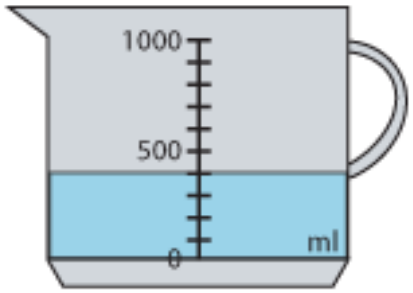
Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (FOOD)

Reading Scales

You need to work out how much each division is worth when reading scales.



There are 5 divisions between 0 and 500

Each division is worth

500 ÷ 5 = 100

So the scale reads <u>400 ml</u>

Using the outside scale (g)…

There are 10 divisions between 0 and 50

Each division is worth

50 ÷ 10 = 5

So the scale reads <u>70g</u>

Using the inside scale (oz)…

There are 4 divisions between 0 and 1

Each division is worth

1 ÷ 4 = 0.25

So the scale reads <u>2.5oz</u>

Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (FOOD)

Proportion

You use proportion with recipes in order to work out how much of each ingredient you need to serve a different number of people from the number given in the recipe.

Flapjacks

(Serves: 10)

120g butter

100g dark brown soft sugar

4 tablespoons golden syrup

250g rolled oats

40g sultanas or raisins

How much of each ingredient would you need to serve 25 people?

First work out how much you need to serve 1 person, then multiply it by 25

This recipe is for 10 people.

To find out how much of each ingredient you need for one person, just divide by 10.

For 25 people:

Butter = 120 ÷ 10 x 25

= 300g

Sugar = 100 ÷ 10 x 25

= 250g

Syrup = 4 ÷ 10 x 25

= 10 tablespoons

Oats = 250 ÷ 10 x 25

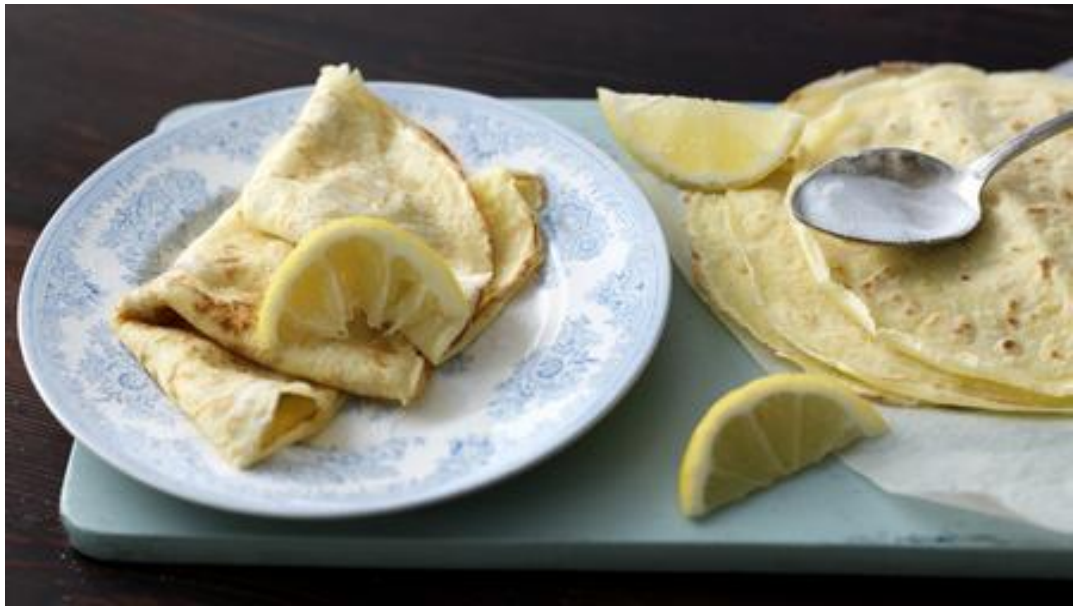
= 625g etc.

Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (FOOD)

Ratio

Sometimes recipes are given in the form of ratios. This allows you to make as much or as little as you want, as long as the ingredients stay in the same ratio to one another.



