Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics B

Paper 2R

Monday 12 January 2015 – Afternoon
Time: 2 hours 30 minutes

Paper Reference
4MB0/02R

You must have: Ruler graduated in centimetres and millimetres, protractor, 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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Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1

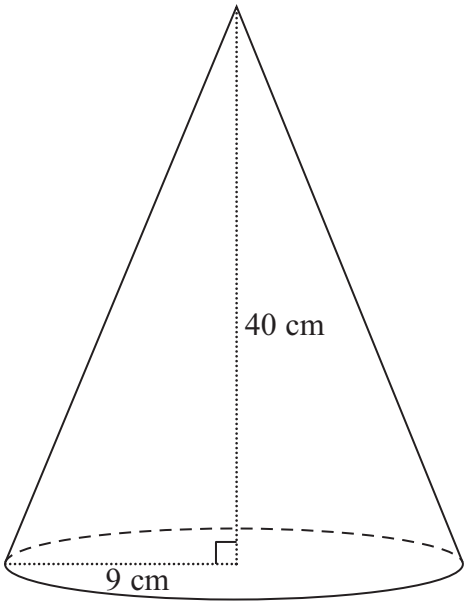


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a solid right circular cone with base radius 9 cm and height 40 cm.

Show that the total surface area of the cone is 450π cm^2.

[Area of circle = πr^2, Curved surface area of right circular cone = πrl.]

(Total for Question 1 is 4 marks)

2 $f: x \mapsto x^2 + 6x + 1$

$g: x \mapsto 3 - 2x$

(a) Calculate $f(-\frac{1}{2})$

(1)

(b) Find the function fg, giving your answer in the form fg: $x \mapsto ax^2 + bx + c$, where a, b and c are integers.

(2)

(c) Find the two values of x for which $fg(x) = 56$

(3)

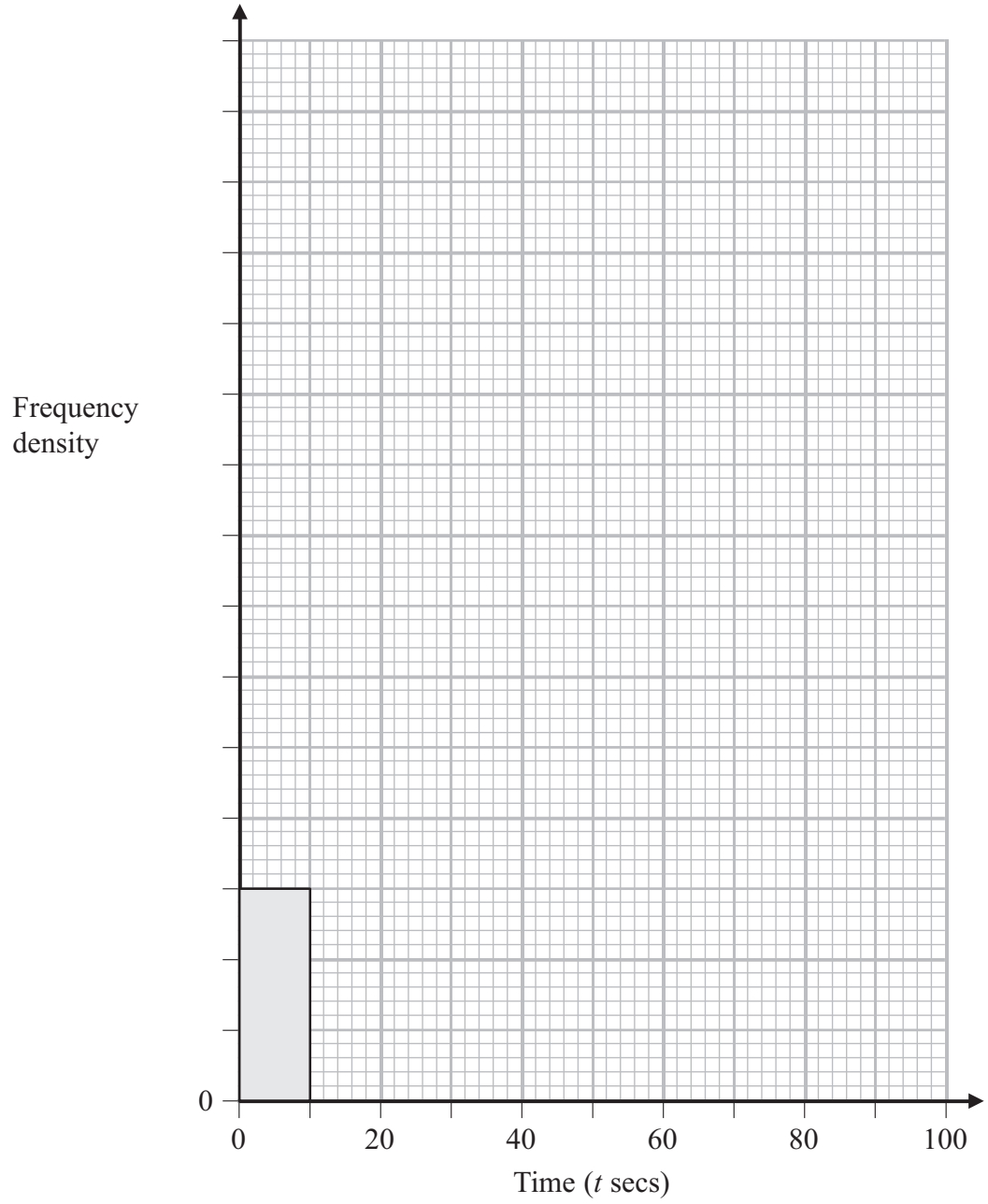
(Total for Question 2 is 6 marks)

