AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

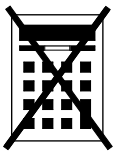
H

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	

Answer **all** questions in the spaces provided.

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

Circle your answer.

[1 mark]

$-\frac{28}{36}$ $-\frac{28}{9}$ $\frac{28}{36}$ $\frac{28}{9}$ (1)

2 Circle the value of $\left(\sqrt{6}\right)^4$ $(6^{1/2})^4 = 6^2 = 36$

[1 mark]

12 36 (1) 10 $\sqrt{24}$

3 $0.203 = \frac{1}{5} + x$ $0.203 - 0.2 = x$

$x = 0.003$

Circle the value of x.

[1 mark]

$\frac{1}{300}$ $\frac{1}{3000}$ $\frac{3}{100}$ $\frac{3}{1000}$ (1)

Do not write outside the box

4 Circle the correct statement.

[1 mark]

$3x \equiv x + 2x$ (1) $\quad 3x \equiv 2 \quad 3x + x \equiv 2 - x \quad 3x + x - 2 \equiv 0$

5 Divide 62 in the ratio 3 : 7

[3 marks]

Total ratio = 3 + 7 = 10 (1)

62 ÷ 10 = 6.2

6.2 × 3 = 18.6 , 6.2 × 7 = 43.4

(1)

(1)

Answer 18.6 and 43.4

Turn over for the next question

7

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
$2 < t \leqslant 5$	12	10
$5 < t \leqslant 8$	11	17
$8 < t \leqslant 11$	14	9
$11 < t \leqslant 14$	2	4
$14 < t \leqslant 17$	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.	✓ (1)		
The range for the **men** is 15 hours.			✓ (1)
The women have a higher median than the men.		✓ (1)	

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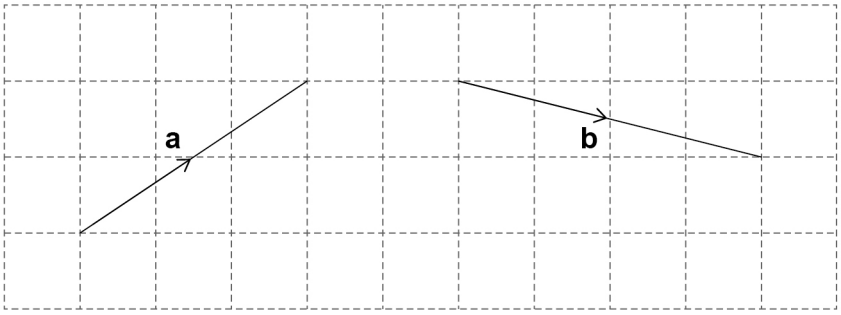
7 The diagram shows the vectors **a** and **b**.

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



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

[2 marks]

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

7 (b) Work out 4**a** as a column vector.

[1 mark]

$4 \times \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 12 \\ 8 \end{pmatrix}$

Answer $\begin{pmatrix} 12 \\ 8 \end{pmatrix}$ (1)

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

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

Circle your answer.

[1 mark]

$\begin{pmatrix} 3 \\ 2 \end{pmatrix} + c = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

$c = \begin{pmatrix} 3-3 \\ 0-2 \end{pmatrix} = \begin{pmatrix} 0 \\ -2 \end{pmatrix}$

$\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ $\quad$ $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ $\quad$ $\begin{pmatrix} -2 \\ 0 \end{pmatrix}$ $\quad$ $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ (1)

7

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

Give your answer as a fraction.

[3 marks]

$\left[\frac{21}{30} - \frac{8}{30}\right] = \frac{13}{30}$ (1)

$\frac{13}{30} \times \frac{31}{2} = \frac{13}{20}$ (1)

(1)

Answer $\frac{13}{20}$

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

[2 marks]

$12 \leqslant 4x$ $\quad$ $4x < 25$

$3 \leqslant x$ (1) $\quad$ $x < \frac{25}{4}$

$3 \leqslant x < 6.25$

3, 4, 5, 6 (1)

Answer 3 4 5 6

Do not write outside the box

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.

