OCR
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F

GCSE (9–1) Mathematics

J560/03 Paper 3 (Foundation Tier)

Wednesday 8 November 2017 – Morning

Time allowed: 1 hour 30 minutes

You may use:
- A scientific or graphical calculator
- Geometrical instruments
- Tracing paper

Model Solutions

First name	
Last name	

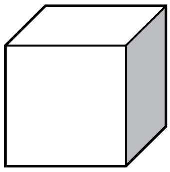
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- This document consists of **24** pages.

Answer **all** the questions.

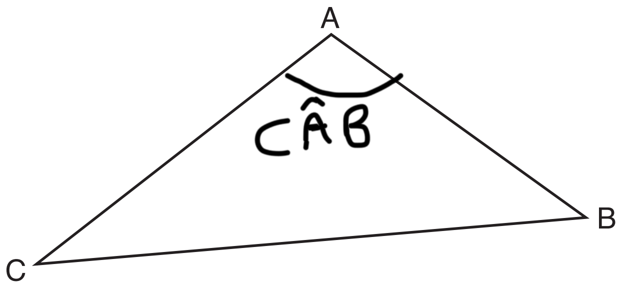
1 **(a)** Use one of these words to complete the sentence.



edges   vertices   faces   planes

A cube has 12 edges .... **[1]**

(b) The diagram shows a triangle ABC.



Mark angle CAB. **[1]**

(c) Use one of these terms to complete the sentence.

a circle   an angle   a straight line   the perimeter

The shortest distance between two points is a straight line .... **[1]**

2 **(a)** Work out $\frac{2}{7} + \frac{1}{7}$.

$$\frac{2+1}{7} = \frac{3}{7}$$

(a) $\frac{3}{7}$ .... **[1]**

(b) The fraction $\frac{n}{16}$ is between $\frac{1}{4}$ and $\frac{1}{2}$.

Write down all the possible values of n.

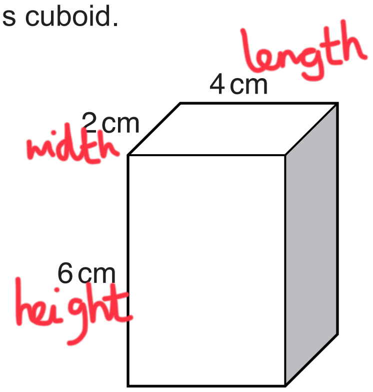
In between $\frac{4}{16}$ and $\frac{8}{16}$ → n is between 4 and 8.

$$\frac{1}{4} = \frac{4}{16}$$

$$\frac{1}{2} = \frac{8}{16}$$

(b) n = 5, n = 6 or n = 7 .... **[2]**

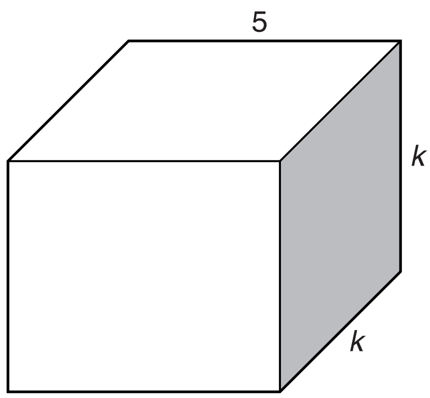
3 **(a)** Calculate the volume of this cuboid.



Volume = 6 × 2 × 4
= 48 cm³

(a) ....48........ cm^3 **[2]**

(b) In this cuboid all lengths are in centimetres.



The cuboid has a volume of 320 cm^3.

Find the value of *k*.

Volume = $5 \times k \times k = 5k^2$

$5k^2 = 320$

$k^2 = 64$

$k = 8$

(b) k = ...8........ **[3]**

4 **(a)** Fill in each missing number.