3 An Internet Service Provider surveyed 100 of its customers to determine the time required to download a particular file from the internet. The table below gives information about the times taken.

Time (t secs) taken to download	Number of customers
$0 < t \leqslant 10$	12
$10 < t \leqslant 15$	24
$15 < t \leqslant 20$	28
$20 < t \leqslant 30$	20
$30 < t \leqslant 70$	16

On the grid opposite, complete the histogram to represent this information.
The first bar has been drawn for you.

Question 3 continued

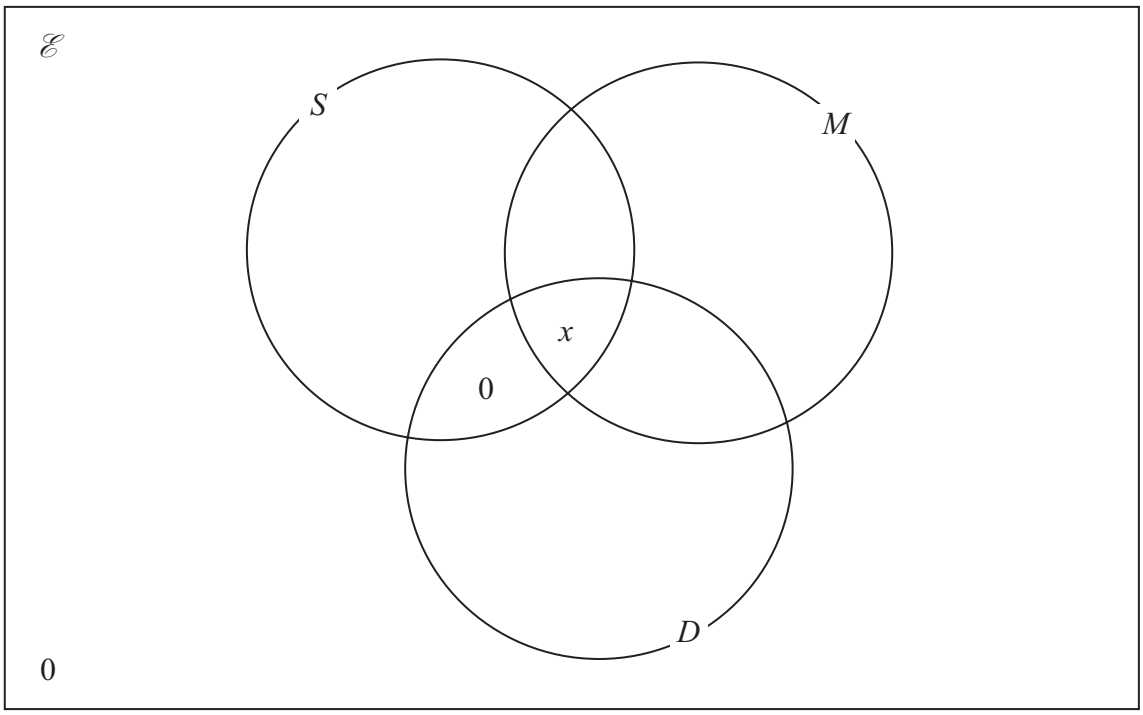


(Total for Question 3 is 4 marks)

4 On one day, 90 customers were served food at the *Crusty Lobster* cafe. All 90 customers had at least one of Soup (S), Main Meal (M) and Dessert (D).

