



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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I declare this is my own work.

# GCSE MATHEMATICS

# H

Higher Tier Paper 1 Non-Calculator

Friday 19 May 2023

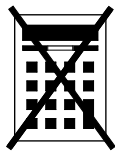
Morning

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (enclosed).



You must **not** use a calculator.

## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use

Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
<b>TOTAL</b>	

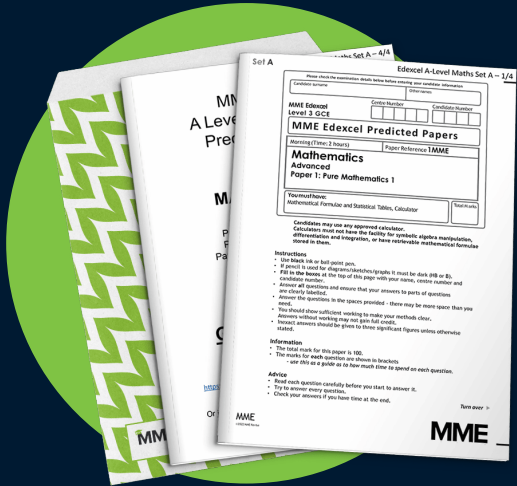


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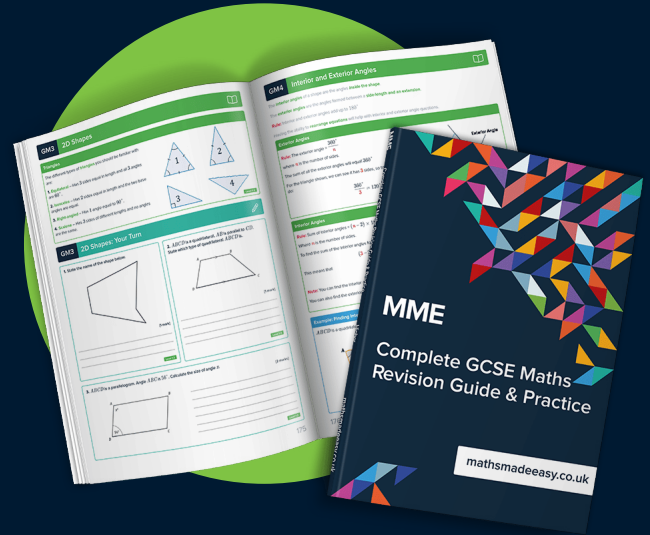
IB/M/Jun23/E8

**8300/1H**

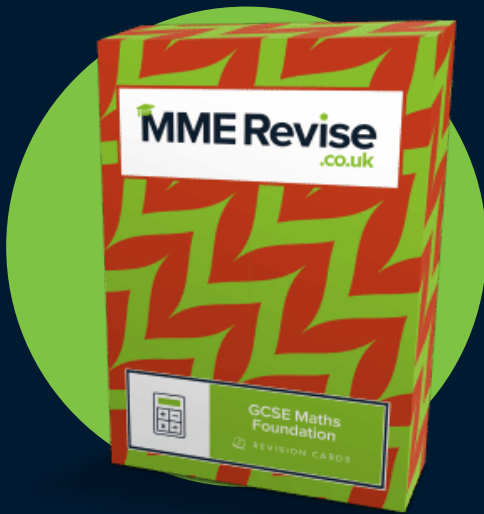
# MME. GCSE Revision - GCSE Maths



GCSE Maths Predicted Papers 2024



GCSE Maths Revision Guide



GCSE Maths Revision Cards



Course in a Box – GCSE Maths (Guaranteed Pass)

Answer **all** questions in the spaces provided.1 (a) Work out  $0.7 \times 0.5$ 

[1 mark]

Answer 0.351 (b) Work out  $\frac{5}{6} \div 3$ 

[1 mark]

$$\frac{5}{6} \div \frac{3}{1} = \frac{5}{6} \times \frac{1}{3} = \frac{5}{18}$$

Answer  $\frac{5}{18}$ 1 (c) Work out  $27 \div 0.6$ 

[1 mark]

$$27 \div 0.6 = 270 \div 6$$
$$= 45$$

$$6 \overline{) 270} \begin{array}{r} 045 \\ \underline{24} \phantom{0} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

Answer 45

2 Solve  $2x < 26$  [1 mark]

$\div 2 \left( \begin{array}{l} 2x < 26 \\ x < 13 \end{array} \right) \div 2$

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Answer  $x < 13$

3 Work out the value of  $\left(\frac{3}{2}\right)^2$  [1 mark]

Give your answer as a mixed number.