(i) 24 – ......12...... = 36 **[1]**

$24 - x = 36$

$24 - 36 = x$

$x = -12$

(ii) $\sqrt{......256......}$ = 16 **[1]**

$\sqrt{y} = 16$

$y = 16^2$

$y = 256$

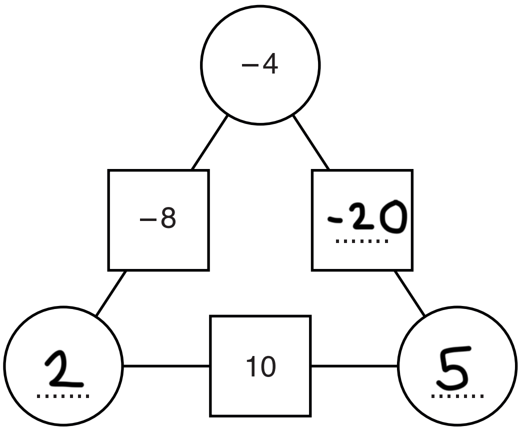
(b) The length of a line is 10.4 cm, correct to 1 decimal place.

Write down the shortest possible length of the line.

± 0.05

(b) ......10.35...... cm **[1]**

5 To find the number in a square, multiply the numbers in the two circles connected to it.



Fill in the missing numbers. **[3]**

6 (a) Lucy and Ben share £42.
Lucy's share is £30.

Write the ratio Lucy's share : Ben's share in its simplest form.

$42 - 30 = £12$

Lucy : Ben

÷6 30 : 12 ÷6

5 : 2

(a) .... : .... [2]

(b) The ratio 2.5 metres to 70 centimetres can be written in the form 1 : *n*.

Find the value of *n*.

$2.5m = 2.5 \times 100cm = 250cm$

250 : 70

$1 : \frac{7}{25}$

1 : 0.28

(b) *n* = 0.28 [2]

(c) Water flows at a steady rate from a tap.
It takes 50 seconds to fill a 5 litre watering can from this tap.

The rate at which water flows from the tap is halved.

(i) Complete.

1 litre = $1000cm^3$

5 litres = 5000 cm^3 [1]

(ii) Find the rate at which the water is **now** flowing from the tap.
Give your answer in cubic centimetres per second (cm^3/s).

$5000cm^3 \div 2 = 2500cm^3$ (in 50 seconds)

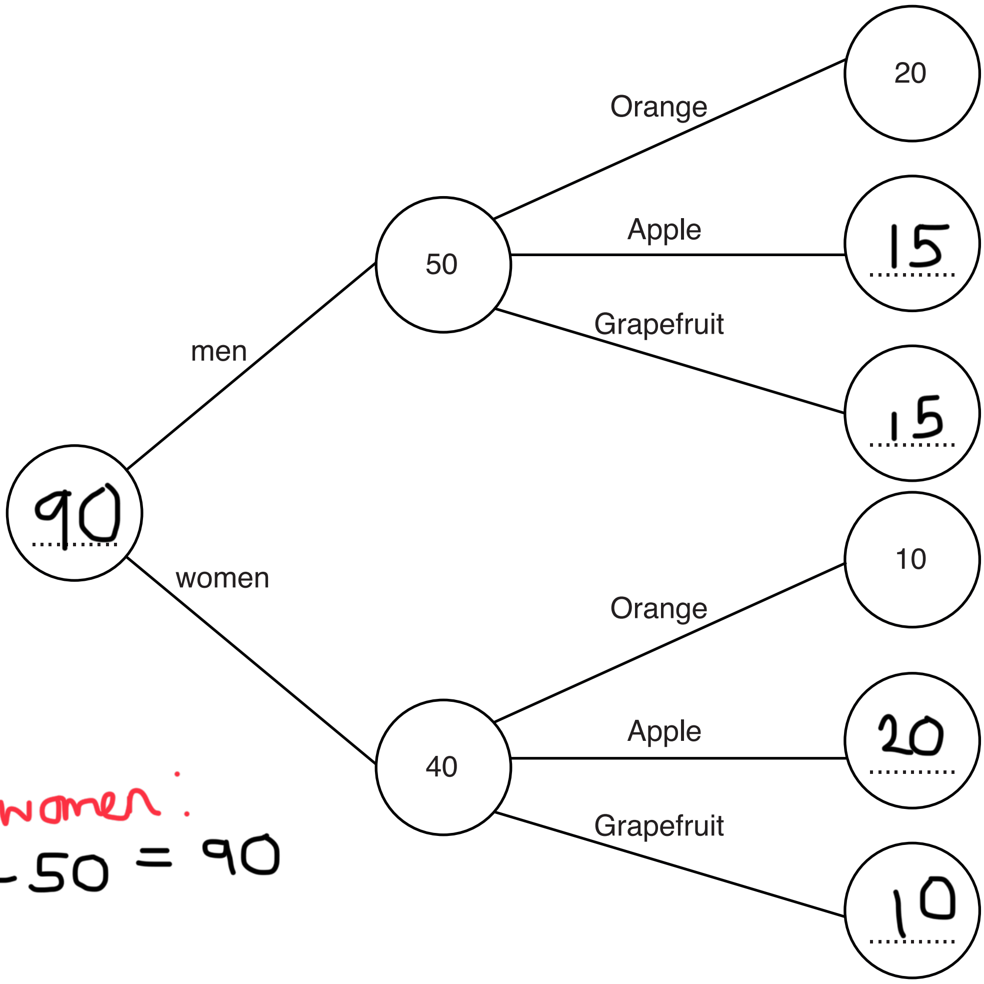
$2500cm^3 \div 50 = 50cm^2$ (in 1 second)

