1) **Double** means multiply by 2. **Halve** means divide by 2. | 5 |

To **estimate** an answer you first need to round all the numbers.

To find the **difference** between two numbers, subtract the lower number from the higher one.

When you multiply **two negative** numbers you get a **positive** number.

When you multiply **one positive** number and **one negative** number you get a **negative** number.

2) The symbol ² means 'square' or multiply a number by itself.

The symbol √ means square root.
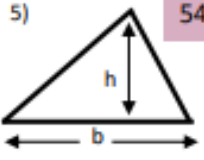
$1^2 = 1$ $7^2 = 49$ $\sqrt{144} = 12$

$2^2 = 4$ $8^2 = 64$ $\sqrt{100} = 10$

$3^2 = 9$ $9^2 = 81$ $\sqrt{49} = 7$

$4^2 = 16$ $10^2 = 100$ $\sqrt{36} = 6$

$5^2 = 25$ $11^2 = 121$ $\sqrt{4} = 2$

$6^2 = 36$ $12^2 = 144$ $\sqrt{1} = 1$

3) The symbol ³ means 'cube' or multiply a number by itself and by itself again.

The symbol ³√ means cube root.

$1^3 = 1$ $\sqrt[3]{1} = 1$

$2^3 = 8$ $\sqrt[3]{8} = 2$

$3^3 = 27$ $\sqrt[3]{27} = 3$

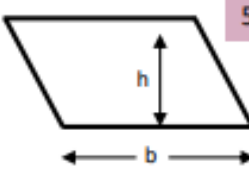$4^3 = 64$ $\sqrt[3]{64} = 4$

$5^3 = 125$ $\sqrt[3]{125} = 5$ | 29 |
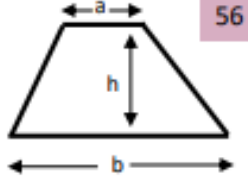
4) The **highest common factor (HCF)** of two numbers is the largest number that is a factor of both numbers. | 79 |

The **lowest common multiple (LCM)** of two numbers is the smallest number that is multiple of both numbers.

All numbers can be written as a product of primes. This is called **prime factor decomposition**. | 80 |

Use prime factor decomposition to find the HCF or LCM of a set of numbers.

Index notation collects factors together and writes them as a power, e.g $2\times2\times2\times2\times2 = 2^5$. index notation saves space. | 131 |

5) | 54 |

Area of a triangle

$= \dfrac{1}{2}$ bh

$= \dfrac{1}{2}$ x base x height

| 55 |

Area of a parallelogram

= bh

= base x perpendicular height

| 56 |

Area of a trapezium

$= \dfrac{1}{2}$ (a+b)h

$= \dfrac{1}{2}$ x (a + b) x h

6) The **volume** of a shape is the amount of 3D space it takes up. | 115 |

Volume is measured in cubic units e.g. mm^3, cm^3, m^3.

Volume of a cube = l^3 = length of a side cubed

Volume of a cuboid = lwh = l x w x h = length x width x height

A **net** is a 2D shape that folds to make a 3D shape.

The **plan** is the view from above a shape.

The **front elevation** is the view from the front of a shape.

The **side elevation** is the view from the side of a shape. | 51 |

7) 1cm = 10mm

1m = 100cm

1km = 1000m

1l = 1000ml

1kg = 1000g

1t = 1000kg

$1cm^2 = 100mm^2$

$1m^2 = 10000cm^2$

1 hectare = $10000m^2$

$1ml = 1cm^3$

$1l = 1000cm^3$

MathsWatch clip 112

Metric and Imperial conversions

30cm = 1 foot

1.6km = 1 mile

1kg = 2.2 pounds (lb)

1l = 1.75 pints

4.5l = 1 gallon

Pie Chart

427

Year 8 languages

- Divided into sections called sectors, each sector represents a fraction of the data.

- Label each of the sectors with the angle and what it represents.

Frequency tables

62

Number of books	Frequency
1	7
2	10
3	8
4	6
5	1

- Frequency tables present large amounts of data in a condensed form.