$\frac{3}{2} \times \frac{3}{2} = \frac{9}{4} = 2\frac{1}{4}$

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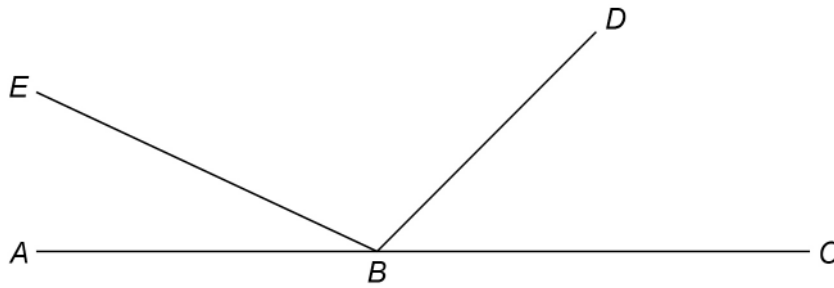
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Answer  $2\frac{1}{4}$

Turn over for the next question



4  $ABC$ ,  $BD$  and  $BE$  are straight lines.



Not drawn  
accurately

$$\text{angle } EBD = 5 \times \text{angle } ABE$$

$$\text{angle } DBC = 3 \times \text{angle } ABE$$

$$\begin{aligned} ABE : EBD : DBC \\ 1 : 5 : 3 \end{aligned}$$

Work out the size of angle  $EBD$ .

[3 marks]

Angles add to  $180^\circ$  so divide 180 in ratio 1:5:3

$$1+5+3 = 9 \text{ parts so } 9 \text{ parts} = 180^\circ$$

$$1 \text{ part} = 20^\circ$$

$$5 \text{ parts} = 100^\circ$$

$$\text{So } EBD = 100^\circ$$

Answer \_\_\_\_\_  $100^\circ$



- 5 Two prime numbers are multiplied together.  
The answer is an **even** number between 50 and 60  
Complete the calculation.

[3 marks]

$$\boxed{2} \times \boxed{29} = \boxed{58}$$

prime numbers: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37 ...

- 6 Andrew and Bruce share some money in the ratio 5 : 6  
Bruce gets £96

Andrew gives  $\frac{1}{4}$  of his share to Carl.

Bruce gives  $\frac{2}{3}$  of his share to Carl.

How much money does Carl receive?

[4 marks]

Looking at Bruce, 6 parts = £96

$$\begin{array}{r} 16 \\ 6 \overline{)96} \end{array}$$

1 part = £16

5 parts = £80 So Andrew gets £80

Andrew gives £80 ÷ 4 = £20 to Carl

Bruce gives £96 ÷ 3 × 2 = £64 to Carl

Carl gets £20 + £64 = £84

Answer £ 84



7

$$2^a \times 3 \times 5^2 = 600$$

Work out the value of  $a$ .You **must** show your working.**[3 marks]**

$$2^a \times 3 \times 25 = 600$$
$$\div 75 \left( 2^a \times 75 = 600 \right) \div 75$$
$$2^a = 8$$
$$2 \times 2 \times 2 = 8 \text{ so } 2^3 = 8$$
$$a = 3$$