(ii) 50 cm^3/s [2]

7 **(a)** A hotel manager asked some people to choose their favourite breakfast fruit juice. They each chose one from Orange, Apple or Grapefruit.

- 20 men chose Orange
- Equal numbers of men chose Apple and Grapefruit.
- 10 women chose Orange
- Twice as many women chose Apple as Grapefruit.

Use this information to complete the frequency tree.



[4]

men + women:

$40 + 50 = 90$

men:

$A = G$

$O + A + G = 50$

$20 + 2A = 50$

$A = 15$

$G = 15$

women:

$G = \frac{1}{2}A$

$O + A + G = 40$

$10 + 3G = 40$

$3G = 30$

$G = 10 \quad A = 20$

(b) In one week 200 men have breakfast at the hotel.

(i) How many men may be expected to drink Orange?

$P(\text{orange}) = \frac{20}{50} = \frac{2}{5}$

$\frac{2}{5} \times 200 = \frac{400}{5} = 80$ **(b)(i)** .... 80 .... **[1]**

(ii) Give one reason why the number of men who drink Orange in this week may be different to your answer to part **(b)(i)**.

The men in the sample are different to the men having breakfast that week, so are likely to make different decisions. **[1]**

8 The average mass of a man is 84 kg and of a woman is 70 kg.

A lift can safely carry 630 kg.

To find how many people the lift can safely carry, Dan divides the safe total mass by the average mass of a person.

$$630 \div 77 = 8.18...$$

(a) How has the average mass of a person, 77 kg, been worked out?

Finding the mean of men and women:

$\frac{84 + 70}{2} = 77$ **[1]**

Dan decides that his answer shows the lift can safely carry 8 people.

(b) Explain why he is wrong and give an example, with working, to support your answer.

84kg and 70kg is only the average mass, but some people may be heavier. E.g. if 4 men got in with a mass of 90kg, and 4 women with a mass of 75kg the total weight would be:

$(4 \times 90) + (4 \times 75) = 360 + 300$

$= 660\text{kg}$

660kg exceeds 630kg, so 8 people would not be able to be safely carried. **[3]**

9 **(a)** Elsie changes $\frac{3}{8}$ to a decimal.

This is her working.

$\frac{3}{8}$ is $\frac{1}{8}$ more than $\frac{1}{4}$ $\left(\frac{1}{4}+\frac{1}{8}=\frac{2}{8}+\frac{1}{8}=\frac{3}{8}\right)$ ✓

$\frac{1}{4}$ is the same as 0.14 $\frac{1}{4} = 1 \div 4 = 0.25$

$\frac{1}{8}$ is $\frac{1}{4} \times 2 = 0.28$ $\frac{1}{8} = \frac{1}{4} \div 2 = 0.25 \div 2 = 0.125$

so $\frac{3}{8} = 0.14 + 0.28 = 0.42$ $0.25 + 0.125 = 0.375$

Where a line of working is wrong, write the correct working beside it. **[3]**

(b) Ali has 1 litre of squash.
He always mixes 0.05 litres of squash with 200 ml of water to make a glass of drink.

