# Ratio

## Key vocabulary

**Ratio** -Ratio compares the size of **one part** to **another part**.

**Proportion** -Proportion compares the size of **one part** to the size of the **whole** .

**Proportional** - a change in one is always accompanied by a change in the other.

**Simplifying** - Divide each part of the ratio by a common factor

**Equivalent**- Ratios are equivalent if they have the same simplest form.

## Picture perfect

Share £20 in the ratio 2:5:3

1) Find the total number of parts

$2 + 5 + 3 = 10$

2) Divide the **amount** by the total number of parts

£20 ÷ 10 = **£2** = 1 part

3) Multiply each number in the ratio by the value of **1 part**

2 : 5 : 3

x £2 x £2 x £2

£4 : £10 : £6

### Find Two Equivalent Ratios

5:20

| Multiply | Divide |
|---|---|
| $5:20 \rightarrow \frac{5}{20}$ | $5:20 \rightarrow \frac{5}{20}$ |
| $\frac{5}{20} \cdot \frac{2}{2} = \frac{5 \cdot 2}{20 \cdot 2} = \frac{10}{40}$ | $\frac{5}{20} \div \frac{5}{5} = \frac{5 \div 5}{20 \div 5} = \frac{1}{4}$ |
| $\frac{10}{40} \rightarrow$ 10:40 | $\frac{1}{4} \rightarrow$ 1:4 |

## Assessment style question

Shannon is revising for her summer exams.
The table below shows the number of minutes Shannon spends revising on each of 5 evenings.
It also shows the number of minutes Shannon spends relaxing on the 5 evenings.

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Number of minutes revising | 88 | 198 | 150 | 133 | 160 |
| Number of minutes relaxing | 20 | 40 | 28 | 25 | 34 |

Sophie is making 400 scones.
She uses butter, sugar and flour in the ratio 2:1:9
Here are the costs of those ingredients.

| | |
|---|---|
| Butter | £2.20 per 500g |
| Sugar | £1.60 per kilogram |
| Flour | 60p per 1.5kg |

The total mass of the butter, sugar and flour in each scone is 30g

Work out the total cost of these ingredients for the 400 scones.

Mrs Chambers is organising a school trip to a museum for year 7 and year 8.
She needs to work out the total cost of the museum tickets and bus hire.
The table below shows the museum ticket prices.

| Visitor Age | Price |
|---|---|
| 0 - 3 | free |
| 4 - 12 | £4.50 |
| 13 - 17 | £6.50 |
| 18+ | £11.50 |

Each bus has 51 seats and costs £125

Altogether 300 students want to go on the trip.
The ratio of the number of students to the number of teachers is 25:1
The ratio of the number of students in year 7 to the number of students in year 8 is 8:7

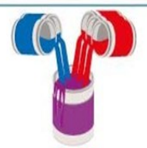
At the time of the trip, all of the students in year 7 are 11 or 12 years old.
Of year 8 students, the ratio of number of 12 year olds to 13 year olds is 2:3.
Work out the total price of the school trip.

## Always remember

### Ratios

A ratio is a way of comparing two or more quantities.

Purple paint is made by mixing blue and red paint in the ratio of 2 to 3.



2:3

To make mortar, sand and cement are mixed together in the ratio of 5 to 2.

5:2

Lilly, Jack and Jo have shared the money in the ratio of 2 to 6 to 3.

2:6:3

A ratio must be written in the correct order, with **the quantity mentioned first written first.**

Ratios are easier to work out when they are in their simplest form.
To simplify ratios, both numbers must be **divided by their highest common factor.**

The ratio of blue to red tiles is 6 to 3 but this can be simplified.

6:3 (÷3) 2:1

3 is the highest common factor of 6 and 3, so divide both numbers by 3.

### Dividing in a Ratio

Sometimes an amount needs to be divided according to a particular ratio.
Ava, Isla and Freya made **£315** selling balloons at a fayre. They agreed to split the money in the ratio of 3:2:4. How much money does each person get?

1. Add the numbers in the ratio to calculate the total number of parts. — $3 + 2 + 4 = 9$
2. Find the value of 1 part by dividing the total amount by the total number of parts, 9. — $315 \div 9 = 35$, 1 part = 35
3. Multiply the value of 1 part, 35, by the numbers in the ratio to calculate how much money each person gets. — 3 x 35 = 105, 2 x 35 = 70, 4 x 35 = 140
4. 315 divided in the ratio of 3:2:4 is 105:70:140. Check your answer by adding together the values. — Ava £105, Isla £70, Freya £140; 105 + 70 + 140 = 315

# Similar Shapes

## Key vocabulary

**Similar** - Two shapes are mathematically similar if one is an enlargement of the other.

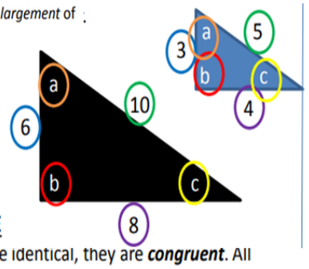
**Congruent** - These shapes are the same shape and same size but can be in any orientation.

