Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

Centre Number | Candidate Number

# Pearson Edexcel International GCSE

**Time** 2 hours 30 minutes

**Paper reference** **4MB1/02R**

# Mathematics B
## PAPER 2R

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used**.

## Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.

*Turn over* ▶

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Q:1/1/1/1/

P 6 9 3 1 0 A 0 1 3 2

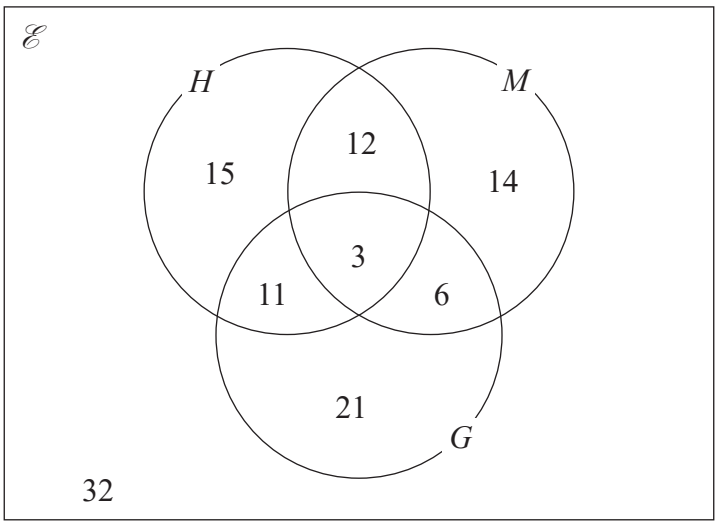
Pearson

**Answer ALL ELEVEN questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1** The Venn diagram shows information about the numbers of students in a school who study History ($H$), Music ($M$) and Geography ($G$).




(a) Find the number of students who study Geography.

**(1)**

(b) Find the number of students who study exactly two of the subjects History, Music and Geography.

**(1)**

(c) On the Venn diagram above, shade the region that represents the set $H \cap G'$

**(1)**

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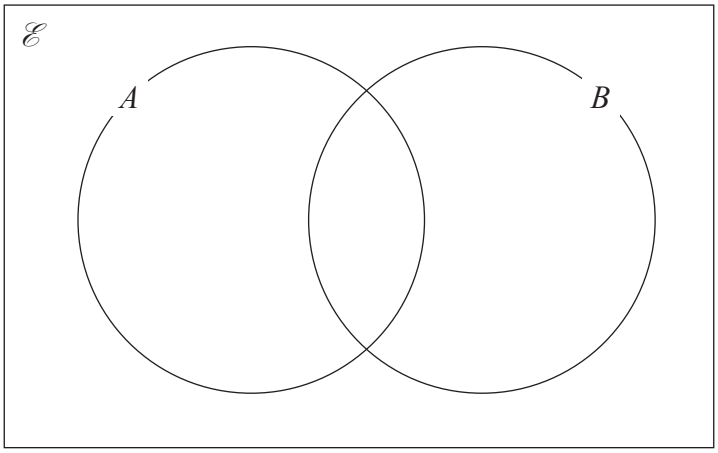
**Question 1 continued**

$\mathscr{E}$ is the universal set and $A$ and $B$ are two sets such that

$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A \cap B = \{\text{multiples of 3}\}$
$A \cap B' = \{2, 4, 8, 10\}$
$(A \cup B)' = \{1, 7\}$

(d) Use the information about the sets $\mathscr{E}$, $A$ and $B$ to complete the Venn diagram below.