Find the total volume of the drink that Ali can make.
Give your answer in litres.

2L ÷ 0.05L = 20 glasses

200ml in 1 glass

4000ml in 20 glasses

4000 ml ÷ 1000 = 4L

1L + 4L = 5l

(b) ....5........ litres **[2]**

10 **(a)** Write 7 × 7 × 7 × 7 as a power of 7.

4 sevens

(a) 7^4 **[1]**

(b) Complete this working to write 4^3 as a power of 2.

$4^3 = 4 \times 4$ × 4

so $4^3 = 2 \times 2 \times 2 \times$ 2 × 2 × 2

so $4^3 =$ 2^6 **[2]**

(c) Write these numbers in order, starting with the largest.

8.1×10^1	1.02×10^3	9.83×10^{-2}	3×10^2
81	1020	0.0983	300

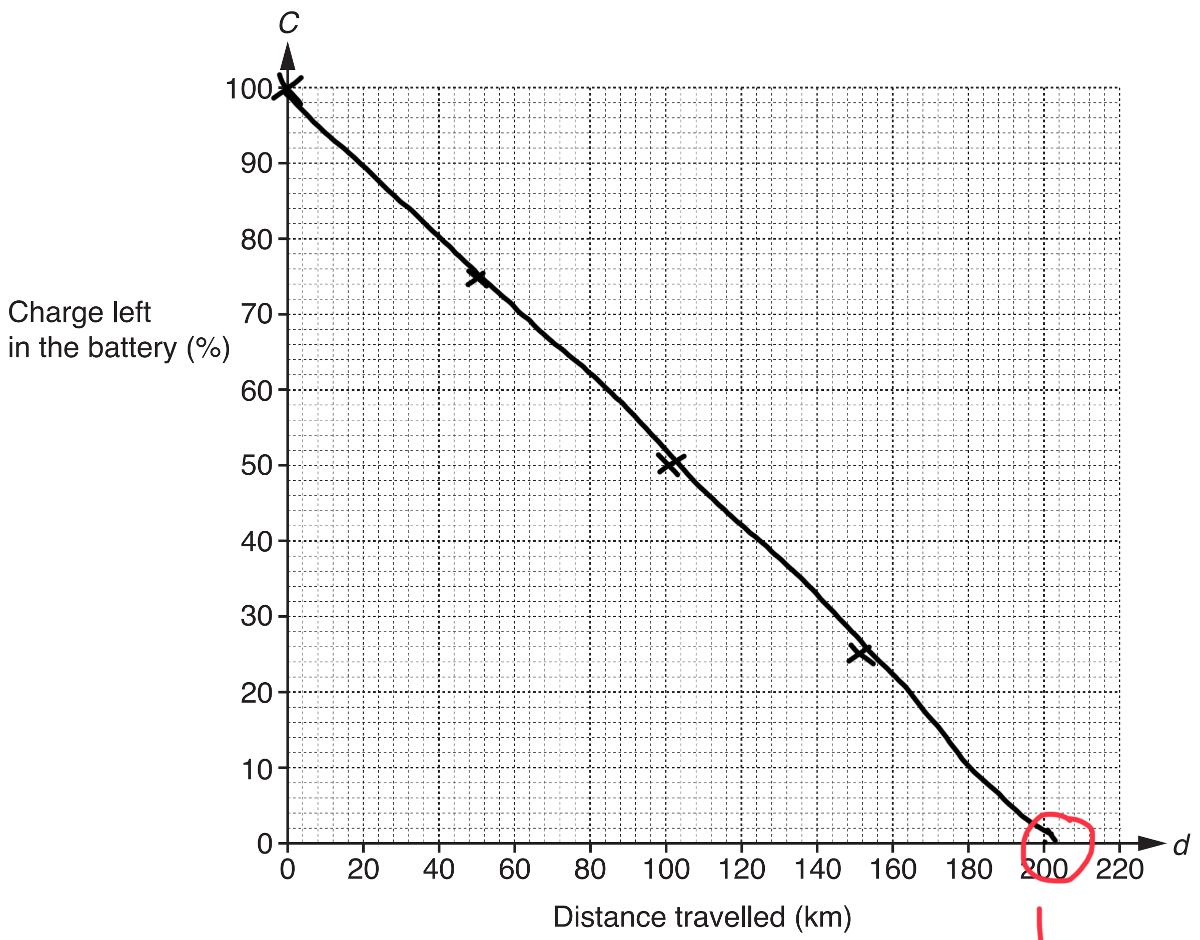
(c) 9.83×10^{-2} , 8.1×10^1 , 3×10^2 , 1.02×10^3 **[1]**
largest

