hundredths

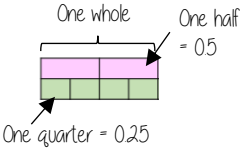




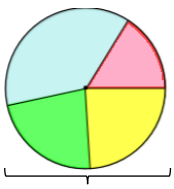
Quarters

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





Simple pie charts



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

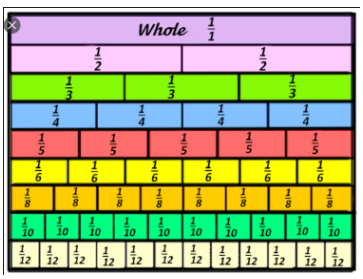
Split into 10 parts = 10% = 36°

Split into 2 parts = 50% = 180°

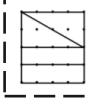
Split into 5 parts = 20% = 72°

Equivalent fractions

Represent equivalence with fraction walls

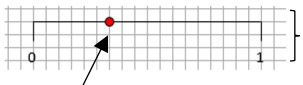


Fractions – on a diagram



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

Fractions – on a number line



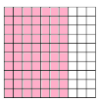
This point is at the 6th part
6 is the **numerator**

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

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

Convert FDP

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



→ 70 hundredths = 70%

Using a **calculator**

→ 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 = $0.\dot{3}$
The dot above the 3

NUMBER...

Directed Number

What do I need to be able to do?

- Directed number and number lines
- Compare and order directed numbers
- Calculations that cross zero
- Directed number and zero pairs
- Add directed numbers
- Subtract directed numbers
- Multiply and divide directed numbers
- Order of operations with directed numbers
- Use a calculator with directed numbers

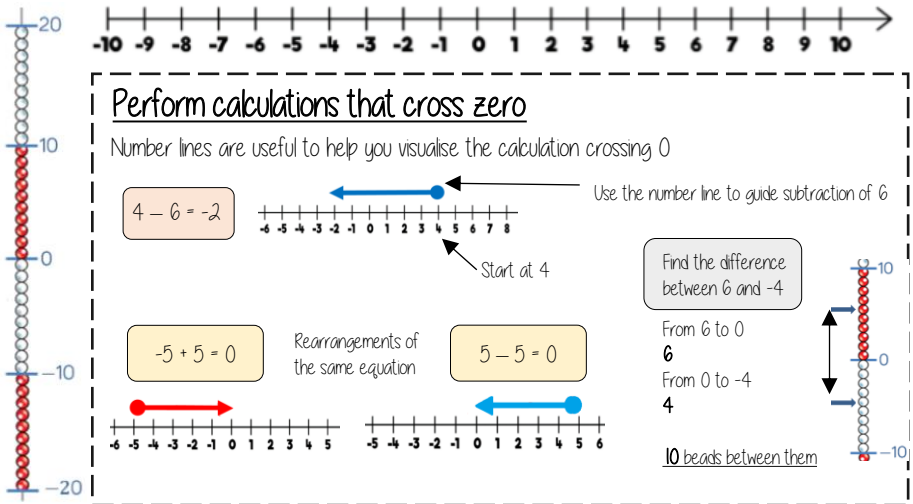
Keywords

Tier 2:

Subtract: taking away one number from another.
Negative: a value less than zero.
Product: multiply terms
Inverse: the opposite function
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)

Tier 3:

Commutative: changing the order of the operations does not change the result
Square root: a square root of a number is a number when multiplied by itself gives the value (symbol $\sqrt{}$)



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

Find the difference between 6 and -4

From 6 to 0
6
From 0 to -4
4

10 beads between them

-5 + 5 = 0

Rearrangements of the same equation

5 – 5 = 0

Add directed numbers

= −1
= 1
Representations

2 + - 4 = -2

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

=

Representation for calculation

2

"Subtract" – means take away or remove

2 - - 1 = 3

Take away one

Start with the representation of 2

= 3

2 - - 3 = 5

= 5

Generalisation
– – = +

Multiply/ Divide directed numbers

-3 -3

Two representations of the same calculation

2 x -3 = -6

Negative, Negative calculation

-2 x -3

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

Compare and order directed numbers

Write these numbers in order of size. Start with the smallest number.