**(3)**

(e) Find n($B$)

**(1)**

**(Total for Question 1 is 7 marks)**

**2**

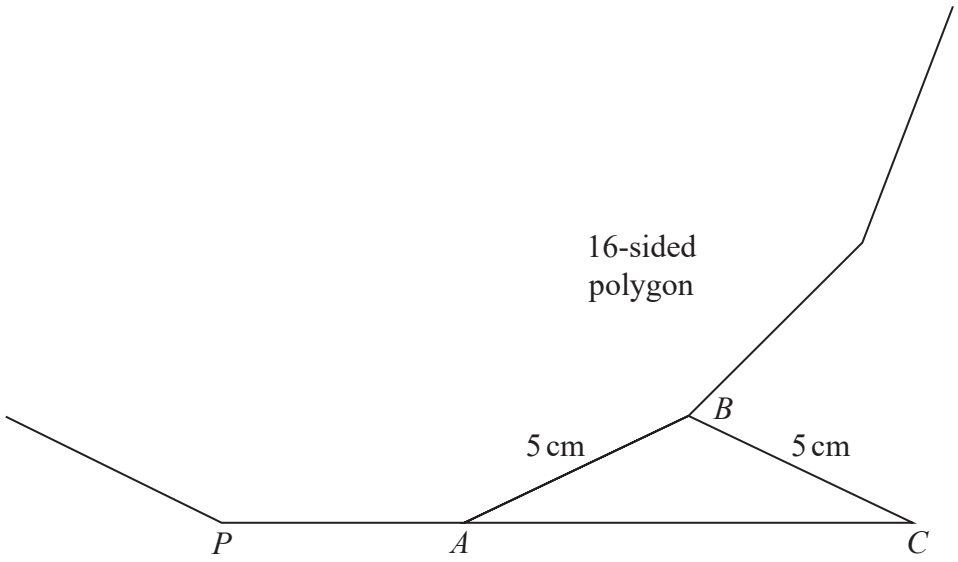



Diagram **NOT** accurately drawn

**Figure 1**

Figure 1 shows part of a regular 16-sided polygon in which $PA$ and $AB$ are two sides.
Figure 1 also shows the isosceles triangle $ABC$ in which $AB = CB = 5$ cm.

$PAC$ is a straight line.

Calculate the length, in cm to 3 significant figures, of $AC$.

**(4)**

**[Sum of interior angles of polygon**
$(2n - 4)$ right angles**]**

**(Total for Question 2 is 4 marks)**

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**3** Arup collects information about the time delay, in minutes, of some trains. He is going to draw a pie chart for his results.

The incomplete table below gives some information about his results together with the size, in degrees, of the angle of each of three sectors in his pie chart.

| Time delay ($t$ minutes) | Frequency | Angle (in degrees) |
|---|---|---|
| $1 < t \leqslant 5$ | 42 | 168 |
| $5 < t \leqslant 10$ | | 92 |
| $10 < t \leqslant 20$ | 15 | |
| $20 < t \leqslant 25$ | | |
| $25 < t \leqslant 40$ | 2 | 8 |

(a) Complete the table.