- We use grouped frequency tables to represent continuous data.

Length, l (cm)	Frequency
$0 \leq l < 2$	
$2 \leq l < 4$	
$4 \leq l < 6$	
$6 \leq l < 8$	

- These groups are called classes.

- $0 \leq l < 2$ means that any data less than 2cm but more than or equal to 0cm is recorded in that class.

Stem and leaf diagrams

430

6 is recorded as 06

The key shows us how to read the diagram

KEY: 2 | 5 means 25

Stem

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

Leaves

This number is 39

- To calculate the median we look for the $\frac{n+1}{2}$ th value.

- The stems can contain either single digits or two depending upon the data being represented.

Extreme value: a value much bigger or smaller than the other values
Discrete data: data that can only take particular values e.g. shoe size
Continuous data: can be measured and can take any value e.g. mass
Frequency: the number of times a value occurs
Range: The smaller the range the more consistent the data

Scatter Graphs - there are three types of correlation

453

positive   negative   No correlation

Index notation means to write a product as its powers. For example:

158

$3 \times 3 = 3^2$ or $p \times p \times p = p^3$

base → b^2 ← power

Laws of indices:

- When multiplying we add the powers. For example, $a^2 \times a^3 = a^5$

- When dividing we subtract the powers. For example, $b^7 \div b^4 = b^3$

These rules only apply when the base is the same.

Algebraic manipulation:

- $c \times d = cd$

- $3m \times 2n = 6mn$

- $w^2 + w^2 + w^2 = 3w^2$

- $b^2 \times b^2 \times b^2 = b^6$

Expanding brackets:
Expanding means to remove brackets from an expression. We multiply each term inside the bracket by the term outside the bracket.
Factorising:
Factorising means to put an expression back into brackets. To do this we take out the common factors of each term.
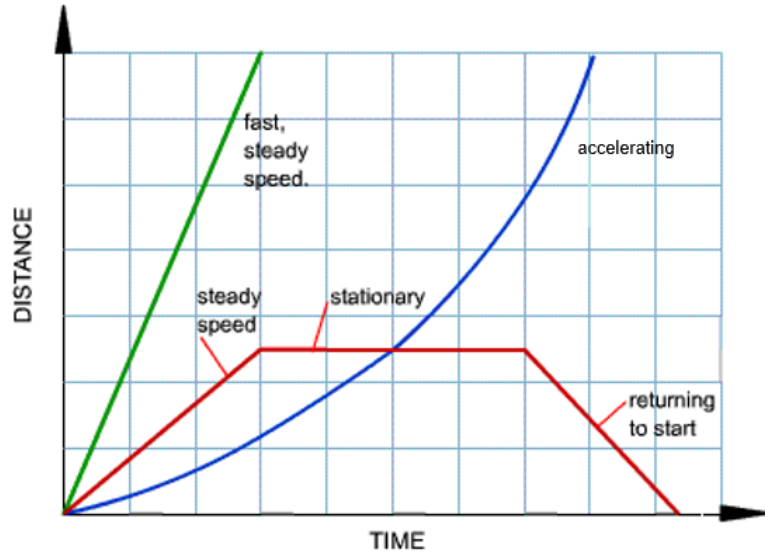
Expand

$2(x + 5) = 2x + 10$

160/168

Factorise

1) Distance-time graphs

fast, steady speed.

accelerating

DISTANCE

steady speed

stationary

returning to start

TIME

2) Rates of change

These rates of change graphs show the time taken against the depth for each of the following vases when they are filled with water.