9, -5, 1, -10 12

When ordering from smallest to largest (ascending), the negative number furthest from zero is the smallest.
When ordering from largest to smallest (descending), the negative number closest to zero is the largest.

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

-10 -5 1 9 12

Value becomes more negative → Value becomes more positive

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

NUMBER..Fractions & percentages of amounts

What do I need to be able to do?

- Fraction of an amount
- Use a fraction to find the whole
- Percentage of an amount (non-calculator)
- Percentage of an amount (calculator)
- Percentage increase and decrease
- Use a percentage to find the whole (E)
- Solve problems with fractions and percentages greater than 1 (E)

Keywords

Tier 2:

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)

Convert: change into an equivalent representation, often fraction to decimal to a percentage cycle

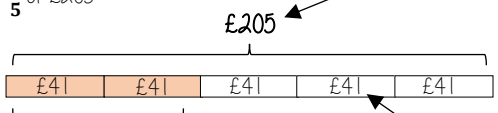
Tier 3:

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

Fraction of a given amount

Find $\frac{2}{5}$ of £205

The bar represents the whole amount

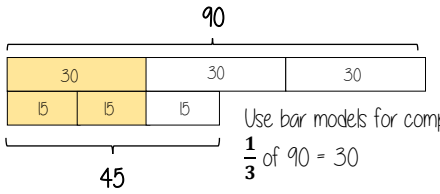


2 out of the 5 equal parts

2 x £41 = **£82**

£205 ÷ 5 = £41

Each part of the bar model represents £41



Use bar models for comparisons

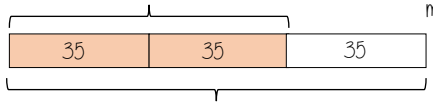
$\frac{1}{3}$ of 90 = 30

$\frac{2}{3}$ 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

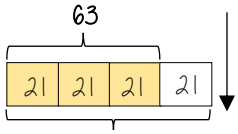
Each part of the bar model represents 35.

35 x 3 = 105

The whole number is 105

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

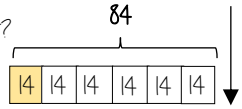
$\frac{3}{4}$ of a number is 63.



Find the whole

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

= 14

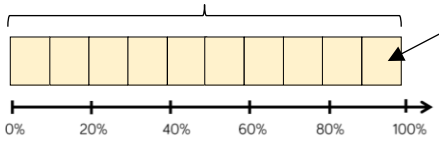


Use the whole to find a given part

Find the percentage of an amount (Mental methods)

The **whole** represents 100⁄

10⁄ = $\frac{1}{10}$ of the whole



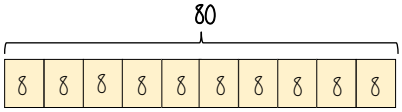
10⁄ = $\frac{1}{10}$ of the whole

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

GEOMETRY...

Perimeter & Area

What do I need to be able to do?

- Convert metric units of length
- 2 Perimeter of a polygon
- Perimeter of a compound shape
- Area of rectangles and parallelograms
- Area of a triangle
- Area of a trapezium
- Solve problems with perimeter and area
- Form expressions with perimeter and area (E)

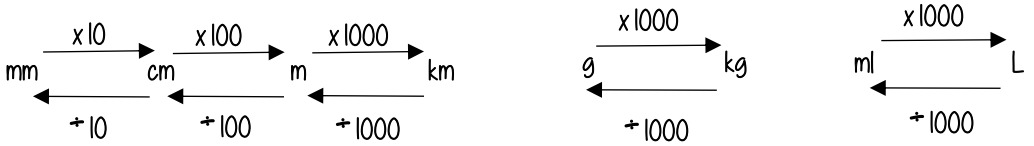
Keywords

Tier 2:

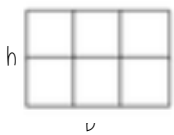
- **Milli:** prefix meaning one thousandth
- **Centi:** prefix meaning one hundredth
- **Kilo:** prefix meaning multiply by 1000
- **Congruent:** The same
- **Area:** Space inside a 2D object
- **Perimeter:** Length around the outside of a 2D object
- **Perpendicular:** At an angle of 90° to a given surface
- **Formula:** A mathematical relationship/ rule given in symbols. E.g. b x h = area of rectangle/ square