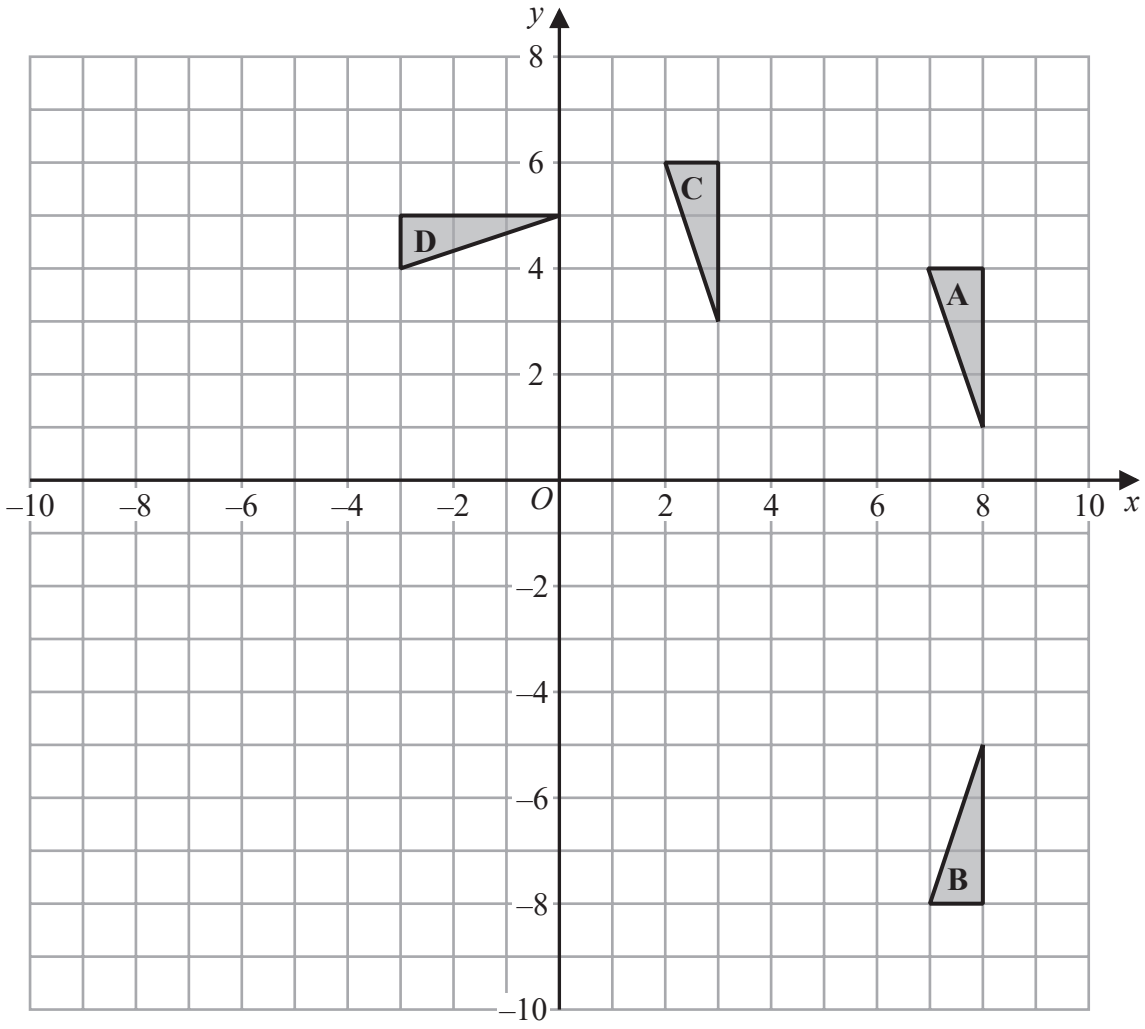
**(2)**

(b) Calculate an estimate, in minutes to 3 significant figures, for the mean time delay of these trains.

**(4)**

**(Total for Question 3 is 6 marks)**

**4**




Triangles $A$, $B$, $C$ and $D$ are drawn on the grid above.

Describe fully the single transformation that maps

(a) triangle $A$ onto triangle $B$

**(2)**

(b) triangle $A$ onto triangle $C$

**(2)**

(c) triangle $A$ onto triangle $D$

**(3)**

Triangle $E$ is the image of triangle $A$ under an enlargement with scale factor –2 and centre of enlargement (4, 0)