**Scale Factor** - What to multiply the lengths of the original shape by to find the lengths on the enlarged shape.

## Picture perfect

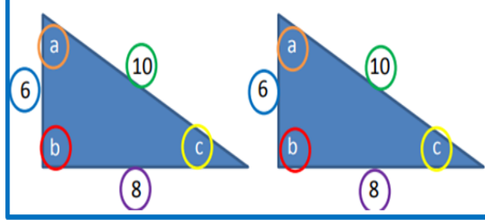
**SIMILARITY**

When shapes look the same but are different sizes, they are mathematically ***similar***. This means their *corresponding* ("matching") **angles** are **equal**, and their *corresponding* **sides** are in the **same ratio**. One shape is an *enlargement* of the other.




**CONGRUENCE**

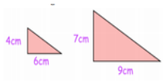
When shapes are identical, they are ***congruent***. All *corresponding* lengths and angles are **equal** – you could fit one perfectly on top of the other.




## Assessment style question

: Triangles A and B are congruent.
Tick the correct boxes.

| | True | False | Maybe |
|---|---|---|---|
| If Triangle A is isosceles, Triangle B has to be isosceles. | ☐ | ☐ | ☐ |
| Triangles A and B have different size angles | ☐ | ☐ | ☐ |
| Triangle A has a larger area than Triangle B | ☐ | ☐ | ☐ |




Finley says "the two triangles are similar because 3cm has been added to both the height and base of the smaller triangle."

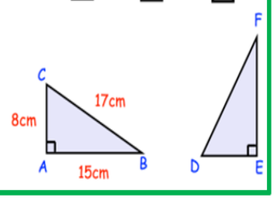
Explain why Finley is incorrect.

Triangles ABC and DEF are congruent.

(a) Write down the length of DF

(b) Write down the length of AC

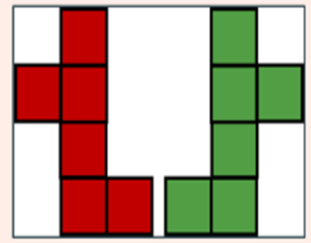
(c) Write down the length of DE




## Always remember

### Congruence

- Congruent shapes are just **exact replicas** of the original
- The angles and side lengths **remain the same**
- The shapes may well be orientated differently

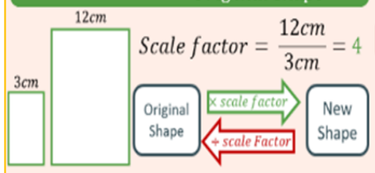


The two shapes are congruent.
They are reflections of each other.

### Similarity in 1D

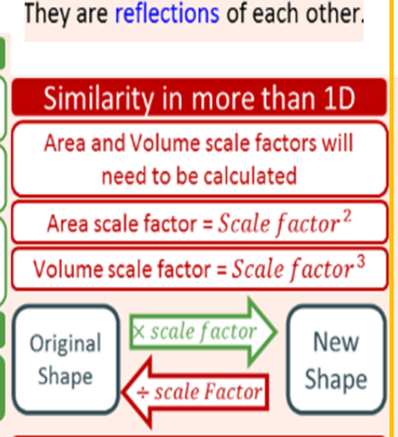
- Similar shapes are just **enlargements** of the original
- The angles remain the same but the **lengths** have been **scaled up or down**
- This **scale factor** needs to be calculated in order to solve problems involving similar shapes.
- Find two comparative lengths.

$$Scale\ factor = \frac{New\ shape}{Original\ shape}$$

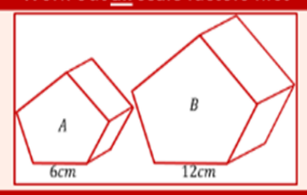



### Similarity in more than 1D

- Area and Volume scale factors will need to be calculated
- Area scale factor = $Scale\ factor^2$
- Volume scale factor = $Scale\ factor^3$