Metric conversions

Useful Conversions

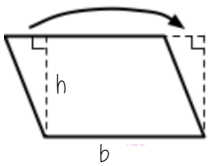


Area – rectangles, triangles, parallelograms



Rectangle

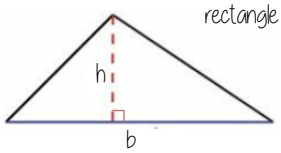
Base x Height



Parallelogram/ Rhombus

Base x Perpendicular height

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



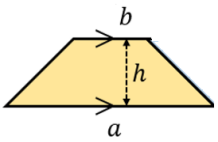
Triangle

½ x Base x Perpendicular height

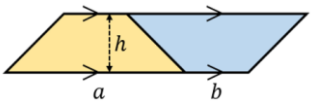
Area of a trapezium

Area of a trapezium

$$\frac{(a+b)\times h}{2}$$



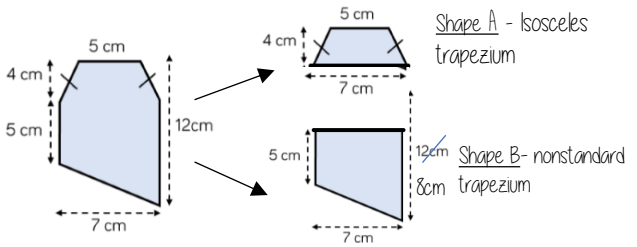
Why?



- 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.



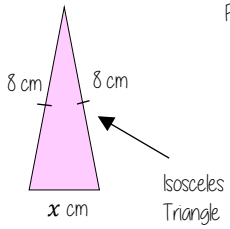
Shape A + Shape B = total area

$$\frac{(5+7)\times 4}{2} + \frac{(5+8)\times 7}{2} = 24 + 45.5 = 69.5\text{cm}^2$$

Units

Solve problems with perimeter

Perimeter is the length around the outside of a polygon



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

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

16cm + $x$cm = 25cm

$x$cm = 9cm

Forming expressions

More than – ADD

Less than/ difference – SUBTRACT

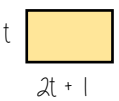
e.g. 4 more than t → t + 4

8 less than k → k - 8

Form expressions with perimeter and area

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

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

NUMBER...

Speed, distance & time

What do I need to be able to do?

- Convert between milliseconds, seconds, minutes and hour
- Convert between hours, days and year
- Fractions of time
- Solve problems with tables and timetables
- Solve problems with time and the calendar
- Calculate speed
- Calculate time and distance
- Solve problems with speed, distance and time
- Interpret distance-time graphs
- Draw distance-time graphs
- Calculate speed from a distance-time graph (E)

Keywords

Tier 2:

Length: the distance from one point to another
Convert: change a value or expression from one value to another
Mass: a measure of how much matter is in an object. Commonly measured by weight.
Origin: the coordinate (0, 0)
Volume: the amount of 3D space a shape takes up
Substitute: putting numbers where letters are – replacing numbers into a formula
Compound Units: units which require two types of measurement

Time

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
52 weeks = 1 year

Convert 3.4 days to hours

1 day = 24 hours, so

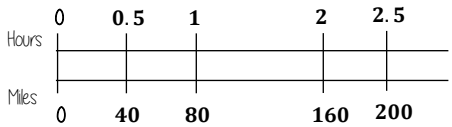
3.4 days is 3.4 x 24
= 81.6 hours

Speed, Distance, Time

"per" for every
e.g. 80 miles per hour (mph)
Travel 80 miles every hour

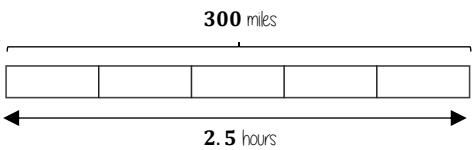
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

You can use a double number line to help you calculate distance



e.g. A boat travels at a constant speed for 2.5 hours
It travels 300 miles.