10 customers had the Soup only.
45 customers had the Main Meal only.
8 customers had the Dessert only.
25 customers had the Soup and the Main Meal.
13 customers had the Main Meal and the Dessert.
No customers had the Soup and the Dessert only.
x customers had the Soup, the Main Meal and the Dessert.

(a) Show all this information on the Venn diagram.



(2)

(b) Use the information in the Venn diagram to write down an equation in x.

(1)

(c) Hence find the value of x.

(1)

(d) Find the value of

(i) n(S)

(ii) $\text{n}\left([M \cup D] \cap S'\right)$

(2)

Question 4 continued

(Total for Question 4 is 6 marks)

5 John Luddite works a metal press in a factory. In each hour that he works, he produces x items.

(a) Write down, in terms of x, an expression for the average time taken, in minutes, by John to produce one item.

(1)

John is to be replaced by a robot. In tests, the robot produces $(x + 6)$ items in each hour.

(b) Write down, in terms of x, an expression for the average time taken, in minutes, by the robot to produce one item.

(1)

The average time taken by the robot to produce one item is $\frac{1}{2}$ minute less than the time taken by John to produce one item.

(c) Using your answers to parts (a) and (b), write down an equation in x.

(1)

(d) Solve this equation to find the value of x.

(4)

Question 5 continued

(Total for Question 5 is 7 marks)

6

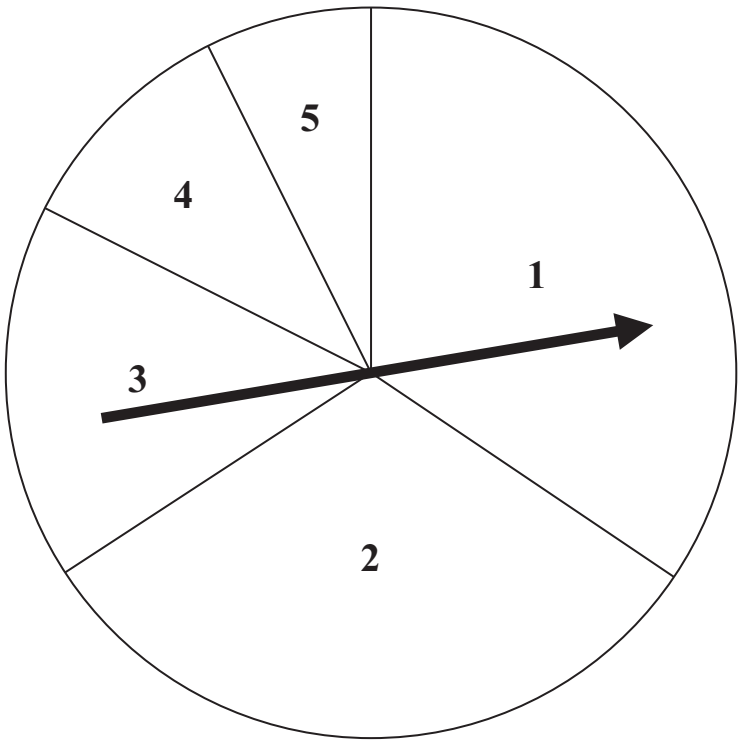


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Figure 2

Figure 2 shows a horizontal circular board divided into five sectors numbered with scores 1, 2, 3, 4 and 5

Given that x is the score, then the size of the angle, $A°$, of the sector for that score is given by the formula $A = 24(6 - x)$

(a) Complete the table below.

Score (x)	1	2	3	4	5
Angle ($A°$)			72°		

(2)

A spinner is pinned in the centre of the board and is spun once.

(b) Write down the probability that the score is 1

(1)

(c) Find the probability that the score is at least 3

(2)

The spinner is now spun twice.

(d) Calculate the probability that the total of the two scores is 4

(3)

Question 6 continued

(Total for Question 6 is 8 marks)

7

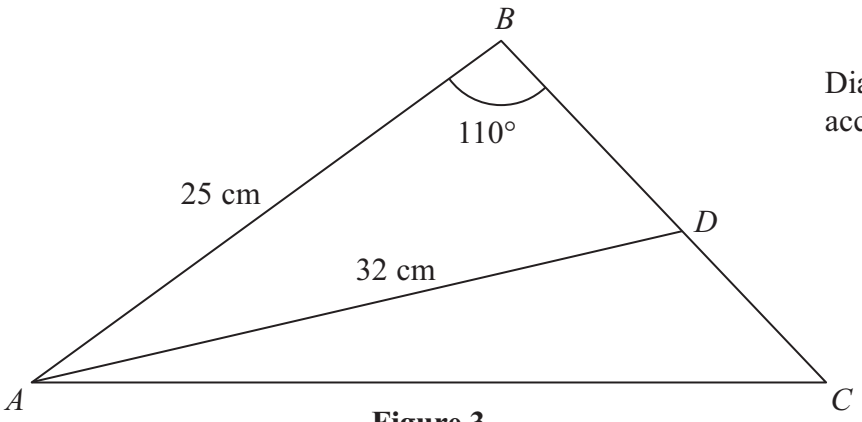


Diagram **NOT** accurately drawn

Figure 3

In Figure 3, ABC is a triangle with $AB = 25$ cm, $BC = 19$ cm and $\angle ABC = 110°$
The point D on BC is such that $AD = 32$ cm.