Pancakes

For every 100g flour, use 2 eggs and 300ml milk

The ratio of flour (g) to eggs to milk (ml) is

100 : 2 : 300

So to make double the quantity of pancakes, we just double the amount of each ingredient

200 : 4 : 600

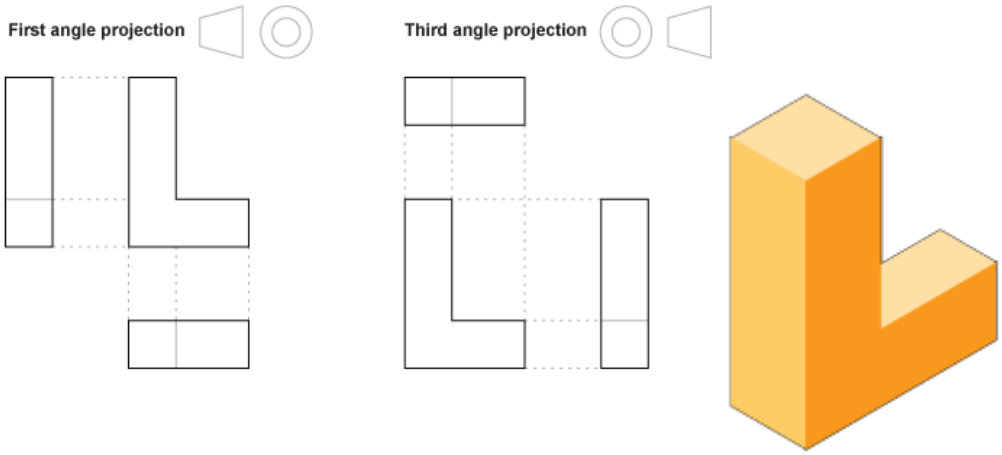
That's 200g flour, 4 eggs and 600ml of milk

Numeracy Across the Curriculum

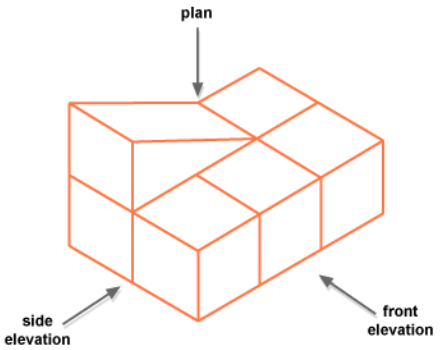
DESIGN & TECHNOLOGY (RESISTANT MATERIALS)

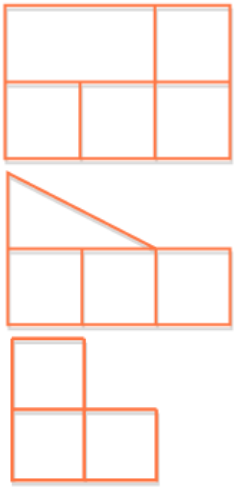
Technical drawings of 3D designs

Technical drawing is an important skill in Design and Technology. Your working drawings should include all the details needed to make your design. In mathematics you will also need to produce accurate drawings which show the exact details of 3D shapes using 2D diagrams.



In D&T, orthographic projection is used to show a 3D object using a front view, a side view and a plan. Orthographic projection may be done using **first angle projection** or **third angle projection**.





Plan view

Front elevation

Side elevation

In maths we use the same method to show 3D shapes – the views are described as **plan view**, **front elevation** and **side elevation**. An arrow on the 3D image shows which direction is the front.

Numeracy Across the Curriculum

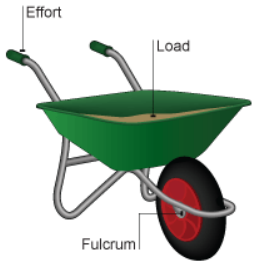
DESIGN & TECHNOLOGY (SYSTEMS AND CONTROL)

Ratio

Ratio is how much you have of one thing compared to another.

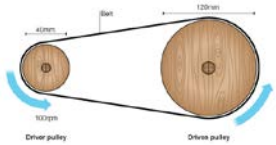
For levers

Velocity ratio = $\frac{\text{distance moved by effort}}{\text{distance moved by load}}$



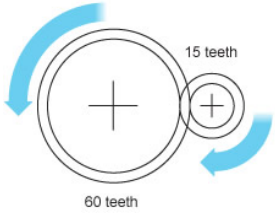
For pulley systems

Velocity ratio = $\frac{\text{diameter of driven pulley}}{\text{diameter of driver pulley}}$



For gears

Gear ratio = $\frac{\text{number of teeth on driven gear}}{\text{number of teeth on driver gear}}$



In **D&T** the main ratios you use are the **velocity ratio** in levers and pulley systems and the **gear ratio** when using gears. When you use ratios in D&T they are normally in the form of a calculation involving division.

