



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Tuesday 1 November 2022 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	
TOTAL	

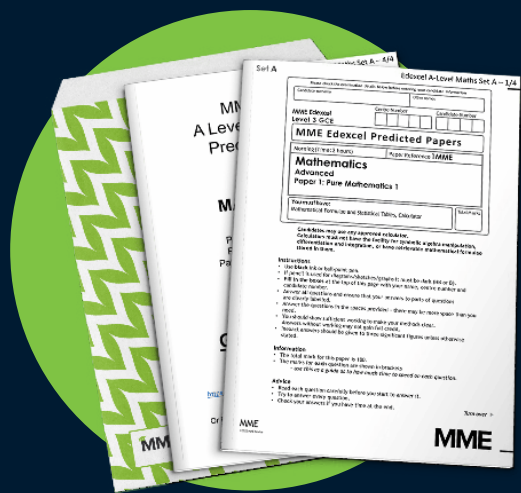


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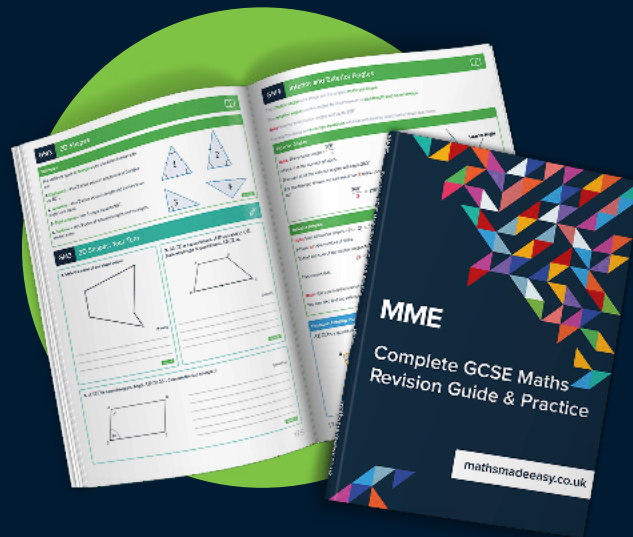
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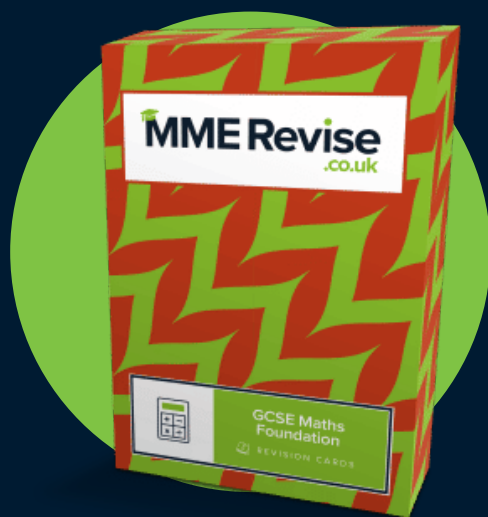
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Answer **all** questions in the spaces provided.Do not write
outside the
box

1 Work out $-4 \times -\frac{7}{9}$

Circle your answer.

[1 mark]

$\frac{28}{36}$

$\frac{28}{9}$

$\frac{28}{36}$

$\frac{28}{9}$

2 Circle the value of $(\sqrt{6})^4$

[1 mark]

12

36

10

 $\sqrt{24}$

3 $0.203 = \frac{1}{5} + x$

Circle the value of x .

[1 mark]

$\frac{1}{300}$

$\frac{1}{3000}$

$\frac{3}{100}$

$\frac{3}{1000}$



Do not write
outside the
box

4 Circle the correct statement.

[1 mark]

$$\textcircled{3x \equiv x + 2x} \quad 3x \equiv 2 \quad 3x + x \equiv 2 - x \quad 3x + x - 2 \equiv 0$$

5 Divide 62 in the ratio 3 : 7

[3 marks]

$$3 + 7 = 10$$

$$62 \div 10 = 6.2$$

$$3 \times 6.2 = 18.6$$

$$7 \times 6.2 = 43.4$$

$$18.6 : 43.4$$

Answer 18.6 and 43.4

Turn over for the next question

7

Turn over ►



03

Do not write outside the box

6 Here is some information about the time spent on social media by 40 women and 40 men last week.

Time spent, t (hours)	Number of women	Number of men
$2 < t \leq 5$	12	10
$5 < t \leq 8$	11	17
$8 < t \leq 11$	14	9
$11 < t \leq 14$	2	4
$14 < t \leq 17$	1	0

Tick **one** box for each statement.