Depth of water — Time

Depth of water — Time

Depth of water — Time

A **rate of change** graph shows how a quantity changes over time.
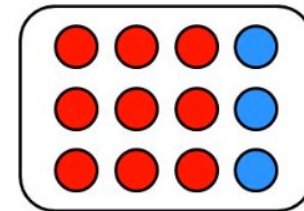
3) Types of graphs

712

Linear graph	A straight line graph
Non-linear graphs	Are not straight line graphs
Line graphs	Are used to see how quantities are changed over time
Distance-time graphs	Represent a journey. The vertical axis represents the distance from a starting point and the horizontal axis represents the time taken

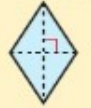## 5) Rounding

6 3 1 . 4 5 9

Hundreds Tens Units Tenths Hundredths Thousandths

Ascending	Order from smallest to largest
Descending	Order from largest to smallest
>	Greater than
<	Less than

When rounding, if it ends in 5 or more round up to the next number

1.2   1.25   1.3

56/17
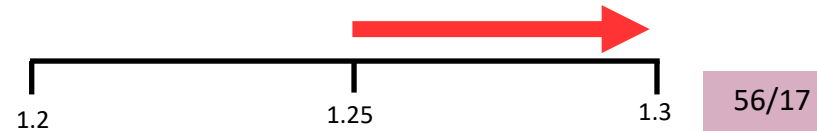
6) Multiplying and dividing decimals

48&50

Multiplying by 0.1 is the same as **dividing by 10**

Multiplying by 0.01 is the same as **dividing by 100**

Dividing by 0.1 is the same as **multiplying by 10**

Dividing by 0.01 is the same as **multiplying by 100**

7) Ratios

329

What is the ratio of red counters to blue counters?

red : blue

= 9 : 3

÷3   ÷3

= 3 : 1

For every three red counters there is one blue counter.

1)

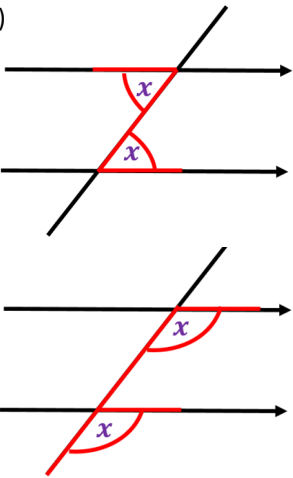| Square	• all sides are equal in length • opposite sides are parallel • all angles are 90° • diagonals bisect each other at 90°	Rectangle	• opposite sides are equal in length • opposite sides are parallel • all angles are 90° • diagonals bisect each other
Rhombus	• all sides are equal in length • opposite sides are parallel • opposite angles are equal • diagonals bisect each other at 90°	Parallelogram	• opposite sides are equal in length • opposite sides are parallel • opposite angles are equal • diagonals bisect each other
Kite	• 2 pairs of sides are equal in length • no parallel sides • 1 pair of equal angles • diagonals bisect each other at 90°	Trapezium	• 1 pair of parallel sides
		Isosceles trapezium	• 2 sides are equal in length • 1 pair of parallel sides • 2 pairs of equal angles

824+

2) Geometric proof-

484

- Uses logical reasoning

- Must work for all values

- Not good enough to show it works for a few values

Solving geometric problems-

- Set up an equation

- Solve the equation

- 'in terms of' tells you which letter to use
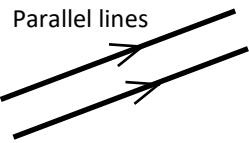
3)

481+

Alternate angles are equal.

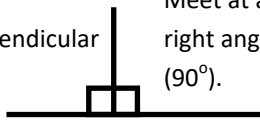Alternate angles can be identified by the Z shape.

Corresponding angles are equal.

Corresponding angles can be identified by the F shape.

Parallel lines

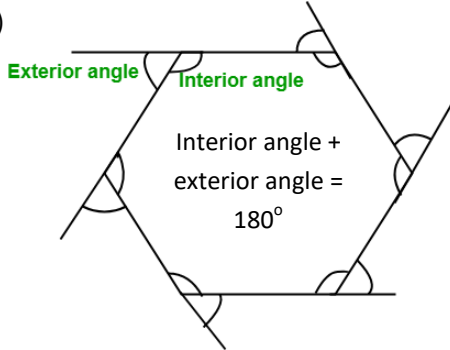Perpendicular lines — Meet at a right angle (90°).

