What do I need to be able to do?

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

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

Keywords

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

Direct Proportion

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

This is a multiplicative change

4 cans of pop = £240

$\times 0.5$
4 cans of pop = £240
2 cans of pop = £1.20

$\times 3$
4 cans of pop = £240
12 cans of pop = £7.20

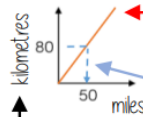This multiplier is the same in the same way that this would be for ratio

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

Conversion Graphs — Compare two variables

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

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

Labelling of both axes is vital

(kilometres vs miles; 80, 50)

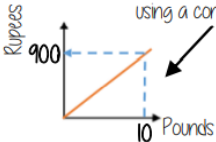## Conversion between currencies

£1 = 90 Rupees — Currency is directly proportional

For every £1 I have 90 Rupees

$\times 10$
£1 = 90 Rupees
£10 = 900 Rupees

Currency can be converted using a conversion graph

(Rupees vs Pounds; 900, 10)

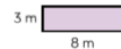Convert 630 Rupees into Pounds

$\times 7$
£1 = 90 Rupees
£7 = 630 Rupees
630 ÷ 90 = 7

Ratio between similar shapes

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

The two rectangles are similar.

3 m, 8 m — 4.5 m, ? m

Corresponding sides

$\div 3$
3m : 4.5m
1m : 1.5 m

$\times 8$
8m : 12m
1m : 1.5 m

Note
Simplify to the same ratio

Understand Scale Factor

The two rectangles are similar.
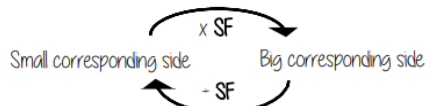
3 m, 8 m — 4.5 m, ? m

$3 \times 1.5 = 4.5$

This is a multiplicative change

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

Missing length
$8 \times 1.5 = 12m$

Scale factor can also be calculated by:

Bigger corresponding side
Smaller corresponding side

$\times SF$
Small corresponding side → Big corresponding side
$\div SF$

Draw and interpret scale diagrams

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

For every 1cm on my image is 30cm in real life
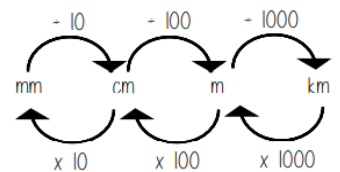
The car image is 10cm

$\times 10$
Image : Real life
1cm : 30cm
10cm : 300cm

The car in real life is 210cm

$\times 7$
Image : Real life
1cm : 30cm
7cm : 210 cm

Interpret maps with scale factors

÷ 10   ÷ 100   ÷ 1000
mm   cm   m   km
× 10   × 100   × 1000

1 cm : 250 m

Ratios need to be in the same units

1 cm : 250m
1 cm : 25000cm

250 × 100 = 25000

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

What do I need to be able to do?

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

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

Keywords

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

Form expressions

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

More than – ADD
Less than/ difference – SUBTRACT

eg 4 more than t $\longrightarrow$ t + 4
8 less than k $\longrightarrow$ k - 8

Only similar terms can be grouped together

eg Find the perimeter of this shape
(Perimeter = length around outside of shape)

$t + 2t + 1 + t + 2t + 1 \longrightarrow 6t + 2$

Directed numbers

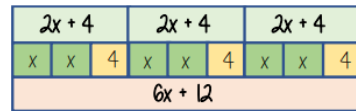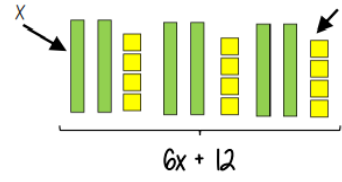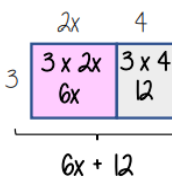+ + $\longrightarrow$ +
− − $\longrightarrow$ +
+ − $\longrightarrow$ −
− + $\longrightarrow$ −

eg a = -5 and b = 2
$a^2 = a \times a = -5 \times -5 = 25$
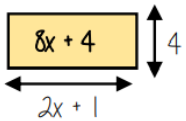$b + a = 2 + -5 = -3$

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

$2x$	4
$3 \times 2x$ = $6x$	3×4 = 12

$6x + 12$

$6x + 12$

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

Factorise into a single bracket $\qquad 8x + 4$

$8x + 4$
$2x + 1$
height 4

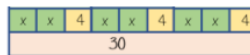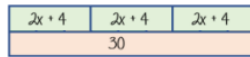Try and make this the **highest common factor**

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 $\qquad 3(2x + 4) = 30$

$3(2x + 4) = 30$ — Expand the brackets

$6x + 12 = 30$
$\quad -12 \qquad -12$
$6x = 18$
$\quad \div 6 \qquad \div 6$
$x = 3$

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

Simple Inequalities

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

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

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

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

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

Form and solve inequalities

Two more than treble my number is greater than 11

Find the possible range of values

Form
$x \longrightarrow \times 3 \longrightarrow +2 \longrightarrow 11$
$3x + 2 > 11$

Solve
$x \longleftarrow -3 \longleftarrow -2 \longleftarrow 11$
$x > 3$

Check
This would suggest any value bigger than 3 satisfies the statement
$3 \times 3 + 2 - 11 \checkmark \qquad 10 \times 3 + 2 - 32 \checkmark$

Algebraic constructs

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

Equation
A statement that two things are equal

Term
A single number or variable

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

Formula
A rule written with all mathematical symbols
eg area of a rectangle $a = b \times h$