11 A company tests a new battery for an electric car.
The distance the car travels, d km, and the charge left in the battery, C%, are measured.

Some measurements are shown in the table.

Distance travelled, d km.	0	50	100	150
Charge left in the battery, C%.	100	75	50	25

(a) Plot these values on the grid and use them to draw a straight line.



[2]

(b) **(i)** Use your line to estimate the greatest distance the car will travel.

(b)(i) ....200........ km **[1]**

(ii) What assumption is made when estimating the greatest distance?

Battery is okay to run car
all the way down to 0% **[1]**

(c) For your line in part **(a)**, find

(i) the gradient,

$$\frac{35-70}{130-60} = \frac{-35}{70} = -\frac{1}{2}$$

(c)(i) $-\frac{1}{2}$ **[1]**

(ii) the C-axis intercept.

where it crosses vertical axis

(ii) 100 **[1]**

(d) Use your answers to part **(c)** to write down the equation of your graph.

Give your equation in the form $C = ad + b$.

a = gradient b = C-intercept

$y = mx + c$

$C = ad + b$

(d) $C =$ $-\frac{1}{2}d + 100$ **[1]**

(e) **(i)** Use your equation to find the value of C when $d = 210$.

$C = -\frac{1}{2}(210) + 100$

$C = (-\frac{1}{2} \times 210) + 100$

$C = -5$

(e)(i) -5 **[2]**

(ii) Comment on your answer.

It is impossible for a battery to have −5%, as this is negative so car cannot travel 210km without battery being recharged. **[1]**

12 **(a)** Find the coordinates of the point where $y - 2x = 1$ crosses the y-axis.

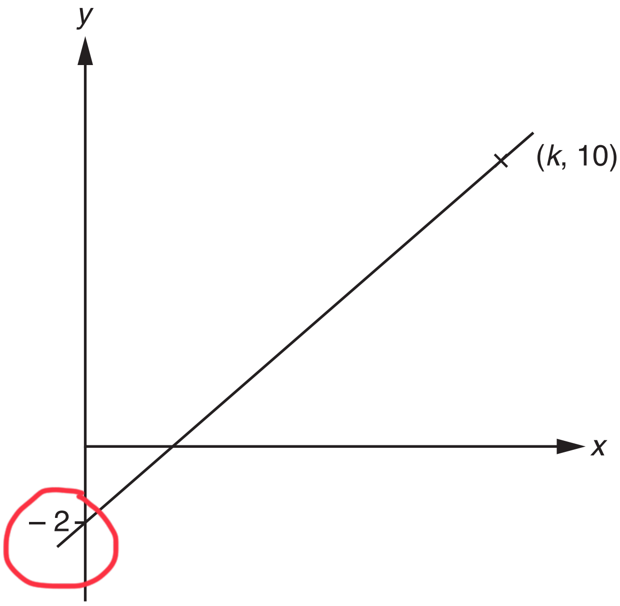
When crossing y-axis, $x=0$

$y - 0 = 1$

$y = 1$

(a) (..........0.......... , ...1..........) **[2]**

(b) The diagram shows the graph of $y = 3x + c$, where c is a constant.