[3 marks]

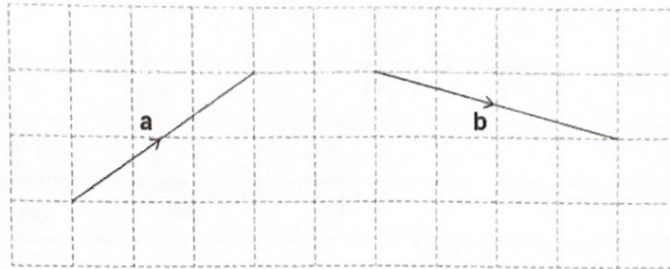
	Definitely true	Might be true	Cannot be true
Three of the women spent more than 11 hours on social media.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The range for the men is 15 hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The women have a higher median than the men.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>



Do not write
outside the
box

7 The diagram shows the vectors **a** and **b**.

As a column vector $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$



7 (a) What is **b** as a column vector?

[2 marks]

Answer $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

7 (b) Work out $4\mathbf{a}$ as a column vector.

[1 mark]

Answer $\begin{pmatrix} 12 \\ 8 \end{pmatrix}$

7 (c) $\mathbf{a} + \mathbf{c} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

Work out **c** as a column vector.

Circle your answer.

[1 mark]

$\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

$\begin{pmatrix} 0 \\ 2 \end{pmatrix}$

$\begin{pmatrix} -2 \\ 0 \end{pmatrix}$

$\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

$\frac{\quad}{7}$

Turn over ►



8 Work out $\left(\frac{7}{10} - \frac{4}{15}\right) \div \frac{2}{3}$

Give your answer as a fraction.

[3 marks]

$$\frac{7}{10} = \frac{21}{30} \quad \frac{4}{15} = \frac{8}{30}$$

$$\frac{21}{30} - \frac{8}{30} = \frac{13}{30}$$

$$\frac{13}{30} \div \frac{2}{3} = \frac{13}{30} \times \frac{3}{2} = \frac{13}{20}$$

Answer $\frac{13}{20}$

9 Work out all the **integer** values of x for which $12 \leq 4x < 25$

[2 marks]

$$12 \leq 4x < 25$$

$$12 \div 4 \leq x < 25 \div 4$$

$$3 \leq x < 6.25$$

Satisfied by 3, 4, 5, 6

Answer 3, 4, 5, 6



10 Here is some information about 120 people who visit a shop.

$\frac{3}{4}$ of the people buy neither a coat nor a dress.

19 people buy a coat.

14 people buy a dress.

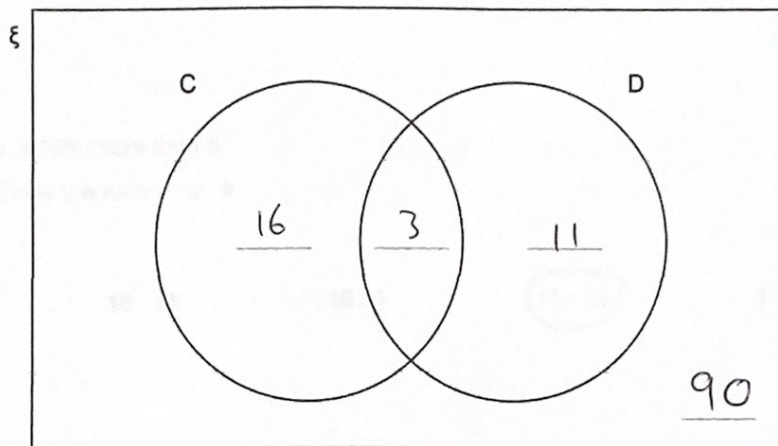
Complete this Venn diagram to represent the information.