(d) On the grid, draw and label triangle $E$

**(2)**

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**Question 4 continued**

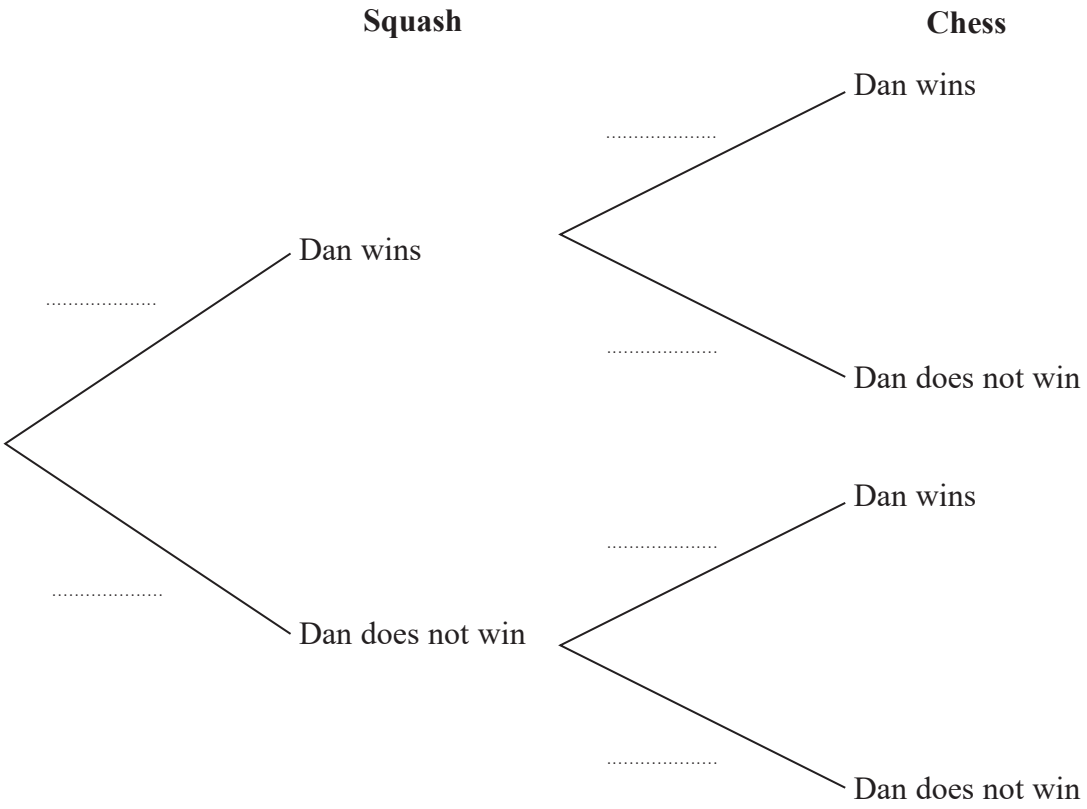
**(Total for Question 4 is 9 marks)**

**5** Dan is going to play one game of squash and one game of chess against his friend.

The probability that Dan will win the game of squash is $\frac{3}{5}$

The probability that Dan will win the game of chess is $\frac{1}{3}$

(a) Complete the probability tree diagram.




**(2)**

(b) Find the probability that Dan will win exactly one game.

**(2)**

Given that Dan won exactly one game,

(c) calculate the probability that he won his game of squash.

**(2)**

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**Question 5 continued**

**(Total for Question 5 is 6 marks)**

**6** In 2018, a badminton club had 460 members.

Of these members,

*A* were younger than 30
*B* were aged between 30 and 60 inclusive
*C* were older than 60

Given that $A : B : C = 2 : 5 : 3$

(a) find the total number of members who were aged 30 or older in 2018

**(2)**

In 2018, the annual membership fee for each member who was older than 60 was \$65
The annual membership fee for each other member was \$135

(b) Calculate the total amount, in \$, that the 460 members paid in annual membership fees in 2018

**(2)**

The annual membership fee for each member who was older than 60 in 2019 was 4% greater than the annual membership fee for each member who was older than 60 in 2018

(c) Calculate the annual membership fee for each member who was older than 60 in 2019

**(2)**

The badminton club buys 12 shuttlecocks for a total cost of \$5.10
The club then sells the shuttlecocks to members for \$0.50 each.

(d) Calculate the percentage profit, to 3 significant figures, made by the club on each shuttlecock that was sold.

