Year 8 Maths – Term 1

Numbers

Directed number (R)

Addition

2 + -4 = -2

Zero pair (-1 + 1 = 0)

Two "-1" left = -2

Generalisation: + − = −

Subtraction

= 2

Representation for calculation

"Subtract" – means take away or remove

2 - -1 = 3

Take away one

= 3

Start with the representation of 2

Multiplication

= −1
= 1

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

-2 x -3 = 6

Divisions are the inverse operations

a = 5

b = -4

Brackets around negative substitutions helps remove calculation errors

2a – b = 2 x 5 – (-4) = 10 + 4 = 14

HCF/LCM (R)

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

HCF = 6

LCM – Lowest common multiple

LCM of 9 and 12

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

12: 12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

Percentage

Percentage Increase/ Decrease (R)

Decrease

100%

42%

Decrease by 58%

100 – 058 = 042

Multiplier Less than 1

Increase

100%

Increase by 12%

100% + 12% = 112%

100 + 0.12 = 1.12

Multiplier More than 1

Reverse Percentages

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

Original Number (100%)

4 4 4 4 4 4 4 4 4 4

16

40% = 16

10% = 4

100% = 40

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

Original Number (100%)

6 6 6 6 6 6 6 6 6 6 6 6 6 6

84

140% = 84

10% = 6

100% = 60

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

Percentage change (R)

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

100%

£200

£125

All values of change compare to the ORIGINAL value

Percentage loss

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

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

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

100%

£180,000

Percentage profit

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

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

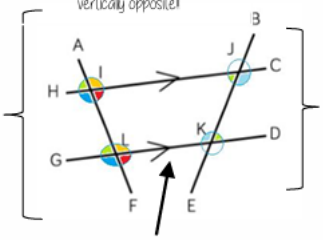
Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

Parallel lines

Still remember to look for angles on straight lines, around a point, and vertically opposite!

Lines QF and BE are **transversals** (lines that bisect the parallel lines)

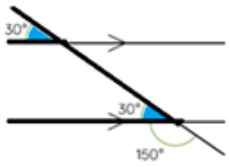
Corresponding angles often identified by their **"F shape"** in position



Alternate angles often identified by their **"Z shape"** in position

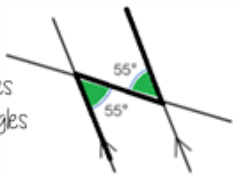
This notation identifies parallel lines

Alternate/ Corresponding angles

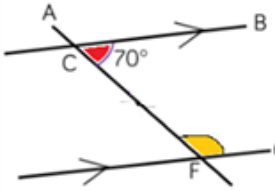


Because alternate angles are equal the highlighted angles are the same size

Because corresponding angles are equal the highlighted angles are the same size



Co-interior angles



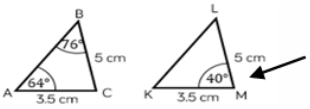
Because co-interior angles have a sum of 180° the highlighted angle is 110°

As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

Congruent figures

Congruent figures are identical in size and shape — they can be reflections or rotations of each other

Congruent shapes are identical — all corresponding sides and angles are the same size



$A\hat{C}B = K\hat{M}L$

Because all the angles are the same and AC=KM BC=LM triangles ABC and KLM are **congruent**

If P is a point on the line the steps are the same

Congruent triangles

Side-side-side
All three sides on the triangle are the same size

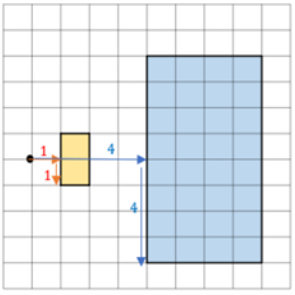
Angle-side-angle
Two angles and the side connecting them are equal in two triangles

Side-angle-side
Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

Right angle-hypotenuse-side
The triangles both have a right angle, the hypotenuse and one side are the same

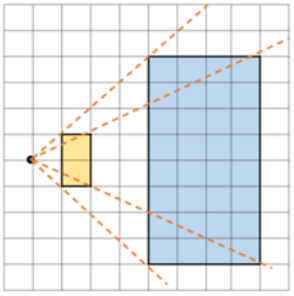
Enlarge a shape from a point

Scaled distances method



Scale the distance between the point of enlargement and each corresponding vertices

Rays method

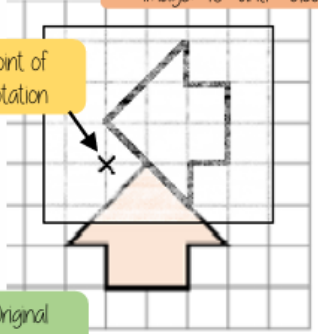


Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Rotate from a point (outside a shape)

Image: 90° anti - clockwise

Point of rotation



1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

Original shape

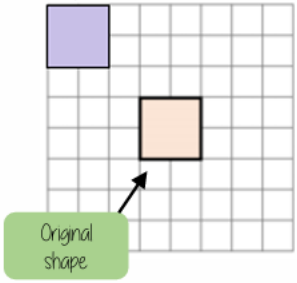
Translation and vector notation

Vector Notation → $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$

How far left or right to move
Negative value (left)
Positive value (right)