5) Arithmetic with fractions

Multiplying - Write any mixed numbers as improper fractions. Multiply the numerators. Multiply the denominators. Cancel down.

Dividing - Write any mixed numbers as improper fractions. Invert the fraction you are dividing by and then multiply the fractions.

Adding - Find a common denominator if you don't already have one. Add the numerators. Keep the common denominator.

Subtracting - Find a common denominator if you don't already have one. Subtract the numerators. Keep the common denominator.

71+

4)

Exterior angle   Interior angle

Interior angle + exterior angle = 180°

Sometimes called internal and external angles.

In a regular polygon the sides are all the same length and the angles are all the same size.

In an irregular polygon the sides are not equal lengths and the angles are not equal.

560+

6)

Fraction line	The line in a fraction means 'divide by'. To convert a fraction to a decimal divide the numerator by the denominator.
Recurring decimal	Contains a digit or sequence of digits which repeat forever. A dot is drawn over a digit to show it recurs.
Integer	A whole number. Can be written as a fraction by putting the integer on the numerator and 1 on the denominator.
Reciprocal	The reciprocal of a fraction is the 'upside down' fraction. A number multiplied by its reciprocal is always 1.

53

71

1) When quantities are in direct proportion-

- plotting them as a graph gives a straight line through the origin.

- when one variable is zero, the other variable is zero.

- when one variable doubles, so does the other.

339

2)

| Equation of a horizontal line	All points have the same y coordinate, eg y = 3. The line is parallel to the x axis.
Equation of a vertical line	All points have the same x coordinate, eg x = -5. The line is parallel to the y axis.
Drawing graphs	Write the numbers on the axes on the grid lines, not in the middle of the squares. Plot the coordinate points then draw a line right to the edge of the grid with a ruler through the points.
Label a graph	Write the equation of the line next to the line.
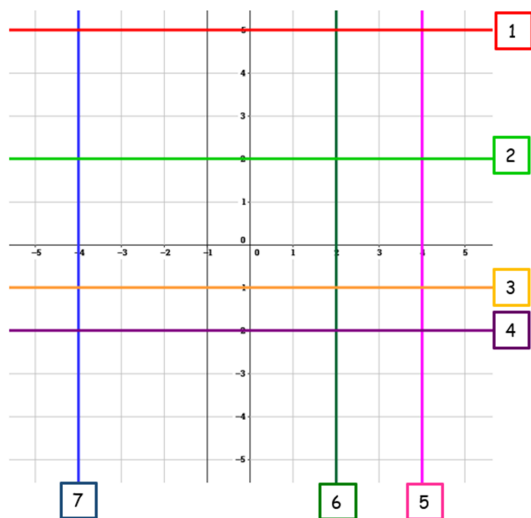
Lines 1- 4 are horizontal. They intersect with the y axis and all begin

y = ……
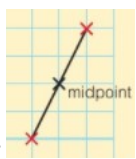
Lines 5-7 are vertical. They intersect with the x axis and all have equation

x = ……

206+

3) Coordinate axes

200

y axis is vertical

x axis is horizontal
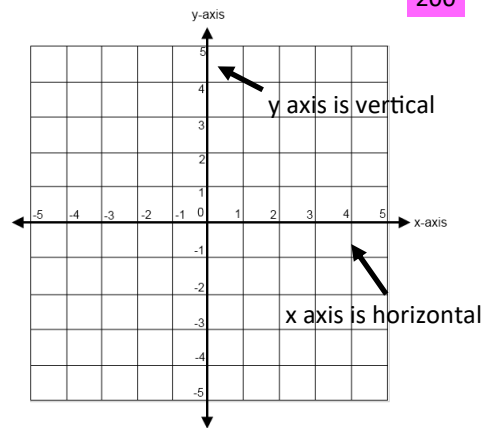
Line segment	The part of a line that connects two points.
Midpoint	The point exactly in the middle.
Finding the midpoint	$\left(\dfrac{x_1 + x_2}{2}\right), \left(\dfrac{y_1 + y_2}{2}\right)$

4)

206+

Gradient	The steepness of a line.
Calculating the gradient	Change in y ÷ Change in x
Linear equation	Generates a straight line graph
Equation of a straight line	y = mx +c
m	The gradient of the line is given by the coefficient of x
Coefficient	Number in front of the x
c	The y intercept
Intercept	Where the line intersects with the axis.