**(2)**

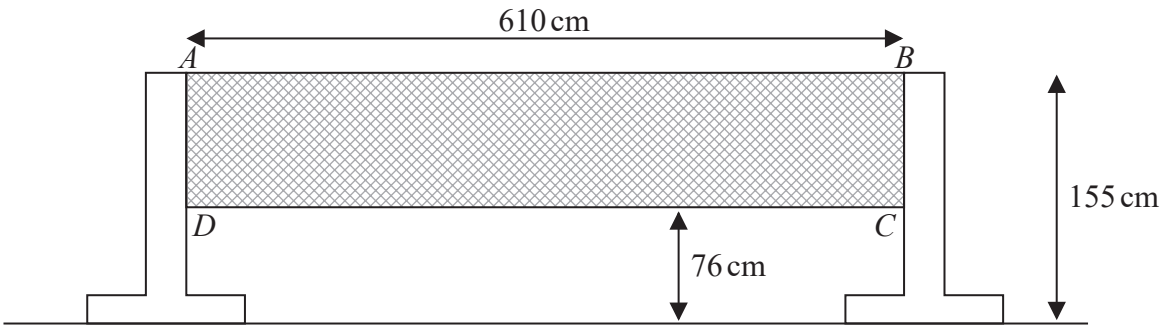


**Figure 2**

Figure 2 shows a badminton net *ABCD* and two supports for the net.
The badminton net is shaded in the diagram.

Figure 2 gives information about the dimensions of the badminton net.
Each measurement is given to the nearest cm.

(e) Calculate the upper bound, in $cm^2$, of the area of the net *ABCD*

**(3)**

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**Question 6 continued**

**Question 6 continued**

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**Question 6 continued**

**(Total for Question 6 is 11 marks)**

**7** A particle $P$ is moving along a straight line through the fixed point $O$
The speed, $v$ m/s, of $P$ at time $t$ seconds is given by

$$v = \frac{t^2}{27} + 2 + \frac{3}{t^2} \quad \text{for} \quad 1 \leqslant t \leqslant 5$$

(a) Complete the table of values for $v = \frac{t^2}{27} + 2 + \frac{3}{t^2}$

Give your values of $v$ to 2 decimal places.

| $t$ | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 |
|---|---|---|---|---|---|---|---|---|---|
| $v$ | 5.04 | | 2.90 | 2.71 | | 2.70 | 2.78 | 2.90 | |

**(2)**

(b) On the grid opposite, plot the points from your completed table and join them to form a smooth curve.

**(3)**

(c) Using your curve, find an estimate, to one decimal place, for the speed of $P$ when $t = 1.75$

**(1)**

The acceleration of $P$ at time $t$ seconds where $1 \leqslant t \leqslant 5$ is $a$ m/s$^2$

(d) Find an expression for $a$ in terms of $t$

**(2)**

(e) Using your answer to part (d), find the value of $t$ when $P$ has its minimum speed in the time interval $1 \leqslant t \leqslant 5$
Show clear algebraic working.