Find the value of k.

$y = 3x + c$

$y = 3x - 2$

At $(k, 10)$ $x = k$, $y = 10$

$10 = 3k - 2$

$k = 4$

(b) k = ...4.......... **[3]**

13 A company makes sweets.
The sweets are put into packets.

Here are some facts.

1.47×10^7 sweets are made every day	3.5×10^5 packets of sweets are produced every day

(a) Calculate the mean number of sweets in one packet.

$$\text{mean} = \frac{\text{total sweets produced}}{\text{total packets produced}} = \frac{1.47 \times 10^7}{3.5 \times 10^5}$$

(a) ....42........ **[2]**

(b) Sweets are made on 288 days each year.

Calculate the number of sweets made each year.
Give your answer in standard form.

Sweets per year = days × sweets per day

$= 288 \times 1.47 \times 10^7$

(b) ....4.2336×10^9........ **[3]**

(c) The company has 152 machines making the sweets.
Each machine operates for 15 hours each day.

(i) Calculate the number of sweets made by one machine each hour.
Give your answer as an ordinary number correct to the nearest 10.

$1.47 \times 10^7 \div 152 = 96710.5 \rightarrow 96711$

$96711 \div 15 = 6447.4 \approx 6450$

(c)(i) ....6450........ **[3]**

(ii) State one assumption you have made in part **(c)(i)**.

All machines make sweets at the same rate for the whole time. **[1]**

14 A shop records the time taken by its customers to complete a purchase on its website. The results from one day are summarised in this table.

Time taken (t minutes)	Number of customers	Midpoint	Midpoint x frequency
$0 < t \leqslant 3$	6	1.5	9
$3 < t \leqslant 6$	10	4.5	45
$6 < t \leqslant 9$	6	7.5	45
$9 < t \leqslant 12$	2	10.5	21
$12 < t \leqslant 15$	1	13.5	13.5

(a) Calculate an estimate of the mean time taken.

$$\text{mean} = \frac{\text{sum of (midpoint} \times \text{frequency)}}{\text{sum of frequency}}$$

$$= \frac{133.5}{25} = 5.34$$

(a) ......5.34...... minutes **[4]**

(b) Explain why it is not possible to use the information from this table to calculate the **exact** value of the mean time taken.

Because the exact time of each customer is not recorded.

.... **[1]**

15 Luka invests £1500.
At the end of the first year, 2% interest is added.
At the end of the second year, after interest has been added, the investment is worth £1606.50.

Show that 5% interest has been added at the end of the second year. **[4]**

After Year 1 :

$100\% + 2\% = 102\% = 1.02$

$£1500 \times 1.02 = £1530$

Interest in Year 2:

difference : $£1606.50 - £1530 = £76.50$

% interest : $\frac{£76.50}{£1530} \times 100\%$

$= 0.05 \times 100\%$

$= \boxed{5\%}$

16 **(a)** Two bags each contain only red counters and yellow counters.

In Bag A, the ratio of red counters to yellow counters is 1 : 4.

In Bag B, $\frac{1}{4}$ of the counters are red.

(i) Sharon says

The proportion of the counters that are red is the same in both bags.

Explain why Sharon is not correct.

In bag A ratio is 1 : 4

As a fraction this is $\frac{1}{5}$

$\frac{1}{5} \neq \frac{1}{4} \rightarrow$ Sharon is incorrect. **[1]**

(ii) The number of counters in the two bags is the same.

Complete the table below to show how many counters of each colour could be in the bags.

Bag A: Yellow = 4 x red

Bag B: Yellow = 3 x red

$Y_A + R_A = Y_B + R_B$

$\frac{1}{4} = \frac{5}{20}$ $\quad \frac{1}{5} = \frac{4}{20}$

	Red counters	Yellow counters
Bag A	4	16
Bag B	5	15

[3]

(b) In another bag, Bag C, the ratio of red counters to yellow counters is 3 : 4.
If 3 of the red counters are removed from Bag C, the ratio of red counters to yellow counters is 3 : 5.