1)

Equivalent	Fractions and decimals that have the same value.
Terminating decimal	Decimal which ends after a definite number of digits, eg 1.53
Recurring decimal	Decimals where the numbers after the decimal point continue forever, eg 4.2̇3̇ = 4.232323232323...
Comparing fractions	To compare fractions, change them so they have a common denominator and then look at the numerators.

2)

Mixed number	A number with an integer part and fraction part.
Proportion of a whole	Can be written as a fraction, decimal, or percentage.

Fractions → Divide Numerator by Denominator → Decimal → Multiply by 100 → Percentage

Percentage → Divide by 100 → Decimal → Convert to Fraction → Fraction
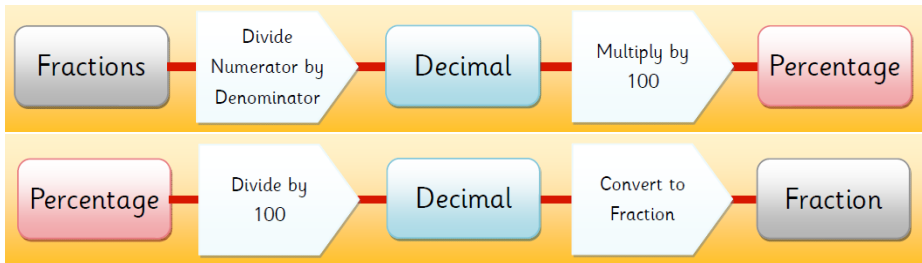
Write a number as a percentage of another	Write the numbers as a fraction of each other and then multiply by 100. **84+**
Percentage increase	Find the percentage, add it on to the original amount.
Percentage decrease	Find the percentage, subtract it from the original amount.
Reverse percentage	Finding the original amount before a percentage increase or decrease happened.

Adding fractions	Find a common denominator if you don't already have one. Add the numerators. Keep the common denominator.
Subtracting fractions	Find a common denominator if you don't already have one. Subtract the numerators. Keep the common denominator.
Multiplying fractions	Multiply the numerators and multiply the denominators.

4) Using a multiplier for percentage change. **89+**

- Add or subtract the percentage you are increasing or decreasing to/ from 100.

- Divide the result by 100 to turn it into a decimal multiplier.

Simple interest	Calculated using the original amount invested.
Compound interest	Amount recalculated every year to allow for previous years' increase.

5)

Prime number	A number that can only be divided by exactly two different numbers (the number itself, and 1).
Factor	A number which divides exactly into another number, with no remainder.
Multiple	A number in the times tables, eg multiples of 5 are 5, 10, 15, 20, 25, etc.

Highest common factor	The largest number that is a factor of both numbers.
Lowest common multiple	The smallest number that is a multiple of both numbers. **27+**

The symbol ^{2} means 'square' or multiply a number by itself.

$1^2 = 1$ $4^2 = 16$ $7^2 = 49$ $10^2 = 100$

$2^2 = 4$ $5^2 = 25$ $8^2 = 64$ $11^2 = 121$

$3^2 = 9$ $6^2 = 36$ $9^2 = 81$ $12^2 = 144$

6) **827+**

Line symmetry	A shape has line symmetry if one half folds exactly on top of the other half.
Rotational symmetry	A shape has rotational symmetry if it looks the same more than once in a turn.

Reflection	The shape is 'flipped' like in a mirror.
Rotation	Turn the shape around a point.
Translation	Moves the shape from one place to another.
Enlargement	Makes the shape bigger or smaller. **637+**

7)

Area = length x width

Area = $\dfrac{\text{base x height}}{2}$

Circumference = π x diameter