**(3)**

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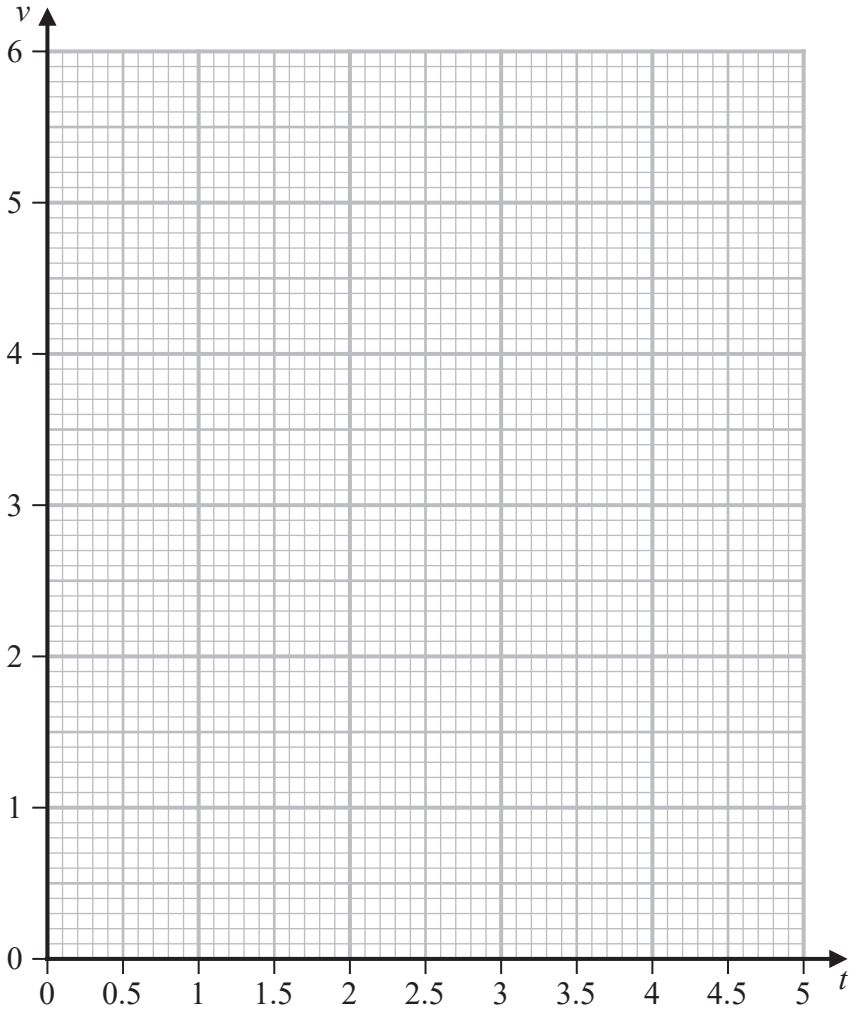
**Question 7 continued**




**Turn over for a spare grid if you need to redraw your curve.**

**Question 7 continued**

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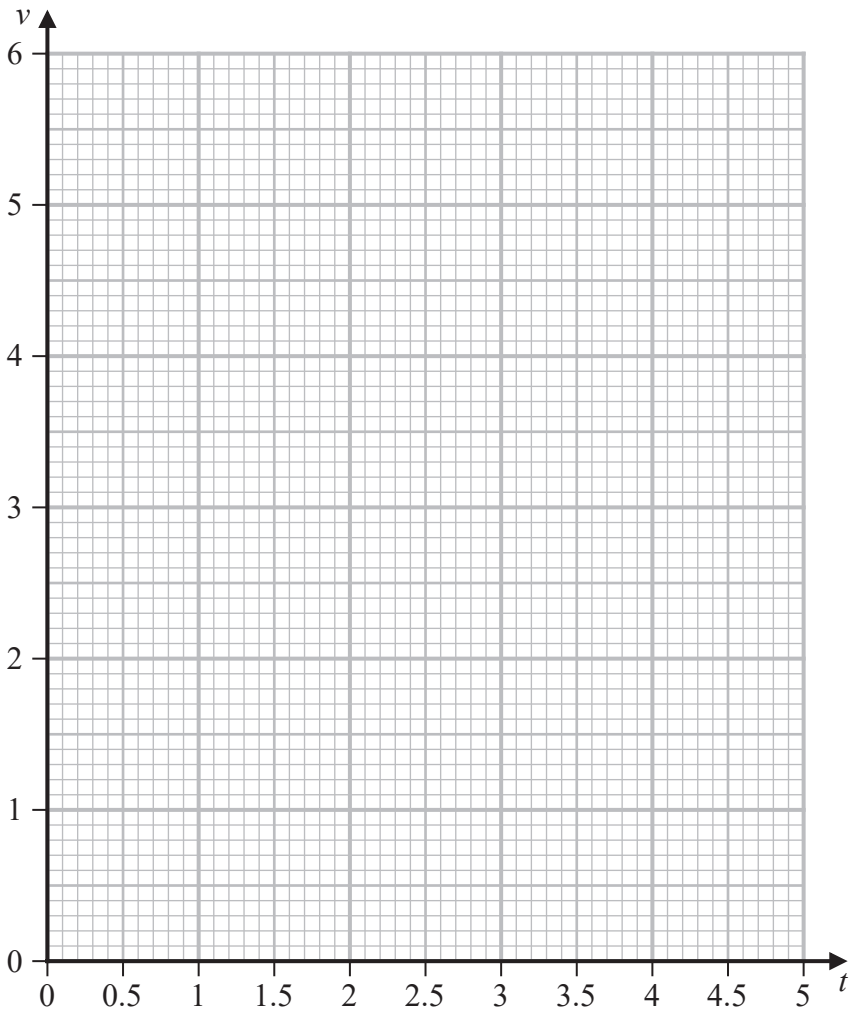
**Question 7 continued**