[3 marks]

ξ = 120 people who visit the shop

C = people who buy a coat

D = people who buy a dress



$$120 \times \frac{3}{4} = 90$$

$$90 + 19 + 14 = 123$$

which is 3 larger than 120, so 3
must be in the middle.

$$19 - 3 = 16$$

$$14 - 3 = 11$$



Do not write
outside the
box11 Write $(3^6 \times 3^5) : 3^7$ in the form $n : 1$ where n is an integer.

[3 marks]

$$\begin{aligned} 3^6 \times 3^5 : 3^7 &= 3^{11} : 3^7 \\ &= 3^{11-7} : 1 \\ &= 3^4 : 1 \\ &= 81 : 1 \end{aligned}$$

Answer 81 : 112 a is 10% more than b .Circle the ratio $a : b$

[1 mark]

10 : 11

10 : 1

11 : 10

1 : 10

13 Work out $0.4\dot{7} + 0.312$

Circle your answer.

[1 mark]

0.782

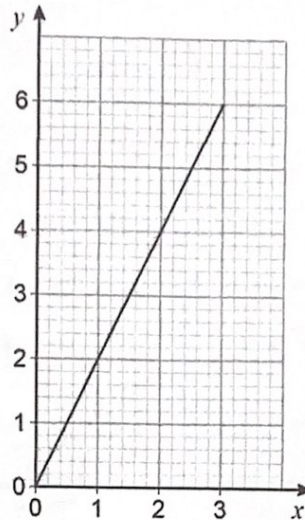
0.789

0.789 $\dot{7}$ 0.78 $\ddot{9}$ 

14

Craig wants to draw a graph, for values of x from -3 to 3 ,
where the x -coordinate and y -coordinate are always in the ratio $2 : 1$

Here is his graph.



Make two criticisms of Craig's graph.

[2 marks]

Criticism 1 This is the graph of $y = 2x$
not $y = \frac{1}{2}x$

Criticism 2 The graph goes from 0 to 3,
not -3 to 3



15 Show that $(3x+4)(2x-5) - 11x(x-2) + 5(x^2-3x-1)$ simplifies to an integer.

[4 marks]

$$\begin{aligned}
 & (3x+4)(2x-5) - 11x(x-2) + 5(x^2-3x-1) = \\
 & 3x(2x-5) + 4(2x-5) - 11x(x-2) + 5(x^2-3x-1) = \\
 & 6x^2 - 15x + 4(2x-5) - 11x(x-2) + 5(x^2-3x-1) = \\
 & 6x^2 - 15x + 8x - 20 - 11x(x-2) + 5(x^2-3x-1) = \\
 & 6x^2 - 15x + 8x - 20 - 11x^2 + 22x + 5(x^2-3x-1) = \\
 & 6x^2 - 15x + 8x - 20 - 11x^2 + 22x + 5x^2 - 15x - 5 = \\
 & (6x^2 - 11x^2 + 5x^2) + (-15x + 8x + 22x - 15x) + (-20 - 5) = \\
 & x^2(6 - 11 + 5) + x(-15 + 8 + 22 - 15) - 25 = \\
 & 0x^2 + 0x - 25 = \\
 & \quad \quad \quad \underline{\underline{25}}
 \end{aligned}$$



Do not write
outside the
box

16

A graph has the equation $y = x^2 + px + r$ where p and r are constants.The graph passes through the points $(0, 4)$, $(1, 3)$ and $(8, w)$ Work out the value of w .

[4 marks]

$$y = x^2 + px + r$$

$$4 = 0^2 + 0 \times p + r$$

$$3 = 1^2 + p \times 1 + r$$

$$4 = 0 + 0 + r$$

$$3 = 1^2 + p \times 1 + 4$$

$$r = 4$$

$$3 = 1 + p + 4$$

$$3 = 5 + p$$

$$p = -2$$

$$y = x^2 - 2x + 4$$

$$w = 8^2 - 2 \times 8 + 4$$

$$w = 64 - 16 + 4$$

$$w = 52$$

$$w = \underline{\quad 52 \quad}$$

Turn over for the next question

8

Turn over ►



1 1

- 17 The table shows information about the heights of 60 athletes.

