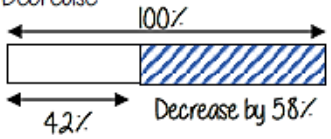
Year 9 Maths – Term 1

Percentage

Percentage Increase/ Decrease (R)

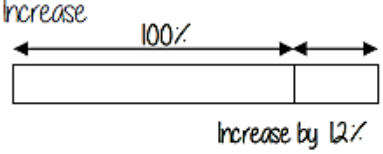
Decrease



Multiplier: Less than 1

100 – 058 = 042

Increase



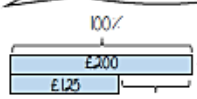
Multiplier: More than 1

100% + 12% = 112%

100 + 0.12 = 1.12

Percentage change (R)

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



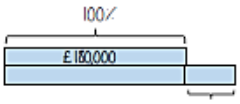
All values of change compare to the ORIGINAL value

Percentage loss

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

$$\frac{\text{Difference in values}}{\text{Original value}} \times 100$$

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



Percentage profit

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

Reverse Percentages

40% of my number is 16. What am I thinking of?

Original Number (100%)

40% = 16

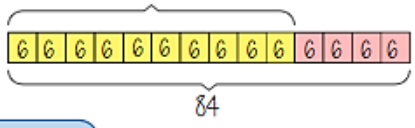
10% = 4

100% = 40

Try to scale down to 10% or 1% and then scale back up to 100%

140% of my number is 84. What is the original number?

Original Number (100%)



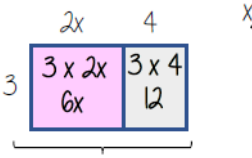
140% = 84

10% = 6

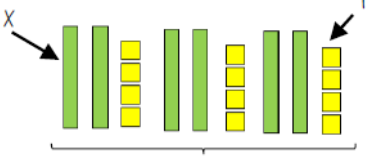
100% = 60

Algebra

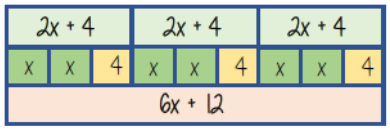
Multiply single brackets $3(2x + 4)$



$6x + 12$



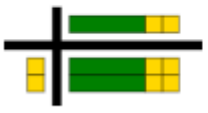
$6x + 12$



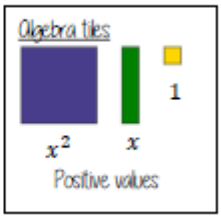
Different representations of $3(2x+4) = 6x + 12$

Expanding binomials

$2(x + 2) \equiv 2x + 4$



Algebra tiles can represent a binomial expansion. Has two terms



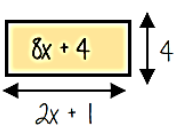
$(x + 3)(x + 3) \equiv x^2 + 6x + 9$

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. $(x + 3)(3 + x)$

Factorise into a single bracket $8x + 4$



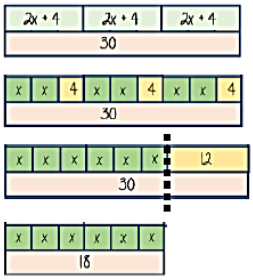
Try and make this the highest common factor

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

$8x + 4 \equiv 4(2x + 1)$

Note:
$8x + 4 \equiv 2(4x + 2)$
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

$6x + 12 = 30$

$-12 \quad -12$

$6x = 18$

$-6 \quad -6$

$x = 3$

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

Geometry

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

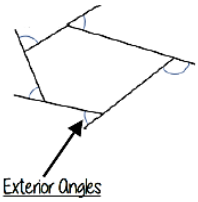
Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

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

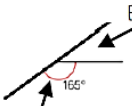
Sum of exterior angles

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



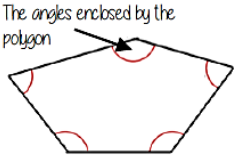
Interior angle + Exterior angle = straight line = 180°
Exterior angle = 180 – 165 = 15°

Number of sides = 360° ÷ exterior angle
Number of sides = 360 ÷ 15 = 24 sides

Sum of interior angles

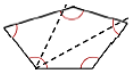
(number of sides – 2) x 180

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

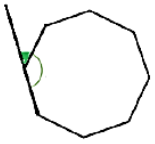


This shape can be made from three triangles
Each triangle has 180°

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 = $\frac{(\text{number of sides} - 2) \times 180}{\text{number of sides}}$

Representing data

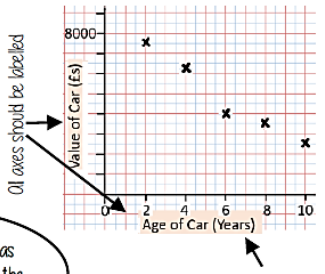
Draw and interpret a scatter graph

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

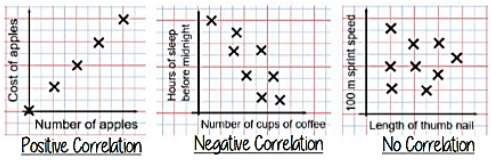
"This scatter graph show as the age of a car increases the value decreases"