Find, giving your answers to 3 significant figures,

(a) the length, in cm, of AC,

(3)

(b) the size, in degrees, of $\angle BDA$,

(3)

(c) the area, in cm^2, of triangle ABD.

(3)

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Area of triangle $= \dfrac{1}{2}bc \sin A$

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 9 marks)

8

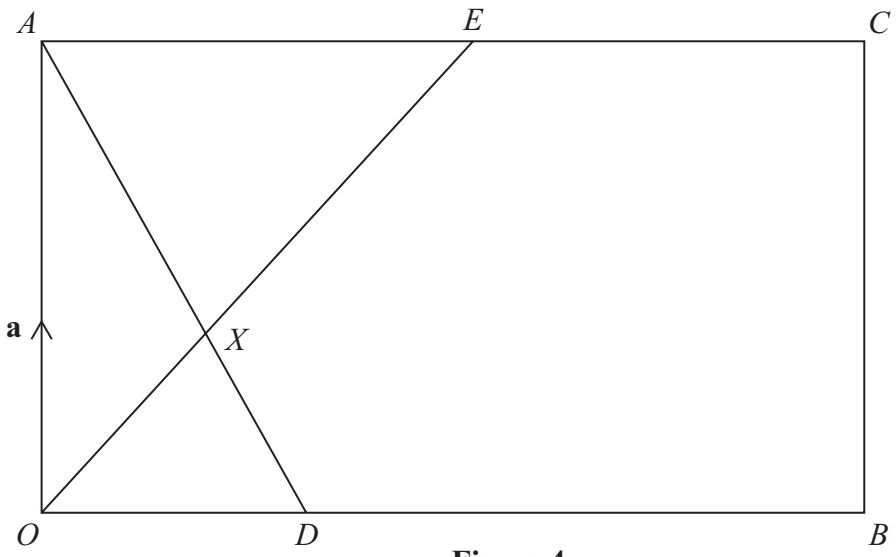


Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows a rectangle $OACB$ with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. The point D on OB is such that $OD : DB = 1 : 3$ and the point E is the midpoint of AC.

(a) Write down, in terms of **a** and **b**,

(i) $\overrightarrow{OE}$, (ii) $\overrightarrow{AD}$.

(2)

X is the point of intersection of AD and OE.

Given that $\overrightarrow{OX} = \lambda\overrightarrow{OE}$,

(b) write down, in terms of λ, **a** and **b**, an expression for $\overrightarrow{OX}$.

(1)

Given also that $\overrightarrow{AX} = \mu\overrightarrow{AD}$,

(c) write down, in terms of μ, **a** and **b**, another expression for $\overrightarrow{OX}$.

(1)

(d) Use your answers to parts (b) and (c) to find the value of λ and the value of μ.

(3)

Given that $|\mathbf{a}| = 4$ and $|\mathbf{b}| = 12$,

(e) find $|\overrightarrow{AD}|$

(2)

(f) Show that, to 3 significant figures, the length of XE is 4.81

(3)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 12 marks)

9 $y = x^2 - 2x + \frac{16}{x}$

(a) Complete the table giving the values to one decimal place where necessary.

x	0.5	1	2	3	4	5	6
y	31.3	15			12		26.7

(3)

(b) On the grid opposite, draw the graph of $y = x^2 - 2x + \frac{16}{x}$ for values of x from 0.5 to 6

(3)

(c) **By drawing a suitable tangent to the curve**, find an estimate, to one decimal place, for the gradient of $y = x^2 - 2x + \frac{16}{x}$ at $x = 4$

(2)

(d) Using the same grid, draw the straight line with equation $y = 20 - 4x$

(2)