In **maths** we also use ratios to compare quantities.

If there are 15 screws and 12 bolts in a bag, we would say that the **ratio of** screws **to** bolts is

15 : 12

which can be **simplified** to

5 : 4

We also use ratios to share amounts. For example, share a mass of 500 kg in the ratio 2 : 3.

Total number of parts = 2 + 3 = 5

200 ÷ 5 = 40

2 x 40 = 80 and 3 x 40 = 120

80 kg : 120 kg

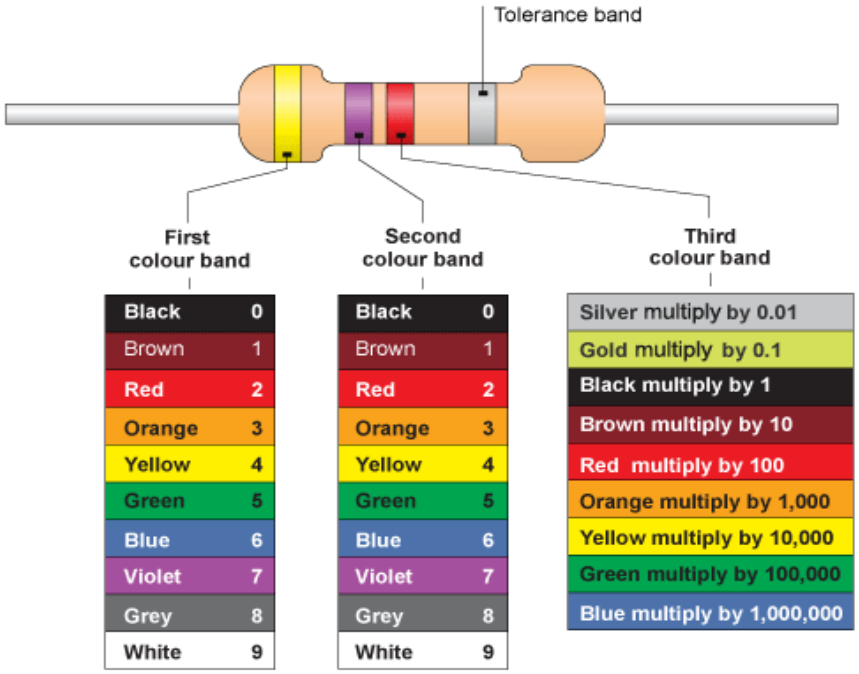
Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (ELECTRONICS)

Percentages

Percentages are used in many aspects of our daily lives.

One example in D&T when you may come across them is when dealing with resistors.



The first three bands on a resistor tell you the resistance.

In this case yellow then violet then red means

Resistance = 4 7 x 100 = 4700 ohms = 4.7 kilo-ohms

The fourth band tells you the tolerance i.e. what accuracy the resistance can be guaranteed to. A red band denotes a tolerance of 2%, gold a tolerance of 5% and silver a tolerance of 10%.

In this case the silver band denotes a tolerance of 10%, this means the actual resistance could be 10% higher or lower than the value given.

To find 10% of a number we divide by 100 (to find 1%) and then multiply by 10.