Height, h (cm)	Frequency
$150 < h \leq 160$	4
$160 < h \leq 170$	12
$170 < h \leq 180$	35
$180 < h \leq 190$	7
$190 < h \leq 200$	2

- 17 (a) Complete the cumulative frequency table.

[1 mark]

Height, h (cm)	Cumulative frequency
$h \leq 150$	0
$h \leq 160$	4
$h \leq 170$	16
$h \leq 180$	51
$h \leq 190$	58
$h \leq 200$	60

- 17 (b) Circle the class interval that contains the lower quartile.

[1 mark]

$150 < h \leq 160$

$160 < h \leq 170$

$170 < h \leq 180$

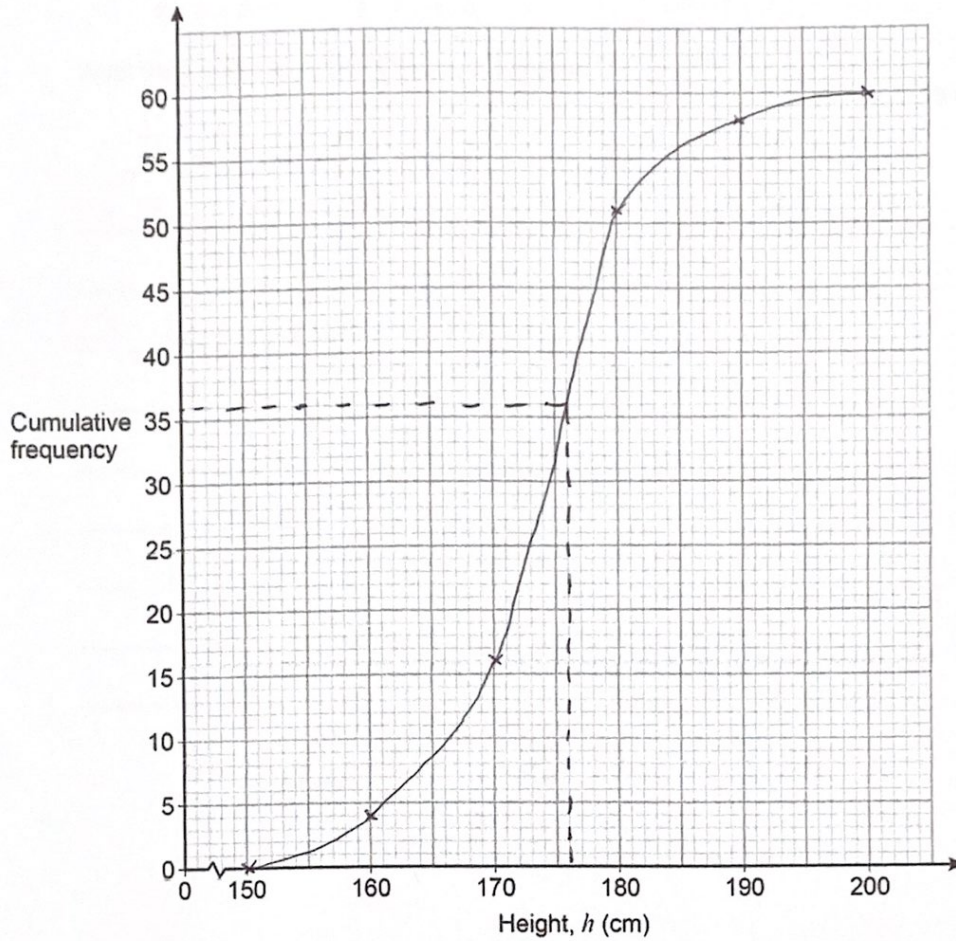
$180 < h \leq 190$



Do not write outside the box

17 (c) Draw a cumulative frequency diagram to represent the data.

[2 marks]



17 (d) Estimate the number of the athletes whose height is more than 176 cm

[2 marks]

176 cm is at 36 frequency
 $60 - 36 = 24$

Answer 24

6

Turn over ►



- 18 A road has three sections, D, E and F.
The lengths of D, E and F are in the ratios

$$D : E = 3 : 5 \quad E : F = 7 : 4$$

What fraction of the length of the road is section D?