Bar models can help to calculate mph



Each part is half an hour
Each part is 60 miles

Tables and timetables

Distance tables

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

	London	
211	Cardiff	
556	493	Glasgow
518	392	177

Belfast

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

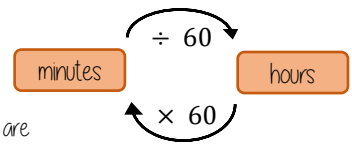
TIME CALCUOLTIONS – use a number line

Two-way tables

	H	T
H	HH	HT
T	TH	TT

Where rows and columns intersect is the outcome of that action

Speed, Distance, Time



Before calculations – make sure you are working in the same units as the speed

Learn or learn how to rearrange the formular for speed, distance and time

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

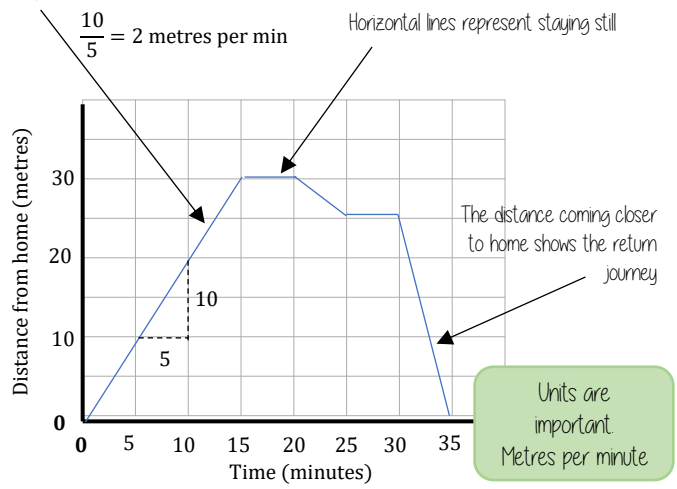
Substitute in the variables given

$$\text{distance} = \text{speed} \times \text{time}$$

Distance – Time graphs

The steeper a gradient the faster the speed

Gradient = speed



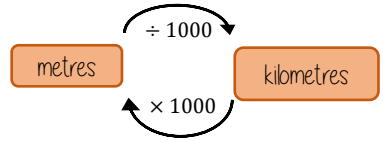
Units are important
Metres per minute

Rates of change & units

Common rates of change relationships

Revisit your conversions between units of length and capacity

Speed: miles **per** hour
Exchange rates: euros **per** pounds



NUMBER... Properties of number

What do I need to be able to do?

- Multiples
- Factors
- Prime numbers
- Write a number as a product of prime factors
- Square, cube and triangular numbers
- Square roots and cube roots
- Explore higher powers and roots (E)
- Highest common factor (HCF)
- Lowest common multiple (LCM)
- HCF and LCM from a Venn diagram (E)
- Use factors to simplify calculations (E)

Keywords

Tier 2:

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)

Tier 3:

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

Factors of 10: 1, 2, 5, 10

10 x 1 or 1 x 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 of 18 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

Comparing fractions

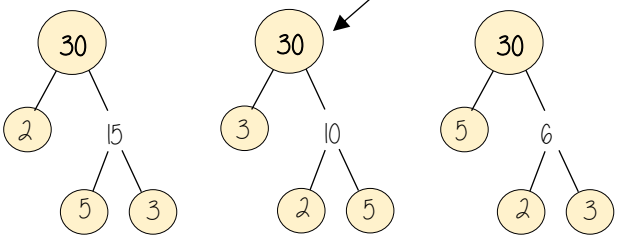
$\frac{3}{5}$ and $\frac{7}{10}$

Compare fractions using a LCM denominator

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

Product of prime factors

Multiplication part-whole models



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

Higher powers and roots

x^n

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

$\sqrt{810000}$

$= \sqrt{81} \times \sqrt{10000}$

$= 9 \times 100$

$= 900$

NUMBER...

Add and subtract fractions

What do I need to be able to do?