$4.7 \div 100 \times 10 = 0.47$

So the possible range of the resistance is,

$4.7 - 0.47\ k\Omega \leq \text{resistance} \leq 4.7 + 0.47\ k\Omega$

$4.23\ k\Omega \leq \text{resistance} \leq 5.17\ k\Omega$

Numeracy Across the Curriculum

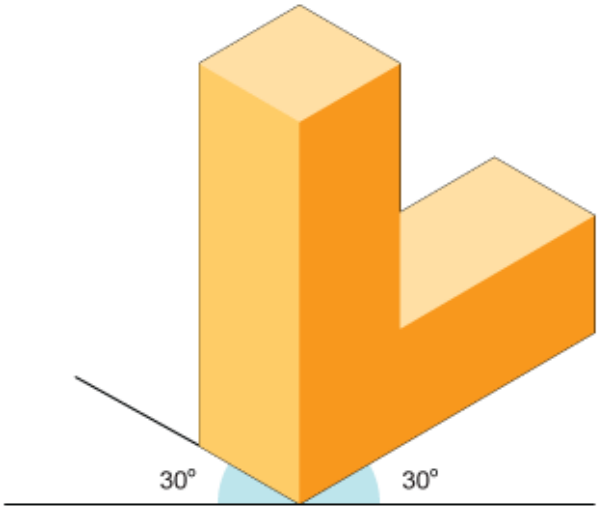
DESIGN & TECHNOLOGY (GRAPHICS)

Isometric Drawings

In **D&T** a representation of a 3D solid on a 2D surface is called a projection.

Isometric projection uses vertical lines and lines drawn at 30° to horizontal.

Dimensions are shown accurately and in the correct proportion. Isometric projection distorts shapes to keep all upright lines vertical.



In **maths** isometric drawings are also used to represent 3D shapes on a 2D surface.

Isometric drawings are drawn on **isometric paper** which uses dots to indicate where lines should go. Upright lines are always drawn vertically, as they are in D&T, with other lines drawn using the diagonal lines between dots.


Figure 1


Figure 2


Figure 3

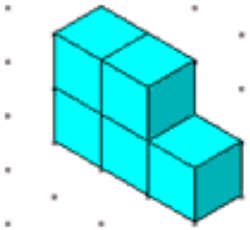


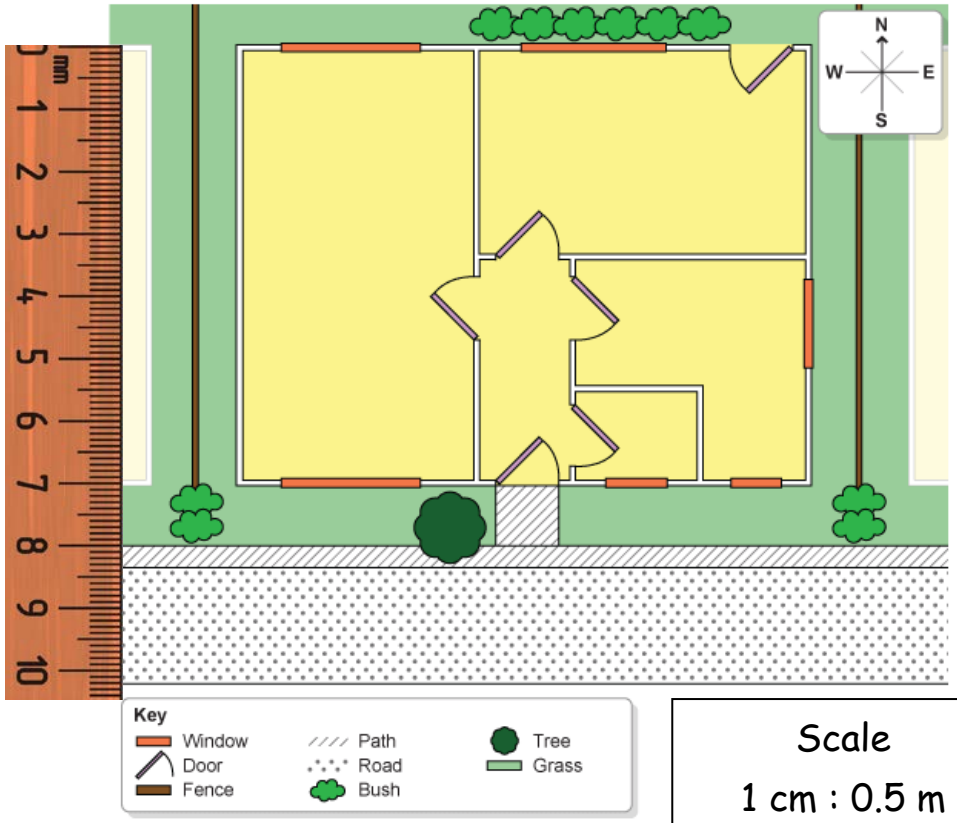
Figure 4

Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (GRAPHICS)

Scale and Scale Factor

In D&T plan drawings, showing a view from above looking down, are often used for room plans, site plans and maps. They should include compass directions, a key and a scale.



