YEAR 10 — PROPORTION...

@whisto_maths

Ratios and fractions

What do I need to be able to do?

By the end of this unit you should be able to:
- Compare quantities using ratio
- Link ratios and fractions and make comparisons
- Share in a given ratio
- Link Ratio and scales and graphs
- Solve problems with currency conversions
- Solve 'best buy' problems
- Combine ratios

Keywords

Ratio: a statement of how two numbers compare
Equivalent: of equal value
Proportion: a statement that links two ratios
Integer: whole number, can be positive, negative or zero.
Fraction: represents how many parts of a whole.
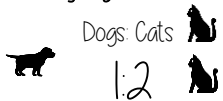**Denominator:** the number below the line on a fraction. The number represent the total number of parts.
Numerator: the number above the line on a fraction. The top number. Represents how many parts are taken
Origin: (0,0) on a graph. The point the two axes cross
Gradient: The steepness of a line

Compare with ratio (R)

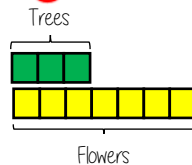"For every dog there are 2 cats"

Dogs: Cats

1:2

The ratio has to be written in the same order as the information is given.

e.g. 2:1 would represent 2 dogs for every 1 cat.

> Units have the be of the same value to compare ratios

Ratios and fraction (R)

Trees: Flowers

3 : 7

Trees | Flowers | Ratio

Fraction of trees

$$\frac{\text{Number of parts of in group}}{\text{Total number of parts}} = \frac{3}{10}$$

Fraction

Sharing a whole into a given ratio (R)

> James and Lucy share £350 in the ratio 3:4.
> Work out how much each person earns

Model the Question

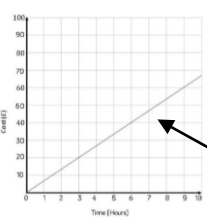James: Lucy

3 : 4
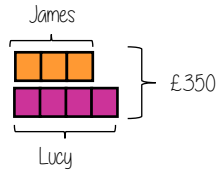
James — £350 — Lucy

Find the value of one part

Whole: £350
7 parts to share between (3 James, 4 Lucy)

£350 ÷ 7 = £50

☐ = one part = £50

Put back into the question

James: Lucy
x 50 3 : 4 x 50
£150:£200

James = 3 x £50 = £150
£350
Lucy = 4 x £50 = £200

Ratio and graphs (R)

Graphs with a constant ratio are directly proportional
- Form a straight line
- Pass through (0,0)

The gradient is the constant ratio

Ratio and scale (R)

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

The car image is 10cm

Image : Real life
x 10 ⟮ 1cm : 30cm ⟯ x 10
10cm : 300cm

Conversion between currencies (R)

For every £1 I have 90 Rupees
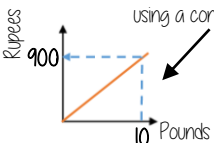
£1 = 90 Rupees ← Currency is directly proportional

x 10 ⟮ £1 = 90 Rupees ⟯ x 10
£10 = 900 Rupees

Currency can be converted using a conversion graph

Rupees
900
10 Pounds

> Convert 630 Rupees into Pounds

x 7 ⟮ £1 = 90 Rupees ⟯ x 7 ← 630 ÷ 90 = 7
£7 = 630 Rupees

Ratios in 1:n and n:1

This is asking you to cancel down until the part indicated represents 1.

> Show the ratio 4:20 in the ratio of 1:n

The question states that **this part has to be 1 unit** Therefore **Divide by 4**

4 : 20
1 : 5

This side has to be divided by 4 too – to keep in **proportion**

the n part does not have to be an integer for this type of question

Combining ratios

B R G

The ratio of Blue counters to Red counters is 5:3

The ratio of Red counters to Green counters is 2:1

Ratio of Blue to Red to Green

10 : 6 : 3

Use **equivalent ratios** to allow comparison of the group that is common to both statements

> Lowest common multiple of the ratio both statements share

Best buys

4 pens costs £2.60

10 pens costs £6.00
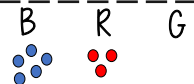
> You could work out how much 40 pens are and then compare

Compare the solution in the context of the question

The best value has the lowest cost "per pen"

The best value means £1 buys you more pens

"1 pen costs…" £2.60 ÷ 4 = £0.65   £6.00 ÷ 10 = £0.60

"1-pound buys…" 4 ÷ 2.60 = 1.54 pens   10 ÷ 6 = 1.67 pens

Vectors

What do I need to be able to do?