- Simplify a fraction
- Convert between mixed numbers and improper fractions
- Add and subtract fractions with the same denominator
- Add and subtract with fractions and integers
- Add and subtract fractions where denominators share a simple common multiple
- Add and subtract fractions with any denominator
- Add and subtract improper fractions and mixed numbers
- Use equivalence to add and subtract decimals and fractions (E)
- Add and subtract simple algebraic fractions (E)
- Substitution and solving equations with fractions (E)

Keywords

Tier 2:

Equivalent: of equal value

Substitute: replace a variable with a numerical value

Tier 3:

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

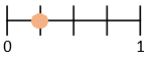
Mixed numbers: a number with an integer and a proper fraction

Improper fractions: a fraction with a bigger numerator than denominator

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

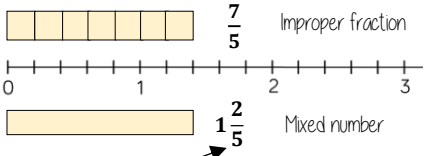
Representing Fractions

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



$1 \div 4$

Mixed numbers and fractions



In this model 5 parts make up a whole

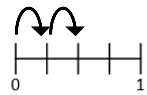
Fractions can be bigger than a whole

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

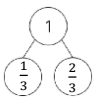
Add/Subtract fractions

Same denominator

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

Sequences

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



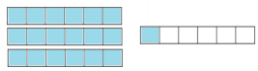
$+\frac{2}{3}$ $+\frac{2}{3}$

Represent this on a number line to help

Add/Subtract from integers

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

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

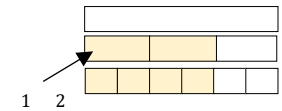


The denominator indicates the number of parts a whole is made up of

Equivalent fractions

Numerator and denominator have the same multiplier

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



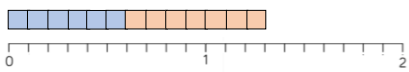
$\frac{1}{3} = \frac{2}{6}$

Add/Subtraction fractions (common multiples)

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

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

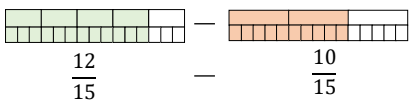
Addition/Subtraction needs a common denominator



$\frac{13}{10}$

Add/Subtraction any fractions

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



$= \frac{2}{15}$

$\frac{12}{15} - \frac{10}{15}$

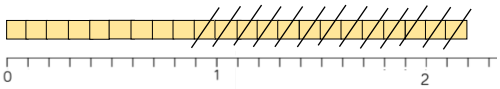
Use equivalent fractions to find a common multiple for both denominators

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

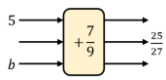
$2\frac{1}{5} - 1\frac{3}{10} = 2\frac{2}{10} - 1\frac{3}{10} = 2\frac{2}{10} - 1 - \frac{3}{10} = 1\frac{2}{10} - \frac{3}{10} = \frac{9}{10}$

Fractions in algebraic contexts

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

Apply inverse operations

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



Form expressions with fractions

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

$p = 5 \quad m = 2$

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

Substitution

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

Fractions and decimals

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

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

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

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

Remember to use equivalent fractions and common denominators

GEOMETRY...

Angles and polygons

What do I need to be able to do?

- Draw and measure lines and angles
- Understand and use geometric notation
- Angles around a point
- Angles on a straight line
- Vertically opposite angles
- Recognise and name polygons
- Angles in a triangle
- Angles in a quadrilateral
- Solve problems with angles
- Parallel and perpendicular lines
- Angles in parallel lines (E)
- Angles in a polygon (E)
- Simple proofs (E)

Keywords

Tier 2:

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

Right-angled triangle: a triangle with a right angle

Protractor: equipment used to measure angles

Compass: equipment used to draw arcs and circles

Tier 3:

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°

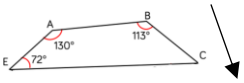
Polygon: A 2D shape made with straight lines

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

Letter and labelling convention

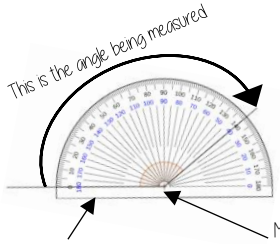
The letter in the middle is the angle
The arc represents the angle



Angle Notation: three letters **ABC**
This is the angle at B = 113 °

Line Notation: two letters **EC**
The line that joins E to C

Measure angles to 180°

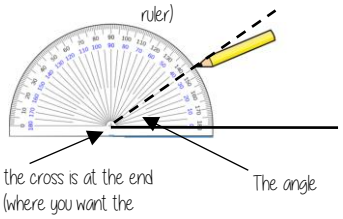


Read from 0° on the base line
Remember to use estimation
This is an obtuse angle so between 90 ° and 180 °

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)