Scale

1 cm : 0.5 m

The scale on this plan drawing tells us that each centimetre on the drawing, represents 0.5 metres of the actual length of the building.

1 m = 100 cm therefore 0.5 m = 50 cm

So the actual building's dimensions are 50 times bigger than those on the drawing, i.e. the scale factor is 50.

From North to South the length of the building on the drawing measures 7 cm. Therefore to work out how long this is in reality we simply multiply by 50.

7 x 50 = 350 cm = 3.5 m

Numeracy Across the Curriculum

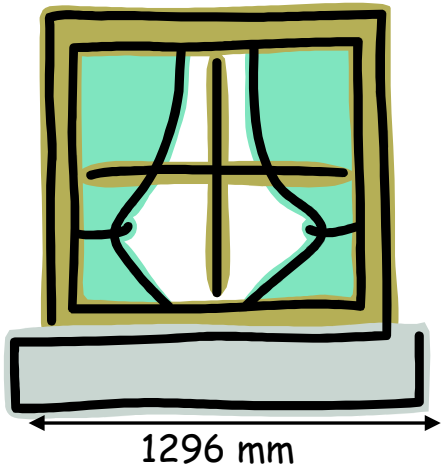
DESIGN & TECHNOLOGY

Accuracy and Rounding

In both Design and Technology and Mathematics it is at times necessary to give measurements to a certain degree of accuracy. This is usually done by rounding to a given number of decimal places or significant figures. Sometimes you may be asked to round to the nearest whole unit.

The measuring equipment you use will determine what accuracy you can measure something to.

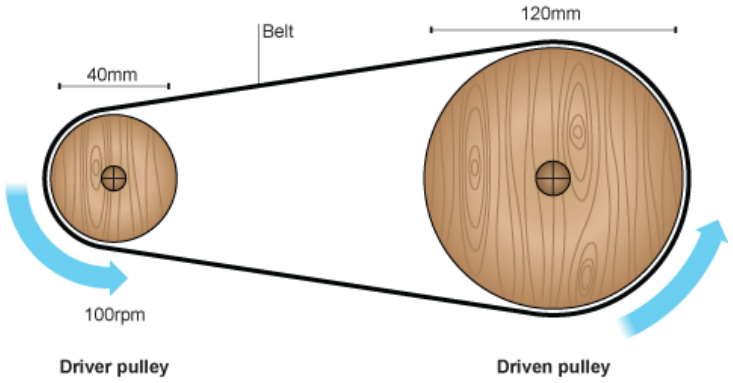
This length has been measured as 1286mm to the nearest mm.



1286 mm = 128.6 cm = 129 cm to the nearest cm

1286 mm = 1.286 m = 1 m to the nearest m

Answers to calculations will often need rounding in order to make them easier to interpret.



Output speed = Input speed ÷ Velocity ratio = 100 ÷ 3

= 33.3333….. rpm

= <u>33.3 rpm</u> (to 1 d.p.)

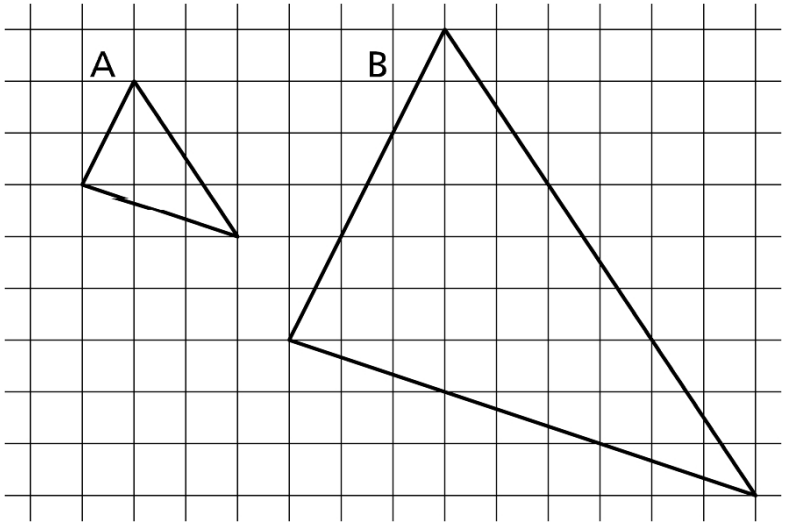
Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (TEXTILES)

Using scale and proportion

In textiles scale and proportion are used to refer to relative measurements. Designs on paper need to be enlarged by a given scale factor whilst keeping the measurements in the same proportion to each other in order to create a pattern from which to make them.