$$a = \underline{3}$$

8

Expand and simplify fully  $5(3x + 4) - 2(x - 1)$ **[2 marks]**

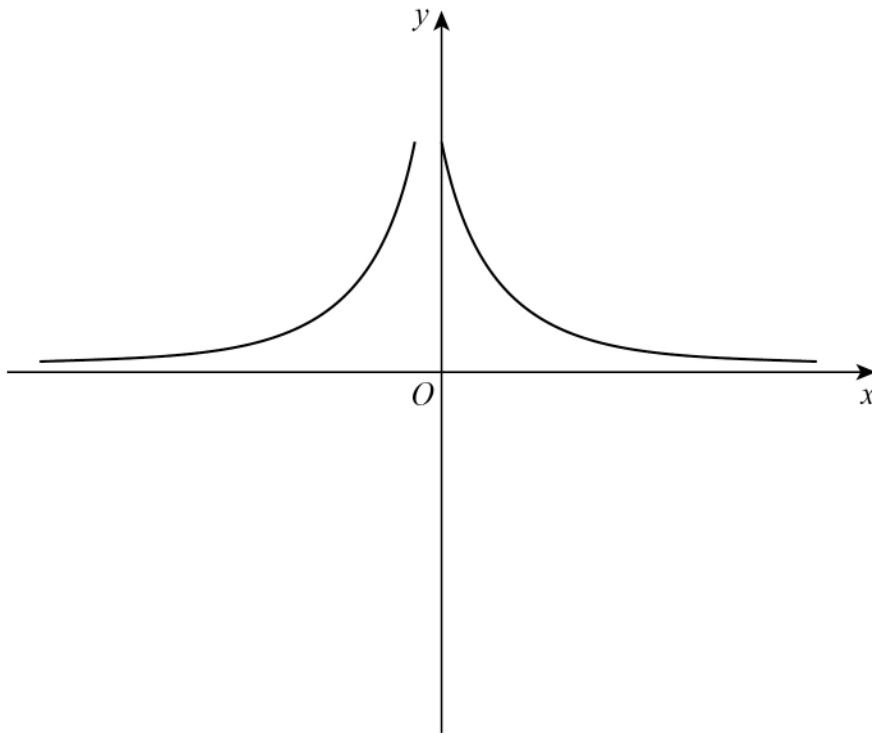
$$15x + 20 - 2x + 2$$

$$13x + 22$$

$$\text{Answer } \underline{13x + 22}$$



- 9 Erika tries to sketch the graph  $y = \frac{1}{x}$  with  $x \neq 0$




Make **two** different criticisms of her sketch.

[2 marks]

Criticism 1 graph passes through point where  $x=0$  and question  
says  $x \neq 0$

Criticism 2 graph incorrect for negative  $x$  values

graph should be this shape: 





10

Sunita is  $x$  years old.Beth is one year younger than Sunita.  $x - 1$ Joel is double Sunita's age.  $2x$ 

The mean of their ages is 5

How old is **Joel**?**[5 marks]**

three people with mean age 5 so total age is  $5 \times 3 = 15$  years

$$x + x - 1 + 2x = 15$$

$$4x - 1 = 15$$

$$4x = 16$$

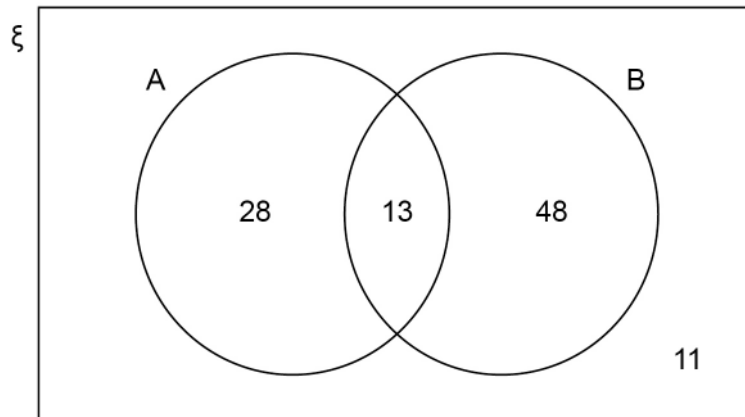
$$x = 4$$

Joel is  $2x$  years old, so  $2 \times 4 = 8$

Answer 8 years



- 11 The Venn diagram represents 100 items.



- 11 (a) Write down  $P(A \cap B)$  *middle section*

[1 mark]

Answer  $\frac{13}{100}$

- 11 (b) Work out  $P(A')$  *not A*

[1 mark]

$$\frac{48 + 11}{100} = \frac{59}{100}$$

Answer  $\frac{59}{100}$

- 11 (c) Work out  $P(A \cup B)$  *A or B or both*

[1 mark]

$$\frac{28 + 13 + 48}{100} = \frac{89}{100}$$

Answer  $\frac{89}{100}$



12 (a)  $a \times 10^n$  is a number in standard form.