How far up or down to move
Negative value (down)
Positive value (up)

Translation $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$



Original shape

Every vertex has been translated by the same amount

Probability

Probability of a single event

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

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

There are 4 blue sectors

There are 10 sectors overall

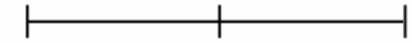
Probability notation P(event)

Probability can be a fraction, decimal or percentage value

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

Probability is always a value between 0 and 1

The probability scale

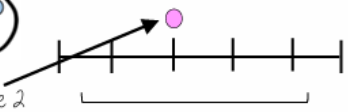


Impossible 0 or 0%

Even chance 0.5, 1/2 or 50%

Certain 1 or 100%

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



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

There are 5 possible outcomes So 5 intervals on this scale, each interval value is 1/5

Sum of probabilities

Probability is always a value between 0 and 1

The probability of getting a blue ball is 1/5

∴The probability of NOT getting a blue ball is 4/5

The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(White chocolate) = 1 − 0.15 − 0.35 = 0.5

Sequences

Linear and Non Linear Sequences

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

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

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

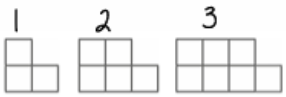
Fibonacci Sequence – look out for this type of sequence

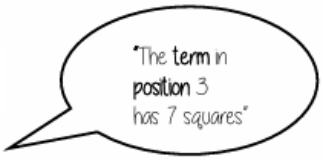
0 1 1 2 3 5 8 ...

Each term is the sum of the previous two terms

Sequence in a table and graphically

Position: the place in the sequence

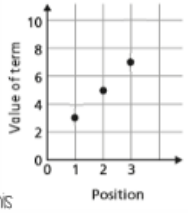




3 5 7

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

Graphically



In a table

Position	1	2	3
Term	3	5	7

+2 +2

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

Sequences from algebraic rules

This is substitution!

$3n + 7$ — This will be linear - note the single power of n. The values increase at a constant rate

$3n^2 + 7$ — This is not linear as there is a power for n

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

e.g.

1st term = 2(1) − 5 = −3

2nd term = 2(2) − 5 = −1

100th term = 2(100) − 5 = 195

Checking for a term in a sequence

Form an equation

Is 201 in the sequence 3n − 4?

$3n - 4 = 201$ ← Term to check; Algebraic rule

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

H Finding the algebraic rule

This is the 4 times table: 4n → 4, 8, 12, 16, 20....

7, 11, 15, 19, 22 ← This has the same constant difference – but is 3 more than the original sequence

4n + 3

This is the constant difference between the terms in the sequence

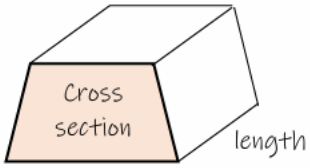
4n + 3

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

Surface area and Volume

Volume of prisms

Volume of a prism = area of cross section x length



Converting units of volume

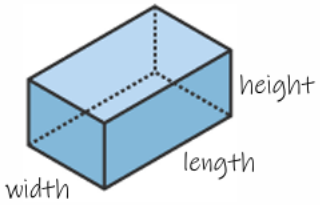
Do the length conversion 3 times, once for each dimension.

$1\ m^3 = 1m \times 1m \times 1m = 100cm \times 100cm \times 100cm = 1{,}000{,}000\ cm^3$

$1\ cm^3 = 1cm \times 1cm \times 1cm = 10mm \times 10mm \times 10mm = 1{,}000\ mm^3$

$1000\ cm^3 = 1$ litre so $1\ m^3 = 1000$ litres

Cubes/cuboids



Volume = length x width x height

Surface area:

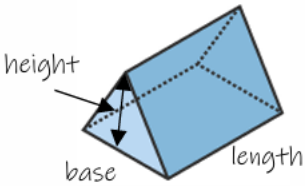
Front + back: length x height x 2 (rectangles)

Side + side = width x height x 2 (rectangles)

Top + bottom = length x width x 2 (rectangles)

Total surface area is these 3 added together.

Triangular prisms



$$\text{Volume} = \frac{\text{base} \times \text{perpendicular height}}{2} \times \text{length}$$

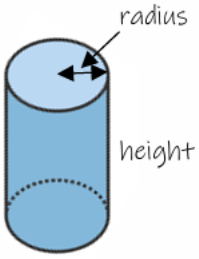
Surface area:

Area of the 2 triangles ($\frac{b \times h}{2}$ for each one)

Area of the three rectangles (note that they may all be different!)

Total surface area is all 5 faces added together.

Cylinders



Volume = π x radius squared x height

$= \pi r^2 h$

Surface area:

Top + bottom: Area of circle x 2

Curved surface area = area of rectangle

Total surface area is both added together.

$S.A = 2\pi r^2 + 2\pi rh$

The curved surface area is the rectangular part of the net of a cylinder. It has a length equal to the circumference of the circle at the top of the cylinder and a height equal to that of the cylinder.