**Only use this grid if you need to redraw your curve.**




**(Total for Question 7 is 11 marks)**

**8** The equation of the straight line **L** is $y = 2 - 3x$

(a) Find the exact coordinates of the points where **L** crosses the coordinate axes.

**(2)**

The functions f and g are defined as

$$f: x \mapsto 2 - 3x$$

$$g: x \mapsto \frac{3 + x}{1 - 2x} \qquad x \neq \frac{1}{2}$$

(b) Find $g(-2)$

**(1)**

(c) Find the values of $x$ for which $ff(x) + g(x) = 0$
Show your working clearly and give your answer in the form

$$\frac{a \pm \sqrt{b}}{c}$$

where $a$, $b$ and $c$ are integers.

**(5)**

(d) Express the inverse of the composite function fg in the form $(fg)^{-1}: x \mapsto ...$

**(5)**

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$$\left[ \text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right]$$

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**Question 8 continued**

**Question 8 continued**

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**Question 8 continued**

**(Total for Question 8 is 13 marks)**

**9**

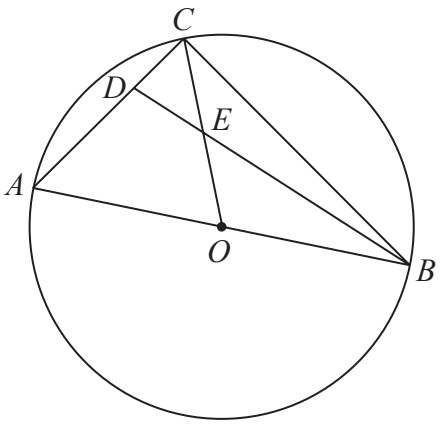


Diagram **NOT** accurately drawn

**Figure 3**

Figure 3 shows three points $A$, $B$ and $C$ on a circle with centre $O$ where $AOB$ is a diameter of the circle.

$D$ is the point on $AC$ such that $AD : DC = 3 : 2$

Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{AD} = \mathbf{b}$

(a) find, in terms of **a** or **b** or **a** and **b** where appropriate, a simplified expression for

(i) $\overrightarrow{AC}$ (ii) $\overrightarrow{CO}$ (iii) $\overrightarrow{DB}$

**(4)**

$E$ is the point such that $CEO$ and $DEB$ are straight lines.

