

REASONING WITH GEOMETRY... Rates

@whisto_maths

What do I need to be able to do?

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

- Solve speed, distance, time questions
- Use distance time graphs
- Solve density, mass, volume problems
- Solve flow problems
- Use flow graphs
- Interpret rates of change and their units

Keywords

Convert: change

Mass: a measure of how much matter is in an object. Commonly measured by weight

Origin: the coordinate (0, 0)

Volume: the amount of 3D space a shape takes up

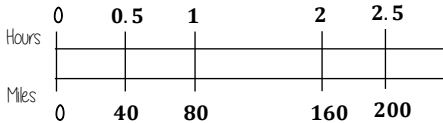
Substitute: putting numbers where letters are – replacing numbers into a formula

Speed, Distance, Time

'per' for every
e.g. 80 miles per hour (mph)
Travel 80 miles every hour

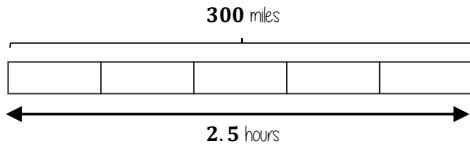
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

You can use a double number line to help you calculate distance



e.g. A boat travels at a constant speed for 2.5 hours
It travels 300 miles.

Bar models can help to calculate mph

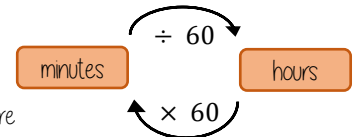


Each part is half an hour
Each part is 60 miles

Speed, Distance, Time



Before calculations – make sure you are working in the same units as the speed



Learn or learn how to rearrange the formula for speed, distance and time

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

Substitute in the variables given

$$\text{distance} = \text{speed} \times \text{time}$$

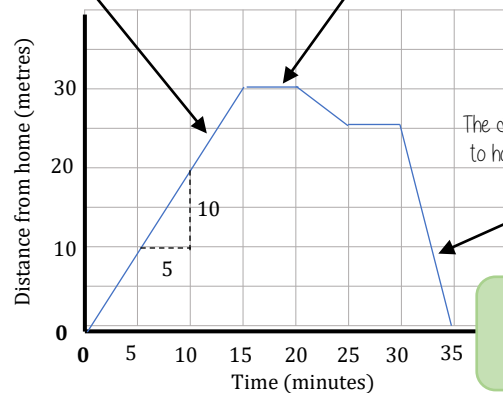
Distance – Time graphs

The steeper a gradient the faster the speed

Gradient = speed

$$\frac{10}{5} = 2 \text{ metres per min}$$

Horizontal lines represent staying still



The distance coming closer to home shows the return journey

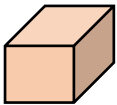
Units are important
Metres per minute

Density, Mass, Volume

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{volume} = \frac{\text{mass}}{\text{density}}$$

$$\text{mass} = \text{volume} \times \text{density}$$



volume of prism = Area of cross section \times Depth



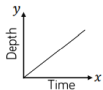
Flow problems & graphs



This will fill at a constant rate, then as the space decreases it will speed up and the neck of the bottle fill at a faster constant speed



The cylinder will fill at a constant speed



Units are important
Ensure any volume calculations are the same unit as the rate of flow

Rates of change & units

Common rates of change relationships

Revisit your conversions between units of length and capacity

Speed: miles per hour

Exchange rates: euros per pounds

Density: mass per volume