Complete the inequality for the value of  $a$ .

[1 mark]

$$\underline{\quad\quad\quad} \leq a < \underline{\quad\quad\quad}$$

12 (b)  $b \times 10^n$  is the number 7200 written in standard form.

Work out  $b \times 10^{-n}$

Write your answer as an ordinary number.

[2 marks]

$$7200 = 7.2 \times 10^3$$

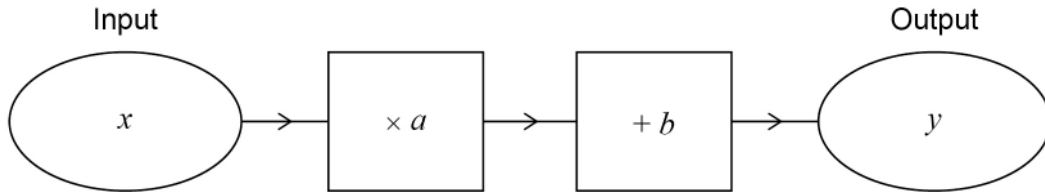
$$\text{So we need } 7.2 \times 10^{-3}$$

$$7.2 \times 10^{-3} = 0.0072$$

Answer 0.0072



13 (a) Here is a number machine.



Show that when the input increases by 2 the output increases by  $2a$ .

[2 marks]

$$y = ax + b$$

If input increases by 2,  $x$  becomes  $x + 2$

So we now get  $y = a(x + 2) + b$

$$y = ax + 2a + b \quad \leftarrow 2a \text{ more than original output}$$

13 (b)  $f(x) = kx^2$  where  $k$  is a constant.

Kai says that  $\frac{f(6)}{f(2)}$  is equal to  $f(3)$  because  $\frac{6}{2} = 3$

Is he correct?

Show working to support your answer.

[2 marks]

$$\begin{aligned} f(3) &= k \times 3^2 \\ &= 9k \end{aligned}$$

$$\begin{aligned} f(6) &= k \times 6^2 \\ &= 36k \end{aligned}$$

$$\begin{aligned} f(2) &= k \times 2^2 \\ &= 4k \end{aligned}$$

$$\text{so } \frac{f(6)}{f(2)} = \frac{36k}{4k} = 9$$

↑  
not  $9k$ , so not equal to  $f(3)$

No he is not correct



14

Here is a list of 11 whole numbers in numerical order.

The lower quartile, median, upper quartile and highest value are missing.

		LQ			M			UQ		
5	8	12	13	19	24	25	28	30	34	41

- median =  $2 \times$  lower quartile
- upper quartile =  $2.5 \times$  lower quartile
- range =  $2 \times$  interquartile range

Complete the list.

[2 marks]

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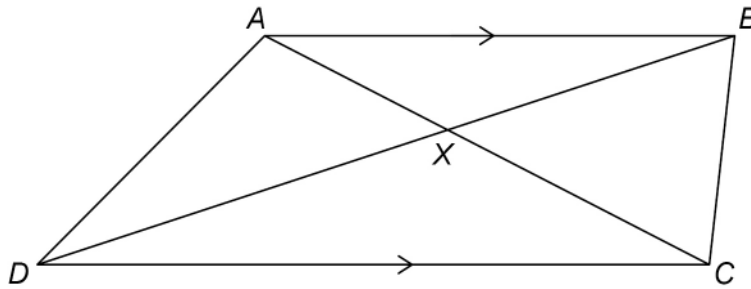
15

$ABCD$  is a trapezium.

All four sides are different lengths.

$AB$  is parallel to  $CD$ .

The diagonals intersect at  $X$ .



Not drawn  
accurately

For each statement, tick the correct box.