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

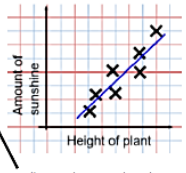
Negative Correlation
As one variable increases the other variable decreases

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



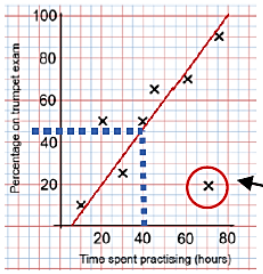
It is only an estimate because the line is designed to be an average representation of the data

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. 40 hours revising predicts a percentage of 45

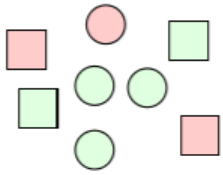


Extrapolation is where we use our line of best fit to predict information outside of our data
This is not always useful – in this example you cannot score more that 100%. So revising for longer can not be estimated

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

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

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 based 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

Cumulative Frequency graphs

A cumulative frequency table shows a running total of the frequencies. A cumulative frequency diagram or graph, is drawn by **plotting** the **cumulative frequency** against the **upper boundary** of the class interval and then joined together.

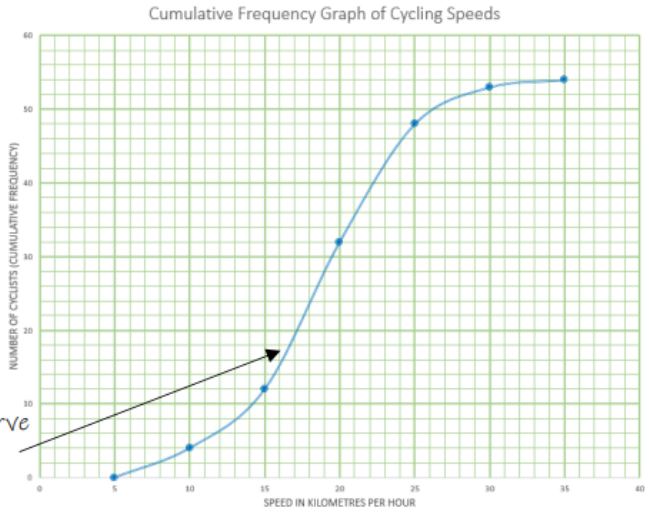
e.g. Plot a cumulative frequency diagram of the following data

Speed of cyclists	Frequency	Cumulative frequency
$5 \leq t < 10$	4	4
$10 \leq t < 15$	8	4 + 8 = 12
$15 \leq t < 20$	20	12 + 20 = 32
$20 \leq t < 25$	16	32 + 16 = 48
$25 \leq t < 30$	5	48 + 5 = 53
$30 \leq t < 35$	1	53 + 1 = 54

Start by calculating the cumulative frequency

Plot the upper bound of the groups against cumulative frequency so (10, 4), (15, 12) and so on.

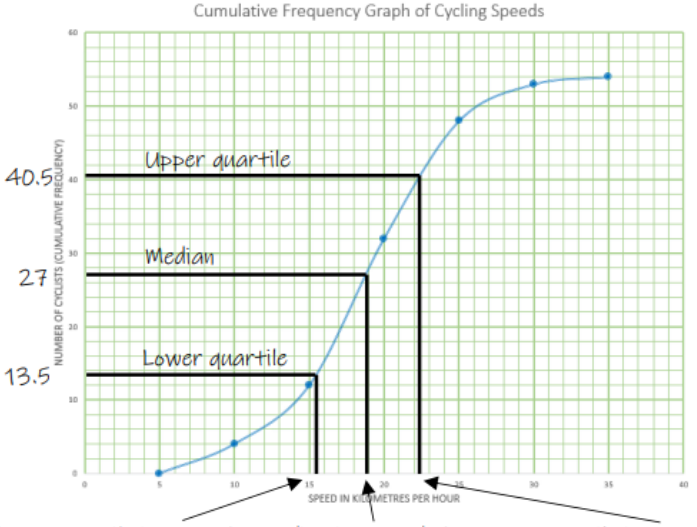
Join as a smooth curve or as straight lines between each point



A cumulative frequency graph can be used to estimate the lower quartile, median and upper quartile of grouped data.

Find one quarter of the total cumulative frequency, (in this case 54 ÷ 4 = 13.5), one half of the total cumulative frequency (54 ÷ 2 = 27) and three quarters of the total cumulative frequency (13.5 x 3 = 40.5).

Draw a line across from each of these points until they hit the curve, then go down to the horizontal scale and read off.



The lower quartile is 15.5, the median is 19 and the upper quartile is 24.5