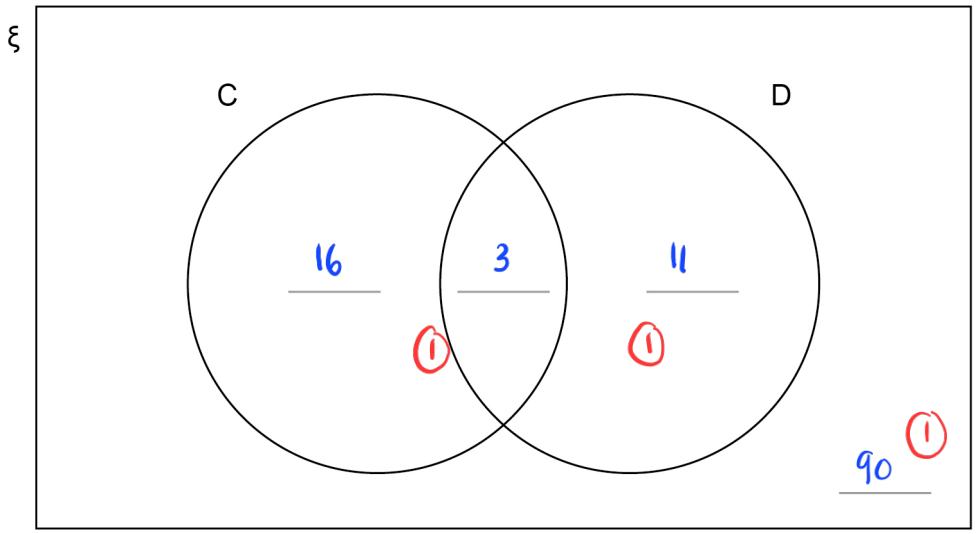
Complete this Venn diagram to represent the information.

[3 marks]

ξ = 120 people who visit the shop

C = people who buy a coat

D = people who buy a dress



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

$120 - 90 = 30$

$19 + 14 = 33$

$33 - 30 = 3$

8

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11 Write $(3^6 \times 3^5) : 3^7$ in the form $n : 1$ where n is an integer.

[3 marks]

$3^{6+5} : 3^7$

$= 3^{11} : 3^7$ (1)

$3^4 : 1$ (1)

$= 81 : 1$ (1)

Answer 81 : 1

12 a is 10% more than b.

Circle the ratio $a : b$

[1 mark]

10 : 11 | 10 : 1 | 11 : 10 (1) | 1 : 10

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

$0.477 + 0.312$

Circle your answer.

[1 mark]

0.782 | 0.789 | $0.789\dot{7}$ (1) | $0.7\dot{8}\dot{9}$

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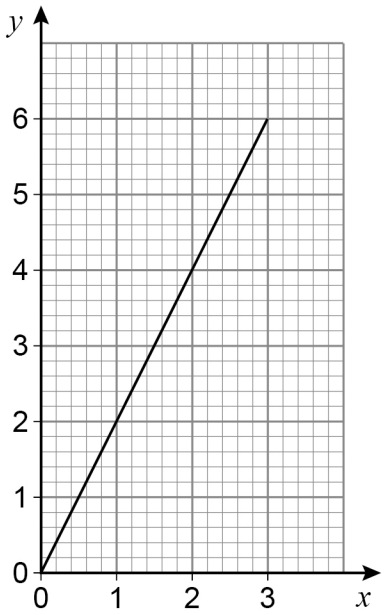
14 Craig wants to draw a graph, for values of x from -3 to 3,
where the x-coordinate and y-coordinate are always in the ratio 2 : 1

Here is his graph.



Make two criticisms of Craig's graph.