Work out **all** scale factors first




Scale factor = 2

Area scale factor = $(2)^2 = 4$

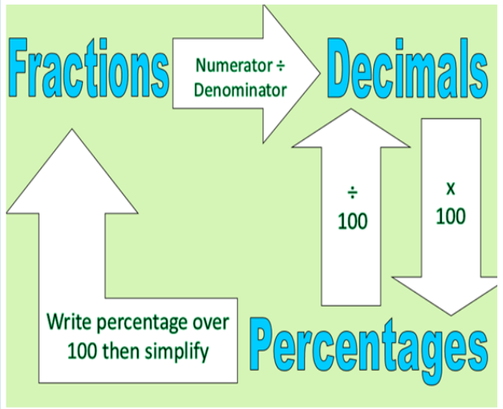
Volume scale factor = $(2)^3 = 8$

# FDP

## Key vocabulary

Fraction
Numerator
Denominator
Improper fraction
Proper fraction
Top-heavy fraction
Tenth
Hundredth
Thousandth
Per cent
Percentage
Decimal
Equivalent

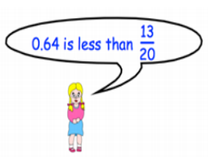
## Picture perfect




## Assessment style question

Write these numbers in order of size.
Start with the smallest number.

$\frac{1}{4}$ 30% $\frac{3}{8}$ 0.2 0.17




Is Sophia correct?
Explain your answer.

.....

.....

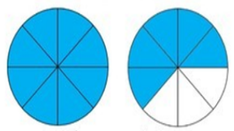
.....

(1)

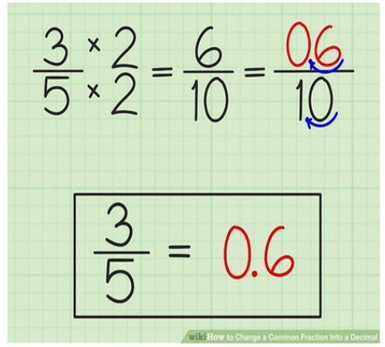
## Always remember

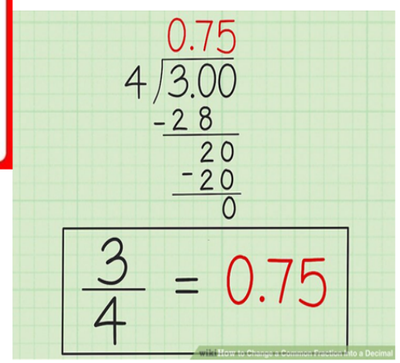
| Fraction | Decimal | Percentage |
|---|---|---|
| $\frac{1}{10}$ | 0.1 | 10% |
| $\frac{1}{5}$ | 0.2 | 20% |
| $\frac{1}{4}$ | 0.25 | 25% |
| $\frac{1}{2}$ | 0.5 | 50% |
| $\frac{1}{3}$ | $0.\dot{3}$ | $33.\dot{3}\%$ |

**Mixed Numbers & Improper Fractions**



$1\frac{5}{8} = \frac{13}{8}$



# Real life Graphs

## Key vocabulary

**Coordinates** - a set of value that show an exact position on a coordinate grid

**Linear equation** - an equation, when plotted, makes a straight line

**Gradient** - the steepness of the line of a linear equation

**y-intercept** - where the linear equation cuts the y-axis

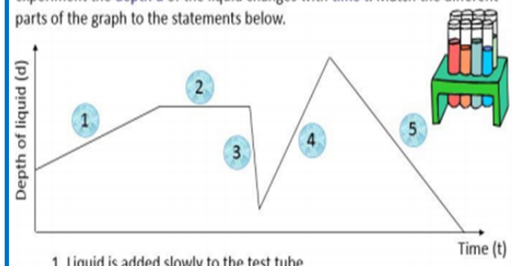
**Substitution** - when you replace an unknown for a given value

## Picture perfect

Graphs can be used to represent a number of real life situations. It is important to read the labels on both axes to determine the meaning of the graph.

Example:

A test tube containing a chemical liquid is used in an experiment. During the experiment the depth d of the liquid changes with time t. Match the different parts of the graph to the statements below.

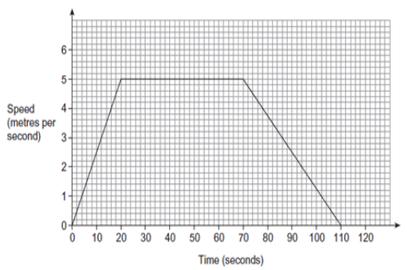



1. Liquid is added slowly to the test tube.
2. The level of the liquid remains constant.
3. Some liquid is poured out quickly.
4. Some liquid is poured in quite quickly
5. The test tube is emptied.

## Assessment style question

The distance around a cycle track is 400 metres.

Robin cycles on the track.
Here is his speed-time graph.