How many **yellow** counters are in Bag C?

Red : Yellow $\xrightarrow[\text{reds taken}]{\text{After 3}}$ Red : Yellow

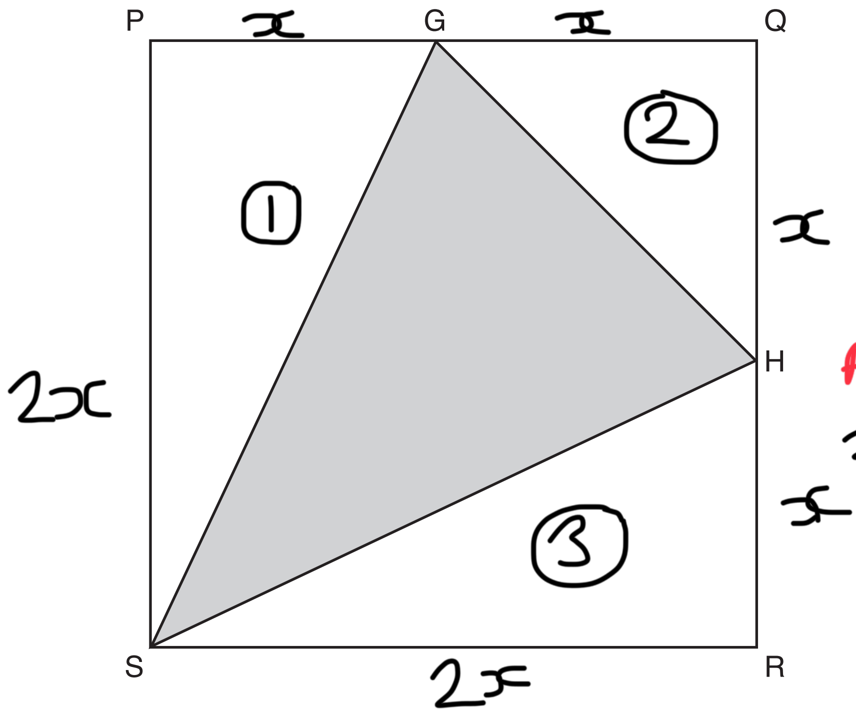
3 : 4 3 : 5

×5 ×4

15 : 20 12 : 20

(b) 20 .... [3]

17 PQRS is a square.
G is the midpoint of PQ and H is the midpoint of QR.
Triangle GHS is shaded.



Area of square:
$2x \times 2x = 4x^2$

Find the ratio shaded area : area of square in its simplest form.
Show all your working.