[2 marks]

Criticism 1 The graph starts from $x = 0$, not $x = -3$. (1)

Criticism 2 The graph is $y = 2x$, not $y = \frac{1}{2}x$ (1)

7

Do not write outside the box

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

[4 marks]

$6x^2 - 15x + 8x - 20 - 11x^2 + 22x + 5x^2 - 15x - 5$ (1) (1) (1)

$= 6x^2 - 11x^2 + 5x^2 - 15x + 8x + 22x - 15x - 20 - 5$

$= -25$ (1)

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]

at point (0, 4) : $4 = (0)^2 + p(0) + r$, $r = 4$ (1)

point (1, 3) : $3 = (1)^2 + p(1) + 4$

$3 = 5 + p$

$p = -2$ (1)

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

at point (8, w) : $w = (8)^2 - 2(8) + 4$

$= 64 - 16 + 4$ (1)

$= 52$ (1)

$w =$ 52

Turn over for the next question

8

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

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

17 (a) Complete the cumulative frequency table.

[1 mark]

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

(1)

17 (b) Circle the class interval that contains the lower quartile. $\frac{1}{4} \times 60 = 15$

[1 mark]

$150 < h \leqslant 160$ $\quad$ $160 < h \leqslant 170$ $\quad$ $170 < h \leqslant 180$ $\quad$ $180 < h \leqslant 190$

(1)

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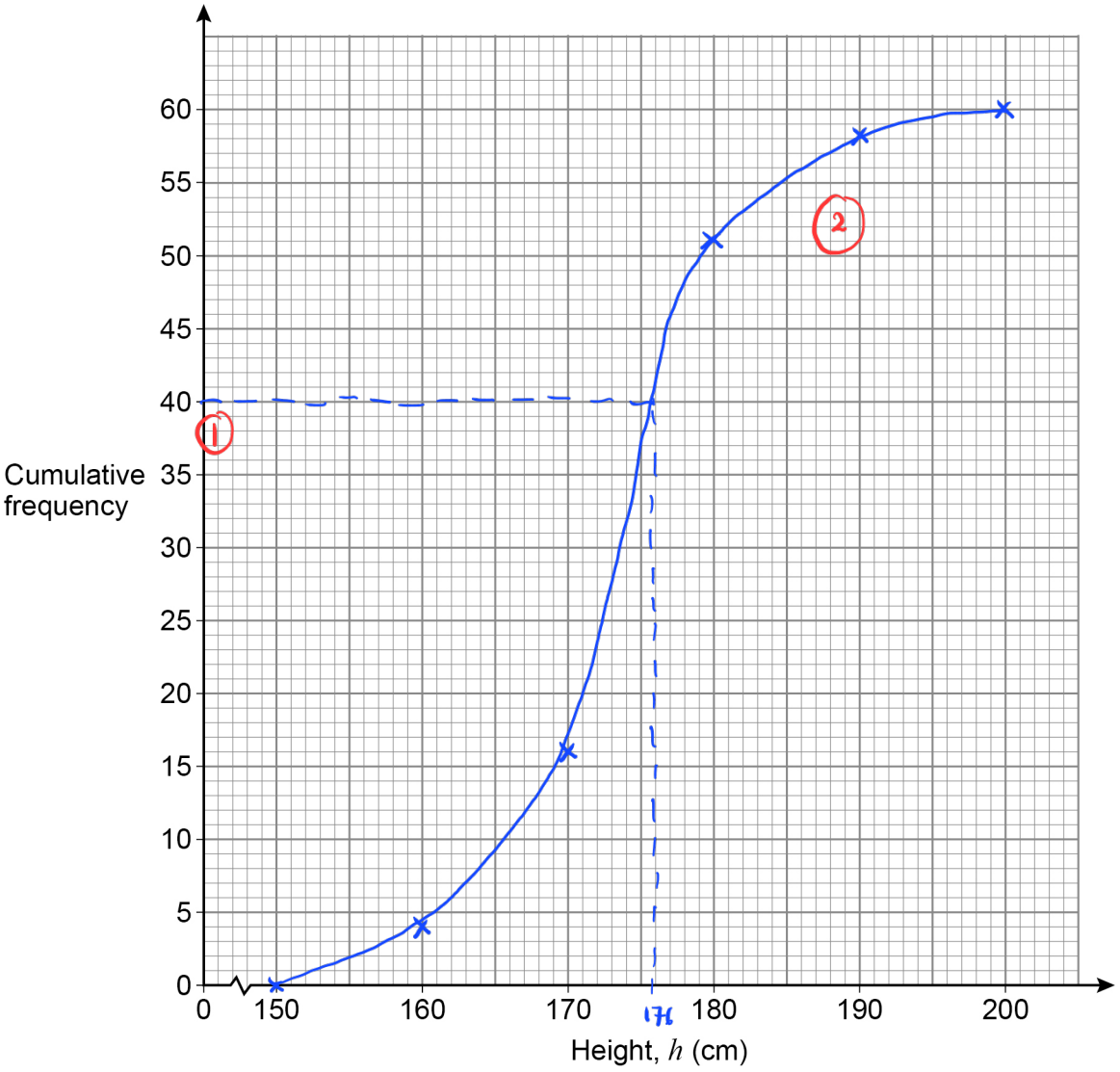
17 (c) Draw a cumulative frequency diagram to represent the data.