[4 marks]

	True	May be true	Not true
Triangles $AXB$ and $CXD$ are similar	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Triangles $AXD$ and $BXC$ are congruent	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Angle $ADB =$ angle $BDC$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Area of triangle $ABC =$ area of triangle $ABD$	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Turn over for the next question

Turn over ►



16

Solve the simultaneous equations

$$2x - 5y = 13 \quad \text{--- (1)}$$

$$3x + 4y = 8 \quad \text{--- (2)}$$

**[4 marks]**

$$(1) \times 4 \text{ gives } 8x - 20y = 52 \quad \text{--- (3)}$$

$$(2) \times 5 \text{ gives } 15x + 20y = 40 \quad \text{--- (4)}$$

$$(3) + (4) \text{ gives } 23x = 92$$

$$x = 4$$

$$\text{Substitute into (1) to get } 2 \times 4 - 5y = 13$$

$$8 - 5y = 13$$

$$5y = 8 - 13$$

$$5y = -5$$

$$y = -1$$

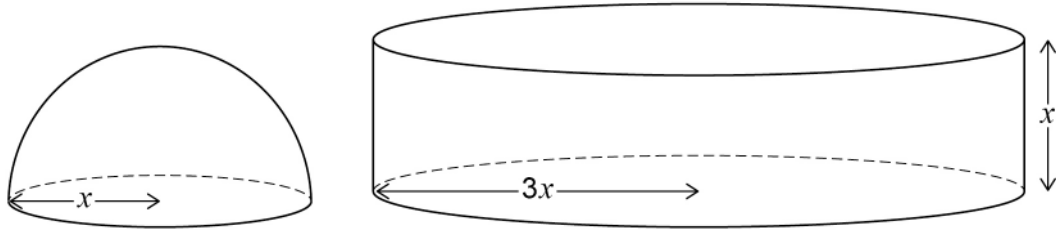
$$x = \underline{4} \quad y = \underline{-1}$$



17

A solid hemisphere has radius  $x$ .

A solid cylinder has radius  $3x$  and height  $x$ .



Surface area of a sphere =  $4\pi r^2$   
 where  $r$  is the radius

Work out the ratio

total surface area of the hemisphere : total surface area of the cylinder

Give your answer in its simplest form.

You **must** show your working.

[3 marks]

<u>hemisphere</u>	<u>cylinder</u>
$\frac{4\pi x^2 + \pi x^2}{2}$	$2 \times \pi \times (3x)^2 + \pi \times 6x \times x$
$= 2\pi x^2 + \pi x^2$	$= 2\pi \times 9x^2 + \pi \times 6x^2$
$= 3\pi x^2$	$= 18\pi x^2 + 6\pi x^2$
	$= 24\pi x^2$

ratio is  $3\pi x^2 : 24\pi x^2$

$3 : 24$

$1 : 8$

Answer 1 : 8

7

Turn over ►





18

$$6 < \sqrt[3]{x} < 7$$

Circle the possible value of  $x$ .

[1 mark]

1.9

20

45

290

19

Work out how many 5-digit **odd** numbers can be made using these digits **once** each.

2

4

6

7

9

Do **not** list them.

[2 marks]

5 options for first digit, 4 options left for second digit, 3 options left for third digit, 2 options for fourth digit, 1 option for last digit

So  $5 \times 4 \times 3 \times 2 \times 1 = 120$  possible numbers

Answer 48

But

Answer must be odd, so must end in 7 or 9. so only  $\frac{2}{5}$  of our 120 possible numbers will be odd.

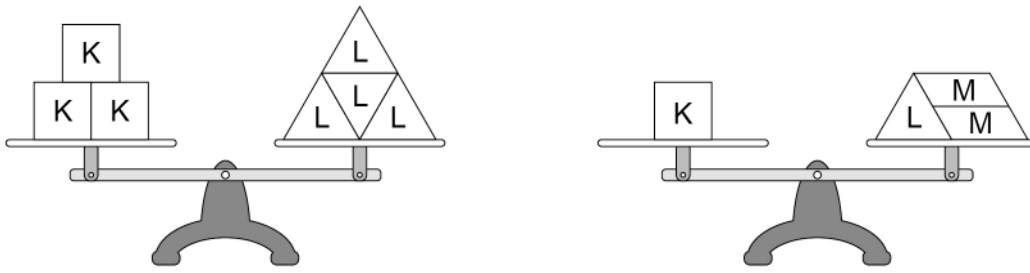
$$\frac{2}{5} \times 120 = 120 \div 5 \times 2$$

$$= \underline{\underline{48}}$$



20

K, L and M are weights.  
Both of the scales balance exactly.



How many M weights are needed to balance **one** L weight?

