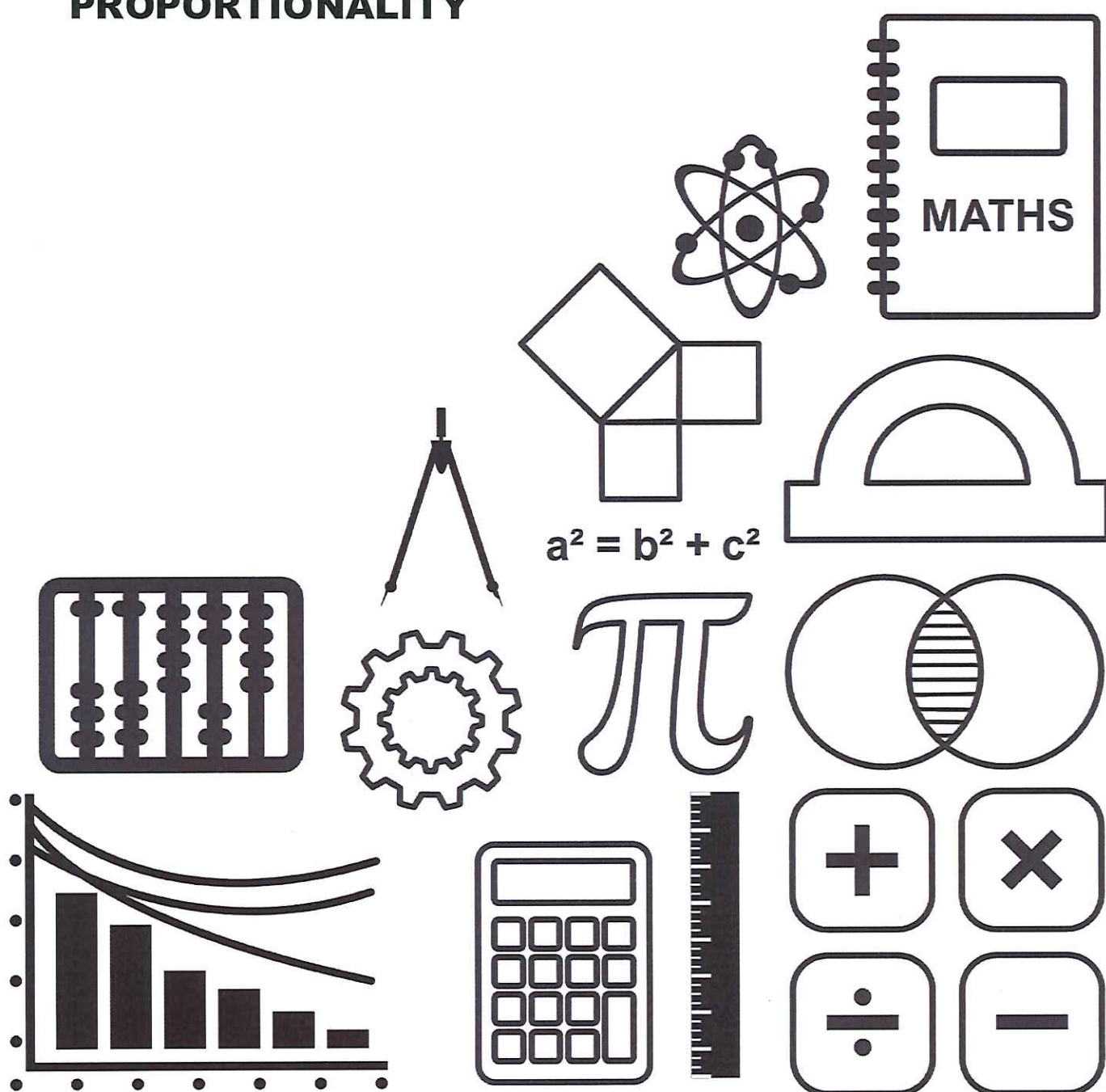


GCSE TOPIC BOOKLET PROPORTIONALITY



1.

It takes 4 hours to empty 6 identical tanks of oil using 15 identical pumps.

How long would it take to empty 2 of these tanks using 3 of these pumps?
Give your answer in hours and minutes.

Tanks	Pumps	Hours
6	15	4
2	5	4
2	1	20
2	3	<u><u>20 hours</u></u> <u>3</u>

$$= 6 \frac{2}{3} \text{ hours}$$

$$= \underline{\underline{6 \text{ hours and } 40 \text{ minutes}}}$$

[4]

2.

A builder paid a total of £1450 for 50 tonnes of gravel and 40 tonnes of sand.
The gravel cost £17 per tonne.

Calculate the cost of the sand per tonne.

[4]

$$\underline{\underline{50 \text{ tonnes gravel}}} = 50 \times £17$$

$$= \underline{\underline{£850}}$$

$$\therefore \underline{\underline{40 \text{ tonnes of sand}}} = £1450 - £850$$

$$= \underline{\underline{£600}}$$

$$\underline{\underline{\text{Cost of sand per tonne}}} = £600 \div 40$$

$$= \underline{\underline{£15}}$$

3.

A farmer is planning to fertilize one of his fields.
The fertilizer he needs is sold in two different sized bags.

- Each size A bag covers an area of 40 m^2 and costs £13.
- Each size B bag covers an area of 70 m^2 and costs £20.

The farmer knows that 65 size A bags contain exactly enough fertilizer for the field.
The local supplier has only size B bags in stock.