[2 marks]



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

[2 marks]

60 - 40 = 20 (1)

Answer 20

6

Turn over ►

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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 E : F = 7 : 4

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

[3 marks]

D : E : F

3 x 7 : 5 x 7 (1)

7 x 5 : 4 x 5

21 : 35 : 20

(1)

Total ratio : 21 + 35 + 20 = 76

D = $\frac{21}{76}$ (1)

Answer $\frac{21}{76}$

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19 (a) Work out the value of $\left(\frac{5}{4}\right)^{-2}$

[2 marks]

$\left[\frac{5}{4}\right]^{-2} = \left[\frac{4}{5}\right]^{2} = \frac{16}{25}$ (1) (1)

Answer $\frac{16}{25}$

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

[2 marks]

$\left[\sqrt{\frac{9}{100}}\right]^{3} = \left(\frac{3}{10}\right)^{3}$ (1)

$= \frac{27}{1000}$ (1)

Answer $\frac{27}{1000}$

Turn over for the next question

7

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

Work out the values of b and c.

[3 marks]

$(x+15)(x+15) = x^2 + 30x + 225$ (1) (1)

$b = 30$, $c = 225$ (1)

$b =$ 30 $c =$ 225

21 Convert $0.6\dot{1}$ to a fraction.

[3 marks]

let $x = 0.61\ldots$

$10x = 6.11\ldots$ (1)

$10x - x = 6.11 - 0.61$

$9x = 5.5$ (1)

$x = \frac{5.5}{9} = \frac{11}{18}$ (1)

Answer $\frac{11}{18}$

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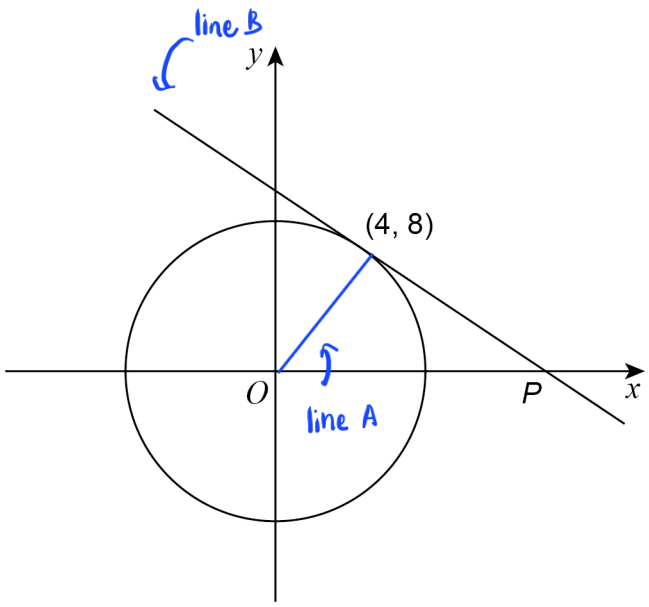
22 (4, 8) is a point on a circle, centre O.