[3 marks]

$$D : E = 3 : 5$$

$$E : F = 7 : 4$$

$$D : E = 21 : 35$$

$$E : F = 35 : 20$$

$$D : E : F = 21 : 35 : 20$$

$$21 + 35 + 20 = 76$$

$$D = \frac{21}{76}$$

Answer

$$\frac{21}{76}$$



Do not write
outside the
box19 (a) Work out the value of $\left(\frac{5}{4}\right)^{-2}$

[2 marks]

$$\left(\frac{5}{4}\right)^{-2} = \left(\frac{4}{5}\right)^2 = \frac{4^2}{5^2} = \frac{16}{25}$$

Answer $\frac{16}{25}$ 19 (b) Work out the value of $\left(\frac{9}{100}\right)^{\frac{3}{2}}$

[2 marks]

$$\left(\frac{9}{100}\right)^{\frac{3}{2}} = \frac{9^{\frac{3}{2}}}{100^{\frac{3}{2}}} = \frac{(9^{\frac{1}{2}})^3}{(100^{\frac{1}{2}})^3} = \frac{3^3}{10^3} = \frac{27}{1000}$$

Answer $\frac{27}{1000}$

Turn over for the next question

7

Turn over ►



1 5

20 The only solution to $x^2 + bx + c = 0$ is $x = -15$

Work out the values of b and c .

[3 marks]

$$x^2 + bx + c = (x + 15)^2$$

$$x^2 + bx + c = x^2 + 30x + 225$$

$$b = 30$$

$$c = 225$$

$$b = \underline{30} \quad c = \underline{225}$$

21 Convert $0.\dot{6}\dot{1}$ to a fraction.

[3 marks]

$$x = 0.\dot{6}\dot{1}$$

$$10x = 6.\dot{1}$$

$$100x = 61.\dot{1}$$

$$100x - 10x = 61.\dot{1} - 6.\dot{1}$$

$$90x = 55$$

$$x = \frac{55}{90}$$

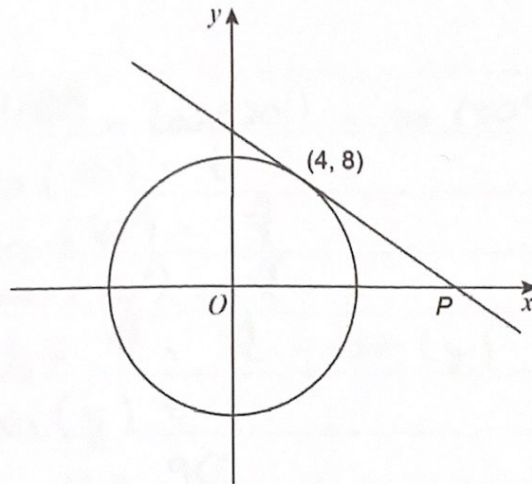
$$x = \frac{11}{18}$$

Answer

$$\frac{11}{18}$$



- 22 (4, 8) is a point on a circle, centre O .
The tangent at (4, 8) intersects the x -axis at P .



Not drawn
accurately

Work out the x -coordinate of P .

[5 marks]

$$\text{Gradient of radius} = \frac{8-0}{4-0} = \frac{8}{4} = 2$$

$$\text{Gradient of tangent} = -\frac{1}{2} = -\frac{1}{2}$$

$$y - y_1 = m(x - x_1)$$

$$y - 8 = -\frac{1}{2}(x - 4)$$

$$y - 8 = -\frac{1}{2}x + 2$$

$$y = -\frac{1}{2}x + 10$$

Substitute $y = 0$

$$0 = -\frac{1}{2}x + 10$$

$$\frac{1}{2}x = 10$$

$$x = 20$$

Answer 20



23

$$4 \times \sin 30^\circ \times \tan 30^\circ \times \cos 30^\circ = \sin y$$

Work out **one** possible value of y .

You **must** show your working.

