Y10 Maths Knowledge Organiser Foundation Tier: Percentages and Compound Measures

What must I be able to do?

New content:
- ☐ Be able to solve problems involving compound measures such as speed, density, rates of pay and pressure.
  - ➢ Sparx U151(speed)
  - ➢ Sparx U910 (density)
  - ➢ Sparx U527 (pressure)

Key vocabulary

Rates of Pay	An amount of money paid in a given time, e.g. per week or per year
Pressure	The force per unit of area. The pressure exerted by a solid object onto another solid surface is the weight of the object divided by the area of the object's surface

Speed
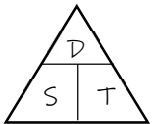
Speed = distance ÷ time

Speed is usually measured in:

Kilometres per hour   km/h

Miles per hour   mph

Metres per second   m/s

The formula can also be rearranged to give:

Time = distance ÷ speed

Distance = speed x time

Questions involving speed will often talk about 'average speed'. Objects rarely travel at a constant speed and instead speed up and slow down during the journey. To get around this we often use the average speed of the journey instead.

Average speed = total distance ÷ total time

Converting units of speed

This is usually best done in stages.

e.g. Convert 60 km/h into m/s

1000m in a km	60 km/h = 60,000 m/h	(x 1000)
60 minutes in an hour	60,000 m/h = 1000 m/min	(÷ 60)
60 seconds in an hour	1000 m/min = 16.67 m/s (2d.p.)	(÷ 60)

Problem solving with speed

On the first part of the journey a car travels 160 km in 3 hours. On the second part of the journey the car travels at 70km/h for 2 hours. What is the average speed of the journey?

During the second part of the journey the car travels:

Distance = speed x time = 70 x 2 = 140km.

So total distance = 140 + 160 = 300km.

And total time = 3 + 2 = 5 hours.

Average speed = total distance ÷ total time = 300 ÷ 5 = 60 km/h.

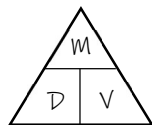## Density

Density is mass ÷ volume

Density is usually measured in:

Kilograms per metre cubed kg/m^3

Grams per centimetre cubed g/cm^3

The formula can also be rearranged to give:

Volume = mass ÷ density

Mass = density x volume
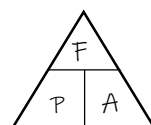
Pressure

Pressure is force ÷ area

Pressure is usually measured in:

Newtons per square metre N/m^2

The formula can also be rearranged to give

Force = pressure x area

Area = Force ÷ pressure

Increase and decrease by a percentage

Find the percentage you are looking for and then for an increase add it to the original value or for a decrease subtract it from the original value.

e.g. Increase £120 by 30%.

   10% of £120 is 120 ÷ 10 = £12

   30% is 10% x 3 = £12 x 3 = £36

   Therefore the new value is £120 + £36 = £156

e.g. Decrease £72 by 71%

   50% of £72 is 72 ÷ 2 = £36

   10% of £72 is 72 ÷ 10 = £7.20

   20% is £7.20 x 2 = £14.40

   1% is £72 ÷ 100 = £0.72

   So 71% is £36 + £14.40 + £0.72 = £51.12

50% plus
20% plus
1% = 71%

   Therefore the new value is £72 - £51.12 = £20.88

Converting between fractions, decimals and %s

Any fraction can be written as a decimal or as a % and vice versa.

Fraction	Decimal	%	Fraction	Decimal	%
$\frac{1}{2}$	0.5	50%	$\frac{1}{1}$	1	100%
$\frac{1}{4}$	0.25	25%	$\frac{3}{4}$	0.75	75%
$\frac{1}{10}$	0.1	10%	$\frac{2}{10}$	0.2	20%
$\frac{1}{5}$	0.2	20%	$\frac{2}{5}$	0.4	40%
$\frac{1}{100}$	0.01	1%	$\frac{2}{100}$	0.02	2%
$\frac{1}{3}$	$0.\dot{3}$	33.3%	$\frac{2}{3}$	$0.\dot{6}$	66.6%

Multipliers

To quickly find a percentage of something, change the percentage into a decimal by dividing by 100. This is the multiplier. Then multiply your value by this decimal.

e.g. Find 18% of 320.

Multiplier: 18 ÷ 100 = 0.18

   0.18 x 320 = 57.6 ← This is 18% of 320

e.g. Decrease 1820 by 75%

Multiplier: 25 ÷ 100 = 0.25

   0.25 x 1820 = 455

If you decrease 100% by 75% there is 25% left

Increasing and decreasing by a percentage using multipliers

The starting value is always 100%. An increase takes it over 100% and a decrease takes it below 100%. Change the new percentage to a decimal to find the multiplier.

e.g. Increase £210 by 15%.   100% + 15% = 115%. 115% as a decimal is 1.15. So £210 x 1.15 = £241.50

e.g. Decrease £210 by 15%   100% - 15% = 85% 85% as a decimal is 0.85. So £210 x 0.85 = £178.50

Writing one number as a percentage of another

Divide the first number by the second to turn into a decimal then multiply by 100 to change into a percentage.

e.g. Simon scores 30 out of 75 in a test. What percentage is this?

   $\frac{30}{75}$ x 100 = 40%

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