The tangent at (4, 8) intersects the x-axis at P.



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Work out the x-coordinate of P.

[5 marks]

gradient of line A $= \frac{8-0}{4-0} = 2$ (1)

gradient of line B $= \frac{-1}{2}$ (1)

$-\frac{1}{2} = \frac{0-8}{p-4}$ (1)

$-p+4 = -16$ (1)

$-p = -20$

$p = 20$ (1)

Answer 20

11

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23 $4 \times \sin 30° \times \tan 30° \times \cos 30° = \sin y$

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

You **must** show your working.

[4 marks]

$\sin 30° = \frac{1}{2}$, $\tan 30° = \frac{\sqrt{3}}{3}$, $\cos 30° = \frac{\sqrt{3}}{2}$ (1)

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

$\sin y = 1$ (1)

$y = 90°$ (1)

Answer 90 degrees

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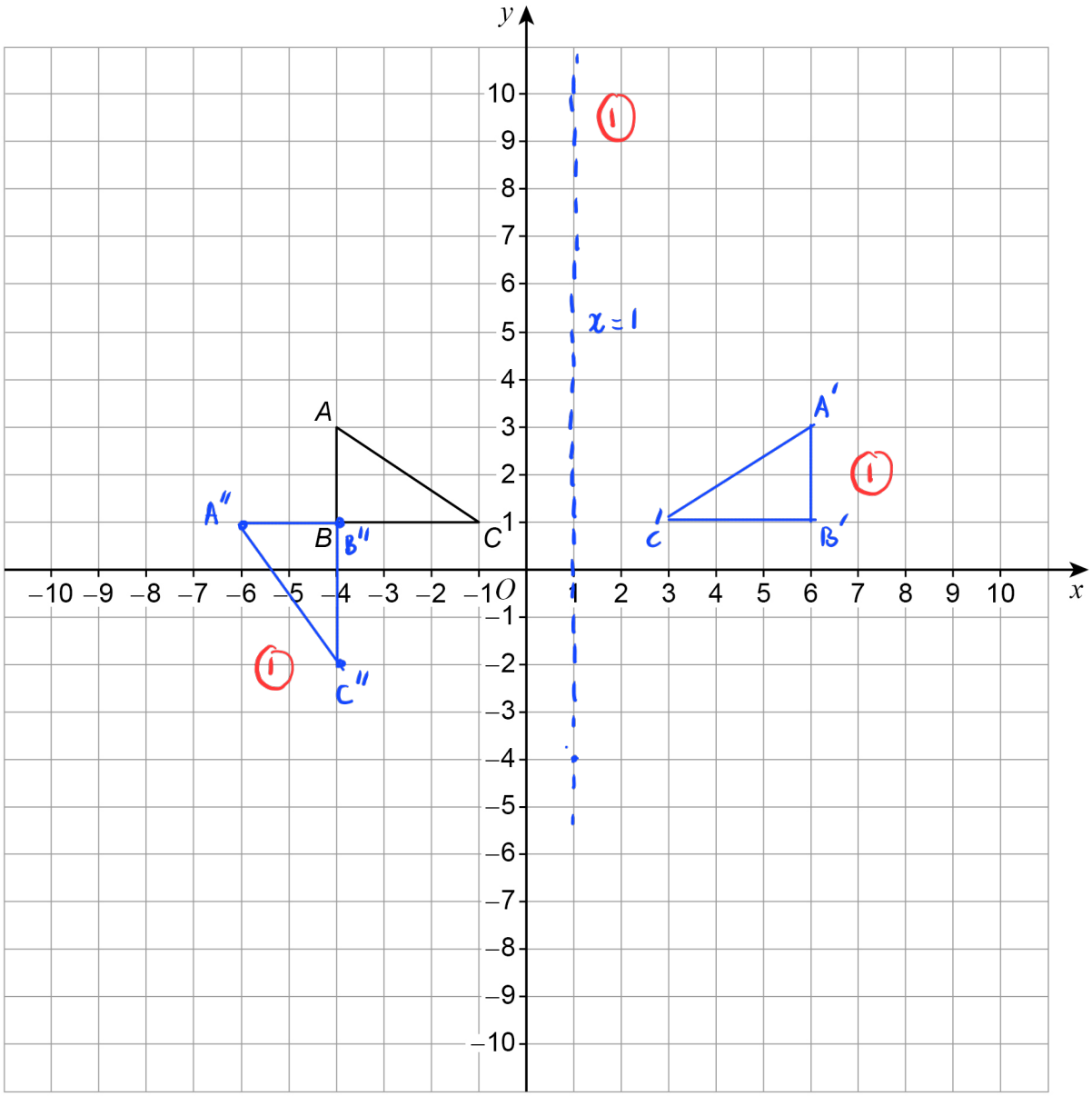
24 Triangle *ABC* is drawn on a grid.