[3 marks]

$$3k = 4L \qquad k = L + 2m$$

$$k = \frac{4L}{3}$$

put eqns equal to each other :  $\frac{4L}{3} = L + 2m$

$$4L = 3L + 6m$$

$$L = 6m$$

$\left. \begin{array}{l} \curvearrowright \times 3 \\ \curvearrowright - 3L \end{array} \right\}$

So one L weight is the same as 6 m weights

Answer 6

Turn over for the next question

6

Turn over ►



21 Express  $x^2 - 6x - 15$  in the form  $(x - a)^2 - b$  where  $a$  and  $b$  are integers.

[2 marks]

$(x - 3)^2 - 24$   $(x - 3)^2 = (x - 3)(x - 3)$   
 $= x^2 - 6x + 9$   
 need to take off 24 to make into -15

Answer  $(x - 3)^2 - 24$

22  $a = \sqrt{2}$  and  $b = \sqrt{18}$

Match each expression to its value.

One has been done for you.

[3 marks]

$\sqrt{2} + \sqrt{18}$   
 $= \sqrt{2} + \sqrt{9}\sqrt{2}$   
 $= \sqrt{2} + 3\sqrt{2}$   
 $= 4\sqrt{2}$

$\sqrt{2}\sqrt{18}$   
 $= \sqrt{2}\sqrt{2}\sqrt{9}$   
 $= 2 \times 3$   
 $= 6$

$\frac{\sqrt{18}}{\sqrt{2}} = \frac{\sqrt{2}\sqrt{9}}{\sqrt{2}}$   
 $= \sqrt{9}$   
 $= 3$

$a^2$		2
$a + b$		3
$ab$		6
$\frac{b}{a}$		36
		$4\sqrt{2}$
		$10\sqrt{20}$



23 Write  $0.\dot{1}3$  as a fraction in its simplest form. [3 marks]

$$x = 0.13333 \dots$$

$$10x = 1.33333 \dots$$

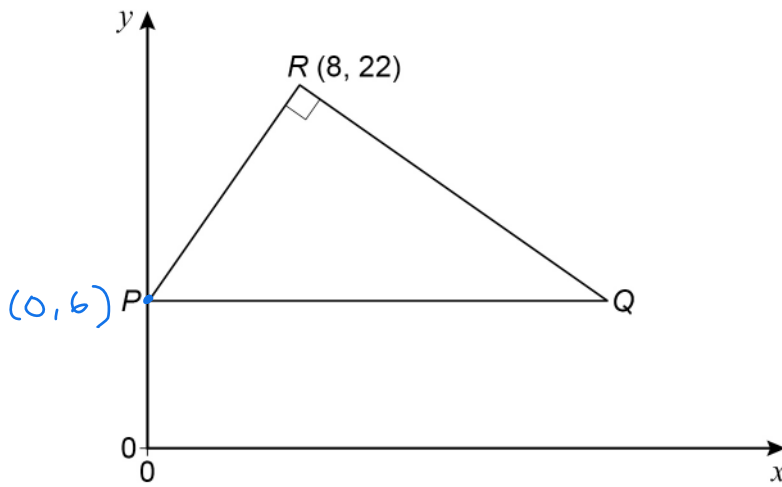
$$9x = 1.2$$

$$x = \frac{1.2}{9} = \frac{12}{90} = \frac{6}{45} = \frac{2}{15}$$

Answer  $\frac{2}{15}$



24 Points  $P$ ,  $Q$  and  $R(8, 22)$  form a triangle.



Not drawn accurately

$PQ$  is a horizontal line, with  $P$  on the  $y$ -axis.

Angle  $PRQ$  is a right angle.

The gradient of  $PR$  is 2

Work out the coordinates of  $Q$ .