Calculate the difference in the cost of buying 65 size A bags and the cost of buying the least number of size B bags needed to fertilize the field. [4]

$$65 \times 40 = 2600 \text{ m}^2 \text{ from 65 size A bags}$$

$$2600 \div 70 = 37.142 \dots = 38 \text{ size B bags}$$

$$\text{Cost if buy size A} = 65 \times 13 = \text{£}845$$

$$\text{Cost if buy size B} = 38 \times 20 = \text{£}760$$

$$\text{Cost difference} = \text{£}845 - \text{£}760$$

$$= \text{£}85$$

4.

A construction company used 36 manual workers to prepare a building site. The site measured 42 acres and the work was completed in 10 days.

The company is asked to do similar work on a similar site measuring 70 acres. This contract has to be completed in 15 days.

Calculate the least number of manual workers the company should employ for this contract.

[3]

Workers	Acres	Days
36	42	10
36	21	5
36	63	15
4	7	15
40	70	15

40 workers

5.

Azira is planning to paint the inside walls of her community centre. A shop is selling the paint she wants in two different-sized tins.

- One tin of size A will cover an area of 24m^2 .
- One tin of size B will cover an area of 45m^2 .

Azira knows that 9 tins of size A will be just enough to paint all of the walls.

What is the least number of tins of size B that would be enough to paint all of the walls?

[3]

$$\begin{aligned} 9 \text{ tins of size A} &= 9 \times 24 \\ &= 216 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Number of size B needed} &= 216 \div 45 \\ &= 4.8 = \underline{\underline{5 \text{ tins of size B}}} \end{aligned}$$

6.

Five identical industrial water pumps working at full capacity can drain 600 000 litres of water in 7 hours.

A local council needs to drain 450 000 litres of water from a flooded area. The work must not take more than 3 hours to complete.

What will be the least number of these water pumps required for this task?

[3]

Pumps	Litres	Hours
5	600,000	7
5	150,000	$7/4$
5	450,000	$\frac{3 \times 7}{4} = \frac{21}{4}$
$5/4$	450,000	21
$5/4 \times 7$	450,000	3
<u>8.75</u>		

9 pumps would be needed

7.

It takes 6 hours for 8 tractors to plough an area of 35 acres.

What is the minimum number of tractors that will be needed to plough 19 acres in less than 5 hours?

You may assume that all the tractors work at the same rate and that all other conditions are similar.

[4]

Tractors	Acres	Hours
8	35	6
8	1	$6/35$
8	19	$6/35 \times 19 = \frac{114}{35}$
$8 \div 35 = 8/35$	19	114
$\frac{8}{35} \times 114 = \frac{912}{35}$	19	1
$\frac{912}{35} \div 5$	19	5
<u>$= 5.211...$</u>		

6 tractors would be needed

8.

- (a) A school's new photocopier will copy three times as many sheets as its old photocopier in the same amount of time.

It used to take 20 minutes to copy 500 sheets on the old photocopier.

How long will the new photocopier take to copy 600 similar sheets?

Old photocopier $20 \text{ mins} = 500 \text{ sheets}$
 $20/5 = 4 \text{ mins} = 100 \text{ sheets}$
 $4 \times 6 = 24 \text{ mins} = 600 \text{ sheets}$

New photocopier = $3 \times \text{faster} = 24/3 = 8 \text{ minutes}$

[3]

- (b) In one round of a competition, Sian is given an initial score of $6\frac{3}{5}$.

Her score is to be revised to take into account the degree of difficulty of that round.

Her new score is found by calculating $6\frac{3}{5} \div \frac{9}{10}$.

Find Sian's new score.

Your answer must be given as a whole number and a fraction (not as a decimal).

$= \frac{33}{5} \div \frac{9}{10} = \frac{33}{5} \times \frac{10}{9} = \frac{66}{9}$

$= 7\frac{3}{9} \quad \left(7\frac{1}{3}\right)$

[2]

9.

A pump is used to fill empty tanks with oil.

It takes 27 minutes to fill 6 identical tanks when the flow rate is 5 litres per second.

Calculate how long it would take to fill 8 of these tanks when the flow rate is 9 litres per second.

[3]

Minutes	Tanks	Litres/second
27	6	5
27	2	$5/3$
27	8	$5/3 \times 4 = 20/3$
$27 \times 20/3$	8	1
$27 \times 20/3$	8	9
<u>9</u>		
$= 20 \text{ minutes}$		

10.

A fruit grower knows that it usually takes 20 workers 8 hours to pick 420 kg of strawberries. She needs to pick 360 kg of strawberries in 5 hours.

What is the minimum number of workers she should employ?
You may assume that all workers pick strawberries at the same rate.

[4]

Workers	Hours	Kgs
20	8	420
$20 \times 8 = 160$	1	420
$160 \div 5 = 32$	5	420
$32 \div 7$	5	60
$32 \div 7 \times 6$	5	360
$= 27.428 \dots$		

$= 28$ workers

11.

Equal-sized trucks were hired to carry 250 tons of soil from one building site to another.

On the first day, it took 10 hours for 3 of these trucks to move 100 tons of soil.
On the second day, 5 of these trucks were used to move the remaining 150 tons of soil.

How long did it take to complete the work on the second day?

You may assume that all other conditions remained the same for both days.

[3]

Hours	Trucks	Tons
10	3	100
5	3	50
15	3	150
45	1	150
$45 \div 5 = 9$	5	150

$= 9$ hours