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

- Understand and represent vectors
- Use and read vector notation
- Draw and understand vectors multiplied by a scalar
- Draw and understand addition of vectors
- Draw and understand addition and subtraction of vectors

Keywords

Direction: the line our course something is going
Magnitude: the magnitude of a vector is its length
**Scalar**: a single number used to represent the multiplier when working with vectors
Column vector: a matrix of one column describing the movement from a point
Resultant: the vector that is the sum of two or more other vectors
Parallel: straight lines that never meet

Understand and represent vectors

Column vectors have been seen in translations to describe the movement of one image onto another

Movement along the x-axis

$$\begin{pmatrix} 4 \\ -3 \end{pmatrix}$$

Movement along the y-axis
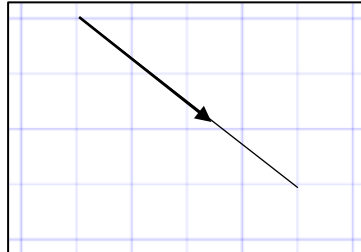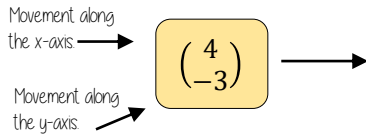
**Vectors show both direction and magnitude**

The arrow is pointing in the direction from starting point to end point of the vector.	The direction is important to correctly write the vector
The magnitude is the length of the vector (This is calculated using Pythagoras theorem and forming a right-angled triangle with auxiliary lines)	The magnitude stays the same even if the direction changes

Understand and represent vectors
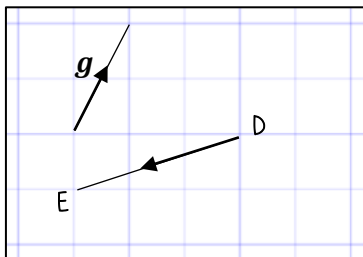
Vector notation $\overrightarrow{DE}$ is another way to represent the vector joining the point D to the point E
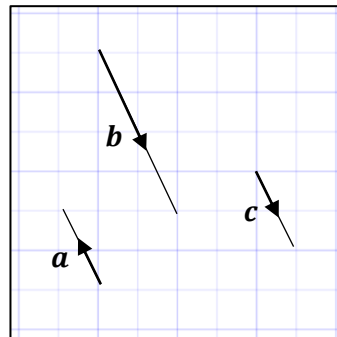
$$\overrightarrow{DE} = \begin{pmatrix} -3 \\ -1 \end{pmatrix}$$

The arrow also indicates the direction from point D to point E

Vectors can also be written in bold lower case so **g** represents the vector

$$g = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

Vectors multiplied by a scalar

Parallel vectors are scalar multiples of each other

$$b = 2 \times c = 2c$$

Multiply **c** by 2 this becomes **b**. The two lines are parallel

$$a = -1 \times c = -c$$

The vectors **a** and **c** are also parallel. A negative scalar causes the vector to reverse direction

$$a = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \quad b = \begin{pmatrix} 2 \\ -4 \end{pmatrix} \quad c = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$$

$$b = -2 \times a = -2a$$

Addition of vectors

$$\overrightarrow{AB} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \qquad \overrightarrow{BC} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$
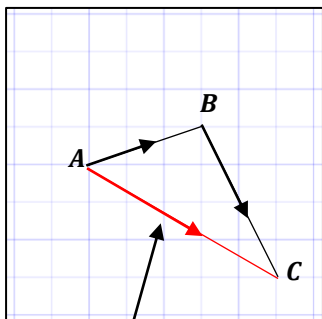
$$\overrightarrow{AB} + \overrightarrow{BC}$$

$$= \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} 3 + 2 \\ 1 + -4 \end{pmatrix}$$

$$\overrightarrow{AC} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

Look how this addition compares to the vector $\overrightarrow{AC}$

The resultant

$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$
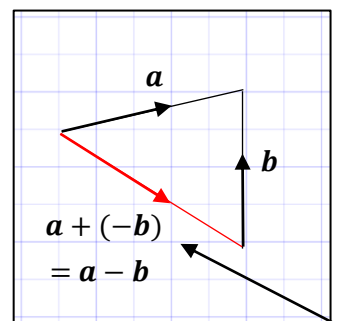
Addition and subtraction of vectors

$$a = \begin{pmatrix} 5 \\ 1 \end{pmatrix} \qquad b = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$$

$$a + (-b) = \begin{pmatrix} 5 + -0 \\ 1 + -4 \end{pmatrix} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$$

$$a + (-b)$$
$$= a - b$$

The resultant is $a - b$ because the vector is in the opposite direction to b which needs a scalar of -1