Say  $P$  is point  $(0, y)$  gradient of  $PR$  is 2 so  $\frac{?}{8} = 2$   
So  $? = 16$  [5 marks]

If height of this triangle is 16, base of triangle must be  $22 - 16 = 6$  units above  $x$  axis, So  $P$  must be  $(0, 6)$  and  $y$ -coordinate of  $Q$  is also 6

As  $PR$  and  $RQ$  are perpendicular their gradients multiply to make  $-1$

If gradient of  $PR = 2$  then gradient of  $RQ$  must be  $-\frac{1}{2}$

So eqn of  $RQ$  is of the form  $y = -\frac{1}{2}x + c$

through  $(8, 22)$  so  $22 = -\frac{1}{2} \times 8 + c$

$c = 26$  so  $RQ$  is  $y = -\frac{1}{2}x + 26$

we know  $y$  coordinate of  $Q$  is 6  
Answer ( 40 , 6 )

so  $6 = -\frac{1}{2}x + 26$

$$-20 = -\frac{1}{2}x$$

$$x = 40$$

so  $Q$  must be  $(40, 6)$



25 Show that  $\frac{4 \sin 30^\circ - \tan 45^\circ}{2 \cos 30^\circ}$  can be written as  $\tan x$ , where  $x$  is an acute angle. [4 marks]

$$\sin 30 = \frac{1}{2} \quad \tan 45 = 1 \quad \cos 30 = \frac{\sqrt{3}}{2}$$

$$\text{so } \frac{4 \sin 30 - \tan 45}{2 \cos 30} = \frac{4 \times \frac{1}{2} - 1}{2 \times \frac{\sqrt{3}}{2}}$$

$$= \frac{2 - 1}{\sqrt{3}}$$

$$= \frac{1}{\sqrt{3}}$$

$$\frac{1}{\sqrt{3}} = \tan 30$$

$$\text{so } x = 30$$

Turn over for the next question

Turn over ►



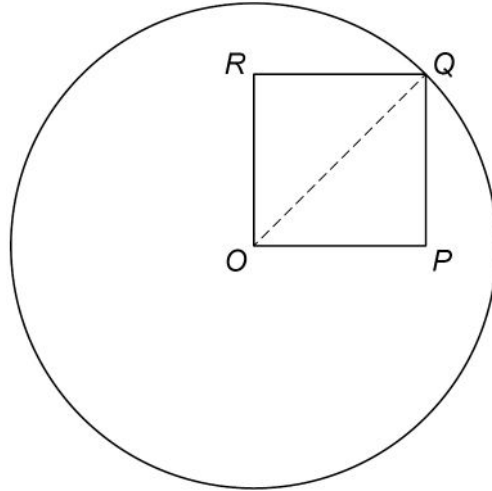
26

A circle, centre  $O$ , has circumference  $20\pi$  cm

$Q$  is a point on the circle.

$OPQR$  is a **square**.

Not drawn accurately



perimeter of the square : circumference of the circle =  $\sqrt{a} : \pi$  where  $a$  is an integer.

Work out the value of  $a$ .

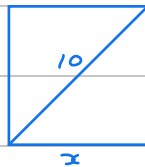
You **must** show your working.

[4 marks]

Circumference =  $20\pi$  so  $2\pi r = 20\pi$

$2r = 20$

$r = 10$  so radius = 10



Say sides of square have length  $x$ . By Pythagoras  $x^2 + x^2 = 10^2$

$2x^2 = 100$

$x^2 = 50$

$x = \sqrt{50}$

Perimeter of square =  $4\sqrt{50} = 4\sqrt{25 \cdot 2} = 4 \times 5\sqrt{2} = 20\sqrt{2}$

Ratio is Square : circle  
 $20\sqrt{2} : 20\pi$   
 $\sqrt{2} : \pi$   
 so  $a = 2$

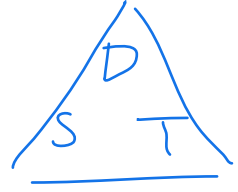
$a = 2$



27

A journey has two stages.

	Distance (km)	Average speed (km/h)	Time (h)
Stage 1	30	$a$	$\frac{30}{a}$
Stage 2	30	$b$	$\frac{30}{b}$



Show that the average speed for the **whole** journey, in km/h, is

$$\frac{2ab}{a+b}$$

[3 marks]

$$\text{Total time} = \frac{30}{a} + \frac{30}{b} = \frac{30b + 30a}{ab}$$

$$\text{Total distance} = 30 + 30 = 60$$

$$\text{Speed} = 60 \div \left( \frac{30b + 30a}{ab} \right)$$

$$= 60 \times \frac{ab}{30b + 30a}$$

$$= \frac{60ab}{30(b+a)}$$

$$= \frac{2ab}{a+b}$$

END OF QUESTIONS