By considering both $\overrightarrow{AD} + \overrightarrow{DE}$ and $\overrightarrow{AC} + \overrightarrow{CE}$

(b) find a simplified expression for $\overrightarrow{AE}$ in terms of **a** and **b**

**(5)**

Given that $|\mathbf{a}| = 7\,\text{cm}$ and $|\mathbf{b}| = 6\,\text{cm}$,

(c) calculate the exact area, in $\text{cm}^2$, of $\Delta ABC$

**(4)**

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**Question 9 continued**

**Question 9 continued**

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**Question 9 continued**

**(Total for Question 9 is 13 marks)**

**10** $\mathbf{A} = \begin{pmatrix} 2k^2 & k-9 \\ -3k & k+1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & -5 \\ 3 & k \end{pmatrix}$

The determinant of matrix **A** is equal to the determinant of matrix **B**

(a) Show that $k$ is a root of the equation

$$2k^3 + 5k^2 - 28k - 15 = 0$$

**(3)**

Given that $f(k) = 2k^3 + 5k^2 - 28k - 15$

(b) use the factor theorem to show that $(k + 5)$ is a factor of $f(k)$

**(2)**

(c) Hence, factorise completely $f(k)$

**(4)**

The transformation with matrix **C**, where **C** is a $2 \times 2$ matrix, is equivalent to the transformation with matrix **A** followed by the transformation with matrix **B**

Given that $k$ is positive,

(d) find matrix **C**

**(3)**

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$$\left[ \textbf{Determinant of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc \right]$$

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**Question 10 continued**

**Question 10 continued**

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**Question 10 continued**

**(Total for Question 10 is 12 marks)**

**11**

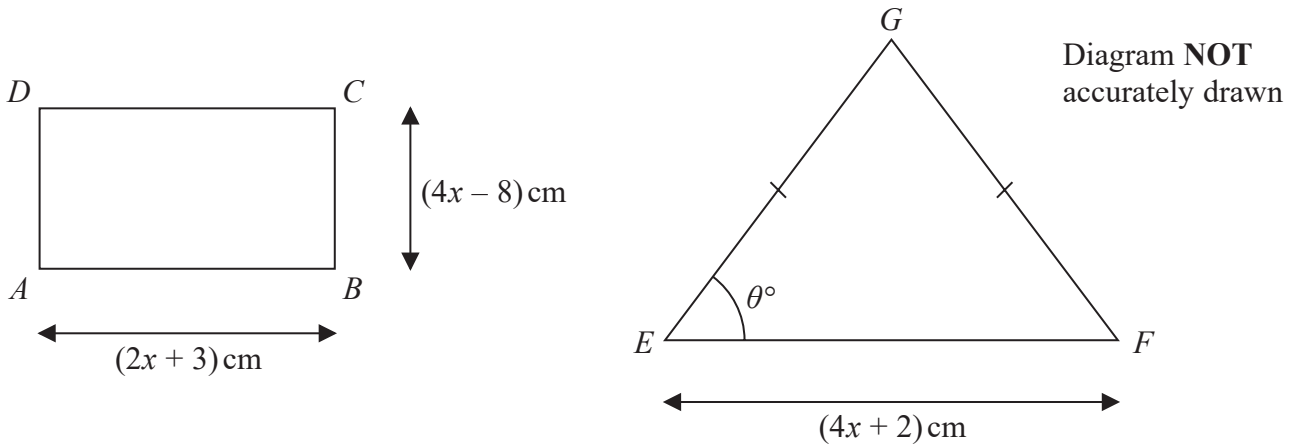


**Figure 4**

Figure 4 shows a rectangle $ABCD$ and an isosceles triangle $EFG$ with $EG = FG$

$AB = (2x + 3)\,\text{cm}$ $BC = (4x - 8)\,\text{cm}$ $EF = (4x + 2)\,\text{cm}$

$\angle FEG = \theta°$ where $\tan\theta° = \frac{1}{2}$

The perimeter of the rectangle is $P$ cm and the area of the triangle is $T\,\text{cm}^2$

Given that $P \geqslant T$

find the range of possible values of $x$
Show your working clearly.

**(8)**

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**Question 11 continued**

**Question 11 continued**

**(Total for Question 11 is 8 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

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