Classify angles

Acute Angles
0°< angle <90°

Right Angles
90°

Right angle notation

Obtuse
90°< angle <180°

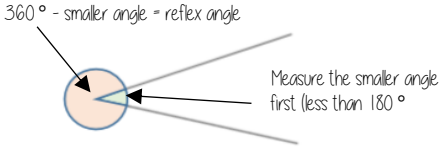
Reflex
180°< angle <360°

Straight Line
180°

Angles over 180°

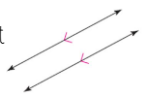
Use your knowledge of straight lines 180 ° and angles around a point 360 °

360 ° - smaller angle = reflex angle

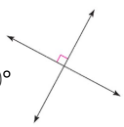


Parallel and Perpendicular lines

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



Perpendicular lines
Straight lines that meet at 90°



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

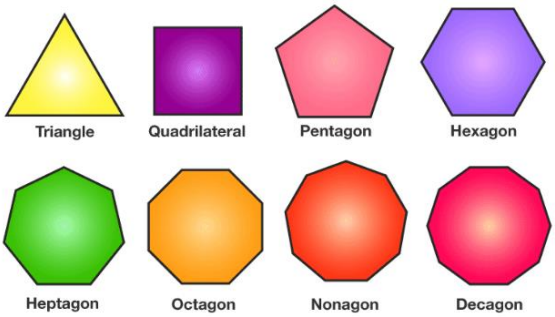
Trapezium
One pair of parallel lines

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

Polygons

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

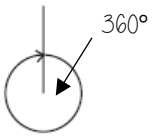


If all the sides and angles are the same, it is a **regular** polygon

GEOMETRY... Angles and polygons

Sum of angles at a point

The sum of angles around a point is 360°



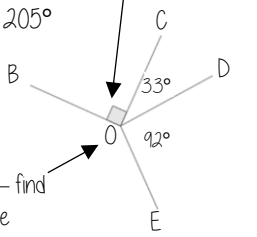
Find angle BOE

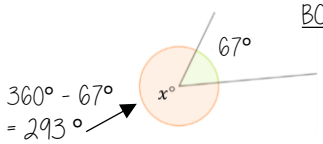
90° + 33° + 92° = 205°

360° - 205°

BOE = **155°**

Angle notation – 90°



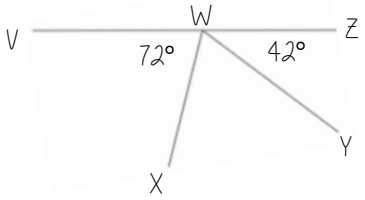


360° - 67°
= 293 °

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°

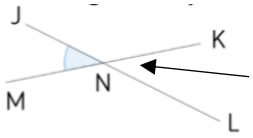


Find angle XWY

72° + 42° = 114°

180° - 114° = **66°**

Vertically opposite angles

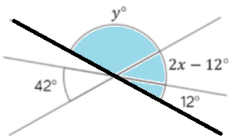


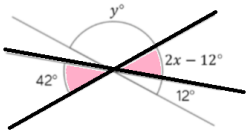
Angle JNM is vertically opposite to angle KNL

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:

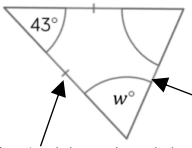
$2x - 12 = 42$

$2x = 54$

$x = 27°$

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°

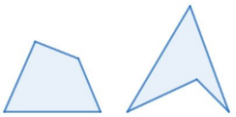
A triangle can only have ONE right angle

Have a go!

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

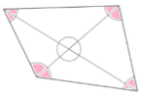
Sum of angles in quadrilaterals

Sum of interior angles in a quadrilateral = 360°

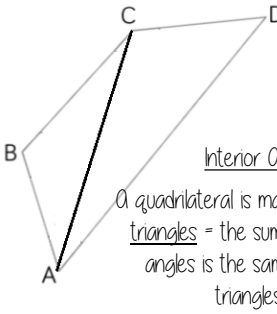


Convex Quadrilateral

Concave Quadrilateral



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



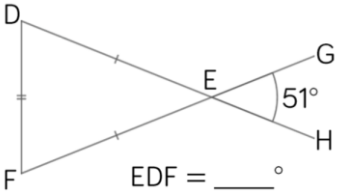
Interior Angles

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



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°

Keep working out clear and notes together