The proportion of a pattern on a textile to the object on which it is to be used is also important. You would generally use fabric with a smaller scaled pattern for a cushion than you would for a sofa.



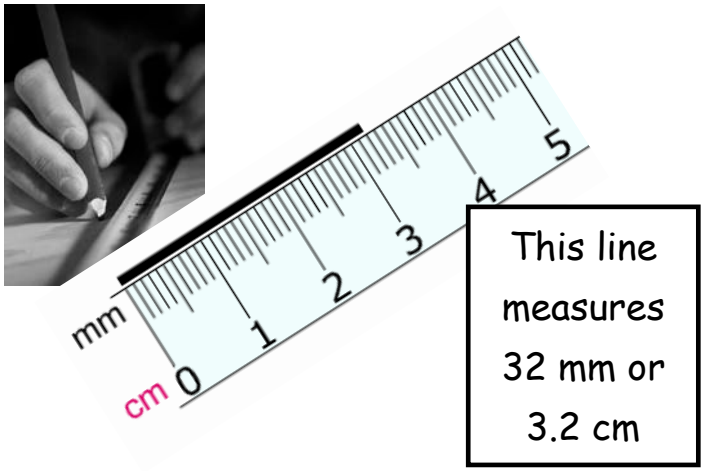
In maths scale and proportion are also used to define the size of one object relative to another.

Look at these two triangles. Triangle A has been enlarged by scale factor 3 to create triangle B. This means that all the side lengths of triangle B are 3 times as big as those in triangle A. (Notice how the interior angles of the triangles stay the same)

Numeracy Across the Curriculum

DESIGN & TECHNOLOGY

Measuring and Estimation

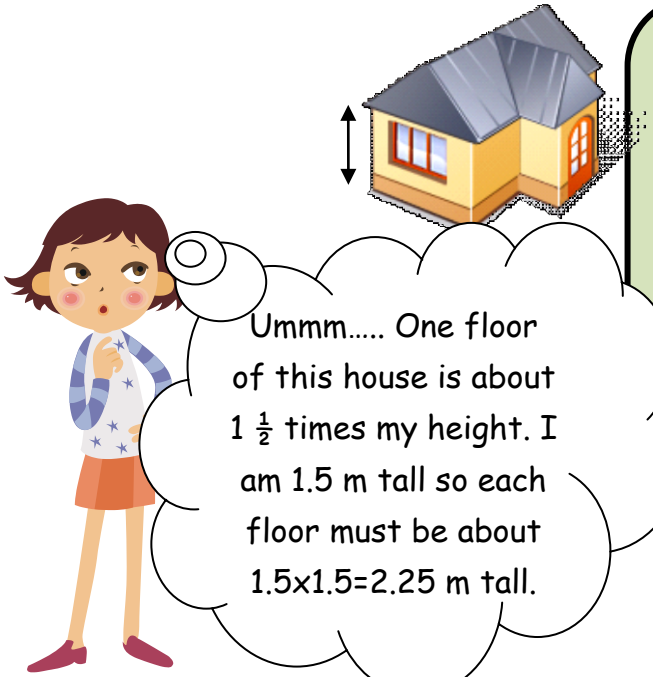


This line measures 32 mm or 3.2 cm

Being able to measure things accurately is an important skill in both D&T and mathematics.

Remember that you can measure lengths in metres, centimetres or millimetres:

1 m = 100 cm and **1 cm = 10 mm**



At times it may be appropriate to estimate the size of something – especially if you do not have time to measure it accurately.

Estimate

$3.6 \times 241 \approx 4 \times 200 = 800$

Accurate Calculation

$3.6 \times 241 = 867.6$

Estimation can also be used to carry out calculations quickly – simply round each number involved to one significant figure and then work out the calculation.