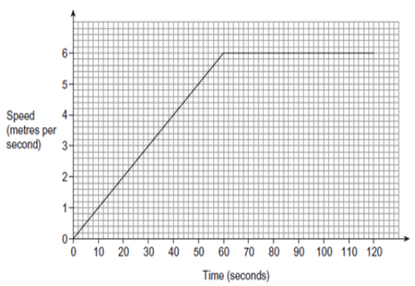



(a) Show that Robin cycles **exactly** once around the track in 110 seconds.

**(2)**

(b) Sanjay cycles on the same track.

Here is his speed-time graph.



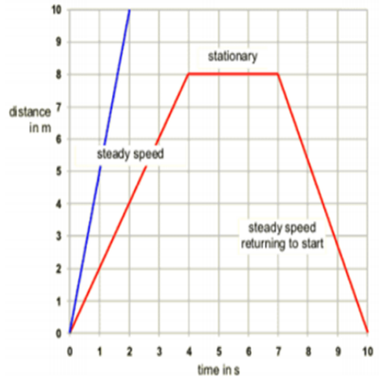

Does Sanjay cycle the first 400 metres in a quicker time than Robin?
You **must** show your working.

**(3)**

## Always remember

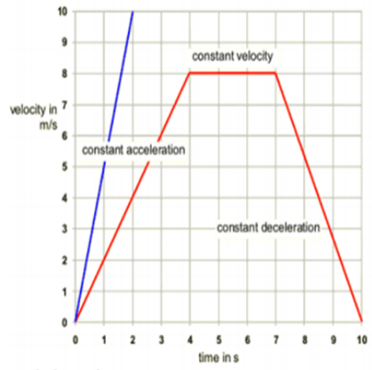
### Distance-time graphs

Distance time graphs show distance away from a point. When an object is stationary, the line on the graph is horizontal. When an object is moving at a steady speed, the line on the graph is straight, but sloped. The **steeper** the line, the greater the **speed** of the object.




### Speed-time graphs

A speed-time graph tells us **changes** over **time**. When the object is travelling at a constant speed, the line on the graph is horizontal. When an object is accelerating or decelerating, the line on the graph is sloped. The **steeper** the gradient of the line, the greater the **acceleration** (a bigger change in speed in the same time).



# Compound measures

## Key vocabulary

**Compound**
**Measure**
**Unit**
**Speed**
**Distance**
**Time**
**Mass**
**Density**
**Volume**
**Pressure**
**Force**
**Area**

## Picture perfect

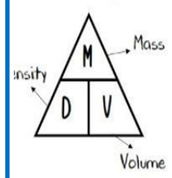
Average Speed


Speed = Distance ÷ Time

Distance = Speed x Time

Time = Distance ÷ Speed

Density

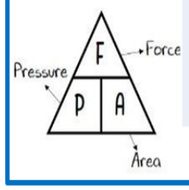



Density = Mass ÷ Volume

Mass = Density x Volume

Volume = Mass ÷ Density

Pressure




Pressure = Force ÷ Area

Force = Pressure x Area

Area = Force ÷ Pressure

## Assessment style question

Question 1: Convert the times from hours/minutes into hours, without a calculator.
e.g. 1 45 minutes = 0.75 hours
e.g. 2 1 hour 30 minutes = 1.5 hours

(a) 15 minutes (b) 30 minutes (c) 45 minutes
(d) 20 minutes (e) 40 minutes (f) 2 hours 30 minutes
(g) 1 hour 15 minutes (h) 3 hours 45 minutes (i) 2 hours 40 minutes

David cycles at 20mph for 1¼ hours, then at 16mph for 2 hours and then 12mph for 45 minutes.
(a) Work out the total distance travelled.
(b) Work out the average speed for the entire journey.

Find the pressure exerted by a force of 180 newtons on an area of $50cm^2$.
Give your answer in newtons/$m^2$

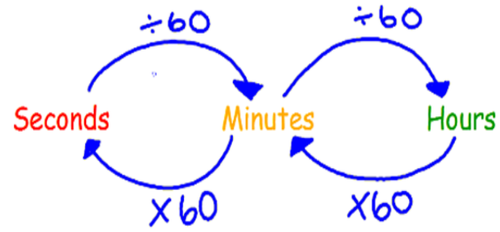
A bus travels 222 miles in 6 hours.
What was the average speed of the bus?

A cube of ice has side length of 5cm.
The mass of the cube of ice is 114.5g.

Find the density of ice.
Give your answer in g/$cm^3$

## Always remember

To convert time




When completing a mass or density question you first may need to calculate the volume of a shape.

Shown is a solid cylinder made from carbon.
The density of carbon is 1.95g/cm

Find the mass of the cylinder.


When completing a pressure question you may need to calculate an area first.

A cylinder is placed on a table.
The cylinder has a weight of 400N and has a diameter of 10cm.

Work out the pressure on the table in newtons/$cm^2$