$$2x \times 2x = 2 \times 2 \times x \times x = 4x^2$$

Area of triangle 1:
$\frac{1}{2} \times x \times 2x = x^2$

Area of triangle 2:
$\frac{1}{2} \times x \times x = \frac{1}{2}x^2$

Area of triangle 3:
$\frac{1}{2} \times x \times 2x = x^2$

total unshaded: $2.5x^2$

total shaded: $1.5x^2$

Ratio: $1.5x^2 : 4x^2$

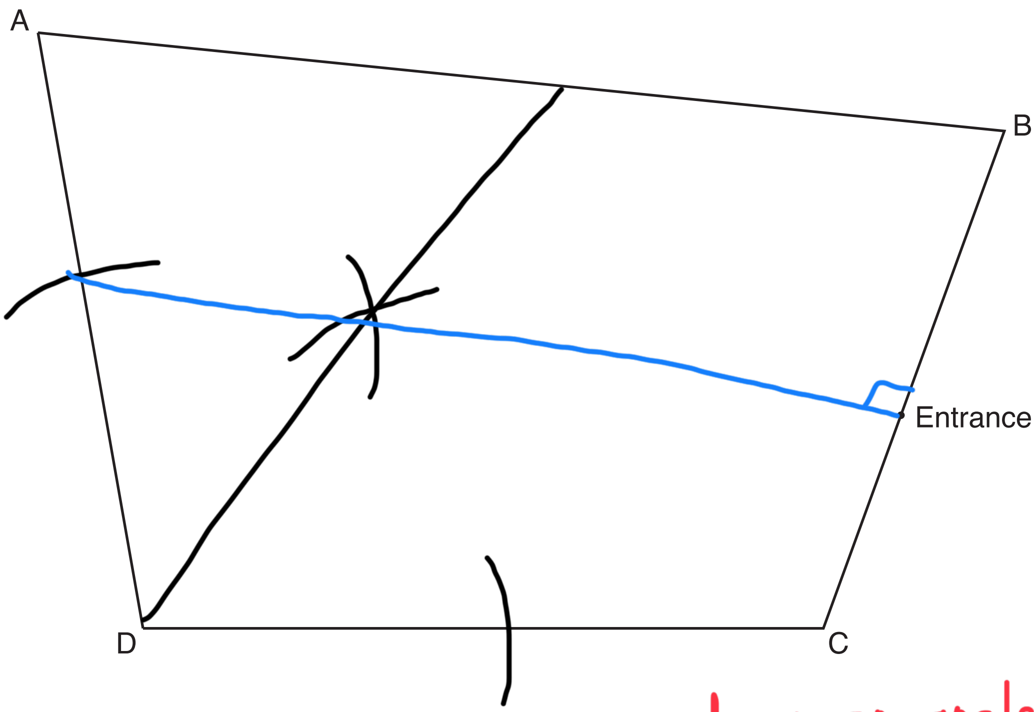
$1.5 : 4$ ×2

$3 : 8$

3 : 8 **[4]**

18 The diagram shows a scale drawing of a park, ABCD.

Scale: 1 cm represents 10 m



draw an angle bisector of $\hat{ADC}$, using a compass

(a) A straight water pipe runs across the park.
The pipe runs equidistant from DA and DC.

Construct, using compasses and ruler only, the position of the water pipe.
You must show all your construction lines. **[2]**

(b) A straight path connects the entrance to the exit.
This path is perpendicular to CB.

(i) Construct, using compasses and ruler only, the position of the path.
Leave in all your construction lines. **[2]**

Construct a perpendicular bisector of CB.

(ii) Find the actual length of the path, in metres.

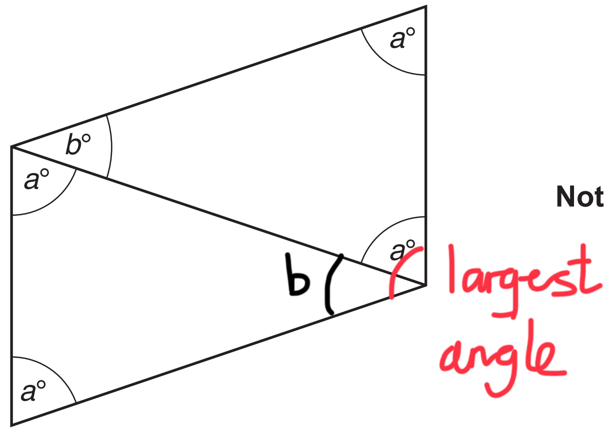
1cm : 10m

×12

12cm : 120m

(b)(ii) ....120.......... m **[2]**

19 Two congruent, isosceles triangles are joined, as shown, to form a parallelogram.
The largest angle of the **parallelogram** is 110°.



Not to scale

Write two equations.
Solve them to find the value of *a* and the value of *b*.

$4a + 2b = 360°$ (Angles in parallelogram sum to 360°)

$2a + b = 180°$

$a + b = 110°$ ①

$2a + b = 180°$ ②

② − ① : $a + 0 = 70°$

$a = 70°$

$b = 40°$

a = 70°

b = 40° **[4]**

20 The middle number of three consecutive whole numbers is $2a$.

Prove that the sum of these three numbers cannot be 250. **[3]**

first number: $2a - 1$

last number: $2a + 1$

Sum: $(2a-1) + (2a) + (2a+1) = 6a$

If sum = 250: $6a = 250$

$a = 41.\dot{6}$ (not a whole number)

a cannot be an integer and $6a$ sums to 250, as $250 \div 6 \neq$ integer.

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).