[4 marks]

$$4 \times \sin(30^\circ) \times \tan(30^\circ) \times \cos(30^\circ) = \sin(y)$$

$$\sin(30^\circ) = \frac{1}{2}$$

$$\tan(30^\circ) = \frac{\sqrt{3}}{3}$$

$$\cos(30^\circ) = \frac{\sqrt{3}}{2}$$

$$4 \times \frac{1}{2} \times \frac{\sqrt{3}}{3} \times \frac{\sqrt{3}}{2} = \sin(y)$$

$$\sin(y) = 1$$

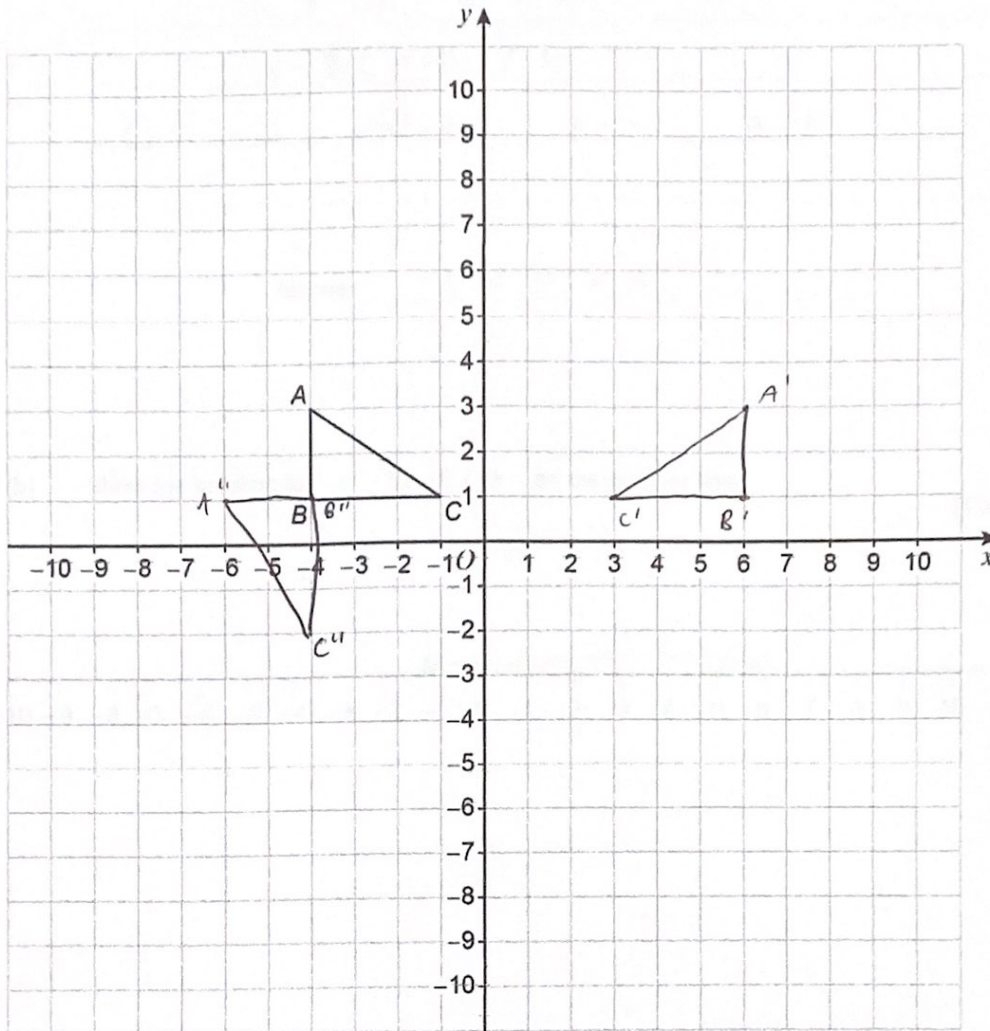
$$y = 90^\circ$$

Answer 90 degrees



Do not write outside the box

24 Triangle ABC is drawn on a grid.



ABC is transformed to A'B'C' by a reflection in the line $x = 1$

A'B'C' is transformed to A''B''C'' by a rotation 90° anticlockwise about $(1, -4)$

Which **one** point on ABC is invariant under the combined transformation?

You **must** show the result of each transformation on the grid.