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 (1)

8

Turn over ►

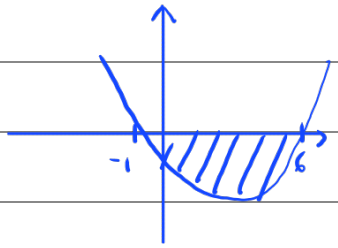
Do not write outside the box

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

[2 marks]

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

$x = -1, \quad x = 6$ (1)

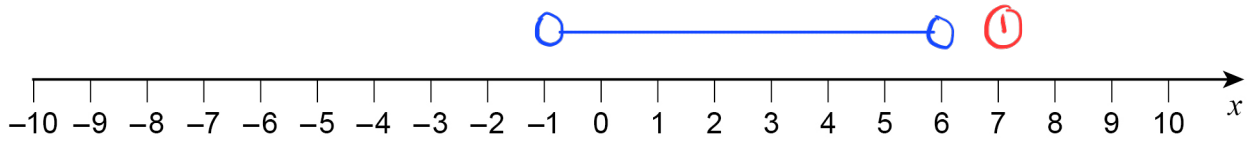


$-1 < x < 6$

Answer $-1 < x < 6$ (1)

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

[1 mark]



(1)

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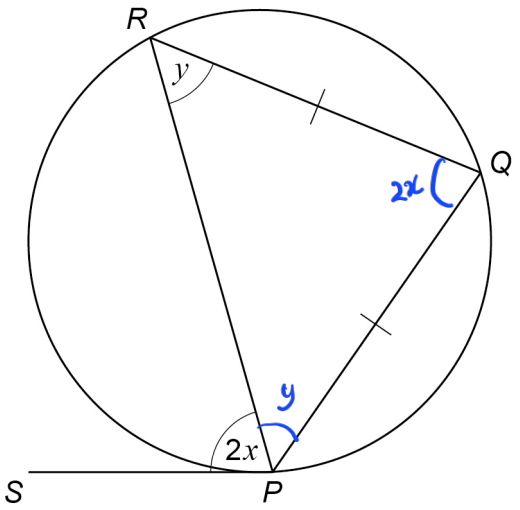
26 P, Q and R are points on a circle.

SP is a tangent to the circle.

$RQ = PQ$



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Prove that $y = 90° - x$

[4 marks]

PQR = SPR = 2x (1)

(alternate segment theorem

RPQ = PRQ = y (1)

(base of isosceles triangle are equal)

2x + 2y = 180° (1)

(angles in a triangle add up to 180°)

2y = 180° - 2x

y = 90° - x (1)

7

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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]

$2\frac{13}{16} = \frac{45}{16}$

$\sqrt{\frac{45}{16}} = \sqrt{\frac{9\times5}{16}} = \frac{3}{4}\sqrt{5}$ (1)

$\frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$ (1)

$\frac{5\times 3\sqrt{5}}{5\times 4} - \frac{2\sqrt{5}\times 4}{5\times 4}$

$= \frac{15\sqrt{5} - 8\sqrt{5}}{20}$ (1) $= \frac{7\sqrt{5}}{20}$

Answer $\frac{7\sqrt{5}}{20}$ (1)

END OF QUESTIONS

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