[4 marks]

Answer B

8

Turn over ►



Do not write
outside the
box

25 (a) Solve $x^2 - 5x - 6 < 0$

[2 marks]

$$x^2 - 5x - 6 < 0$$

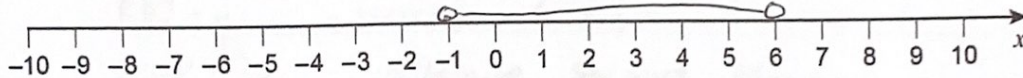
$$(x - 6)(x + 1) < 0$$

Critical values: $x = -1, x = 6$

Answer $-1 < x < 6$

25 (b) Show the solution to $x^2 - 5x - 6 < 0$ on the number line.

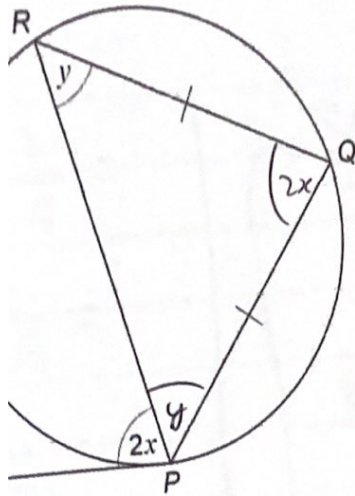
[1 mark]



Do not write outside the box

circle.

1.



Not drawn accurately

$90^\circ - x$

[4 marks]

Isosceles triangle
 alternate segment theorem
 $y + y = 180^\circ$ sum of angles in triangle
 $y = 90^\circ$
 $y = 90^\circ - x$

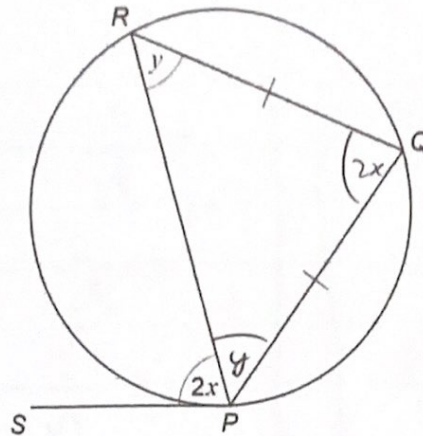
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Turn over ►

Do not write outside the box

26

P, Q and R are points on a circle.
 SP is a tangent to the circle.
 $RQ = PQ$



Not drawn accurately

Prove that $y = 90^\circ - x$

[4 marks]

$\angle RQP = y$ isosceles triangle
 $\angle RQP = 2x$ alternate segment theorem
 $2x + y + y = 180^\circ$ sum of angles in triangle
 $2x + 2y = 180^\circ$
 $x + y = 90^\circ$
 $y = 90^\circ - x$

7

Turn over ►



Do not write outside the box

27

Work out $\sqrt{2\frac{13}{16}} - \frac{2}{\sqrt{5}}$

Give your answer in the form $\frac{a\sqrt{5}}{b}$ where a and b are integers.

[4 marks]

$\sqrt{2\frac{13}{16}} - \frac{2}{\sqrt{5}} =$	$\frac{3\sqrt{5}}{4} - \frac{2}{\sqrt{5}} =$
$\sqrt{\frac{45}{16}} - \frac{2}{\sqrt{5}} =$	$\frac{3\sqrt{5}}{4} - \frac{2 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} =$
$\frac{\sqrt{45}}{\sqrt{16}} - \frac{2}{\sqrt{5}} =$	$\frac{3\sqrt{5}}{4} - \frac{2\sqrt{5}}{5} =$
$\frac{\sqrt{45}}{4} - \frac{2}{\sqrt{5}} =$	$\frac{15\sqrt{5}}{20} - \frac{8\sqrt{5}}{20} =$
$\frac{\sqrt{9 \times 5}}{4} - \frac{2}{\sqrt{5}} =$	$\frac{7\sqrt{5}}{20}$
$\frac{\sqrt{9 \times 5}}{4} - \frac{2}{\sqrt{5}} =$	

$\frac{7\sqrt{5}}{20}$

Answer _____

END OF QUESTIONS

4