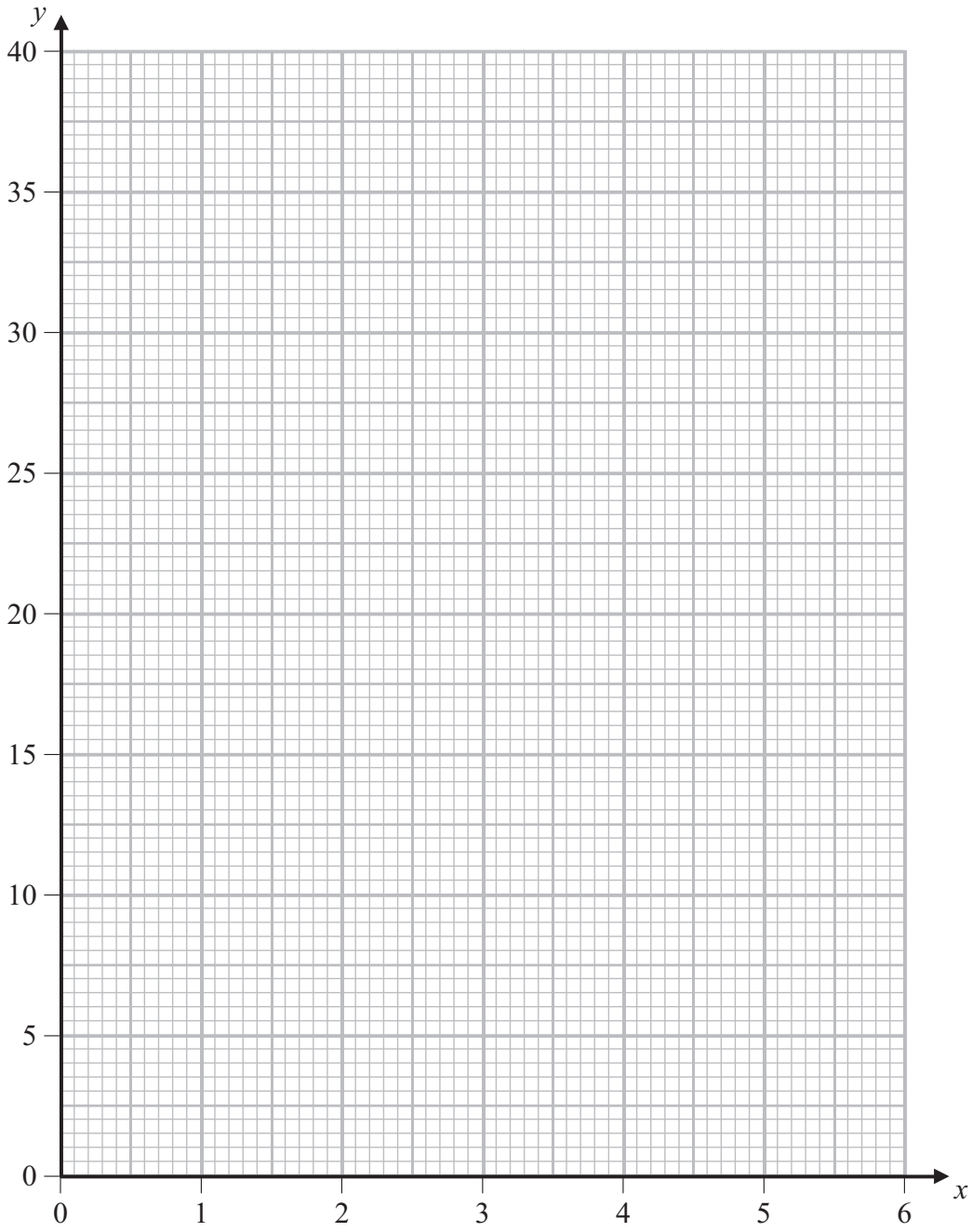
(e) Show that $x^2 - 2x + \frac{16}{x} = 20 - 4x$ simplifies to $x^3 + 2x^2 - 20x + 16 = 0$

(2)

(f) Use your graphs to find estimates, to one decimal place, of two roots of the equation $x^3 + 2x^2 - 20x + 16 = 0$

(2)

Question 9 continued



(Total for Question 9 is 14 marks)

10 The vertices of triangle A are the points with coordinates (2, 2), (4, 2) and (6, 6).

(a) On the grid opposite, draw and label triangle A.

(1)

Triangle B is the image of triangle A under a reflection in the line with equation $y = -1$

(b) On the grid, draw and label the line with equation $y = -1$

(1)

(c) On the grid, draw and label triangle B.

(1)

Triangle B is transformed to triangle C by the enlargement with centre (0, –2) and scale factor $-\frac{1}{2}$

(d) On the grid, draw and label triangle C.

(3)

Triangle C is transformed to triangle D under the transformation with matrix $\mathbf{M}$ where $\mathbf{M} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

(e) On the grid, draw and label triangle D.

(3)

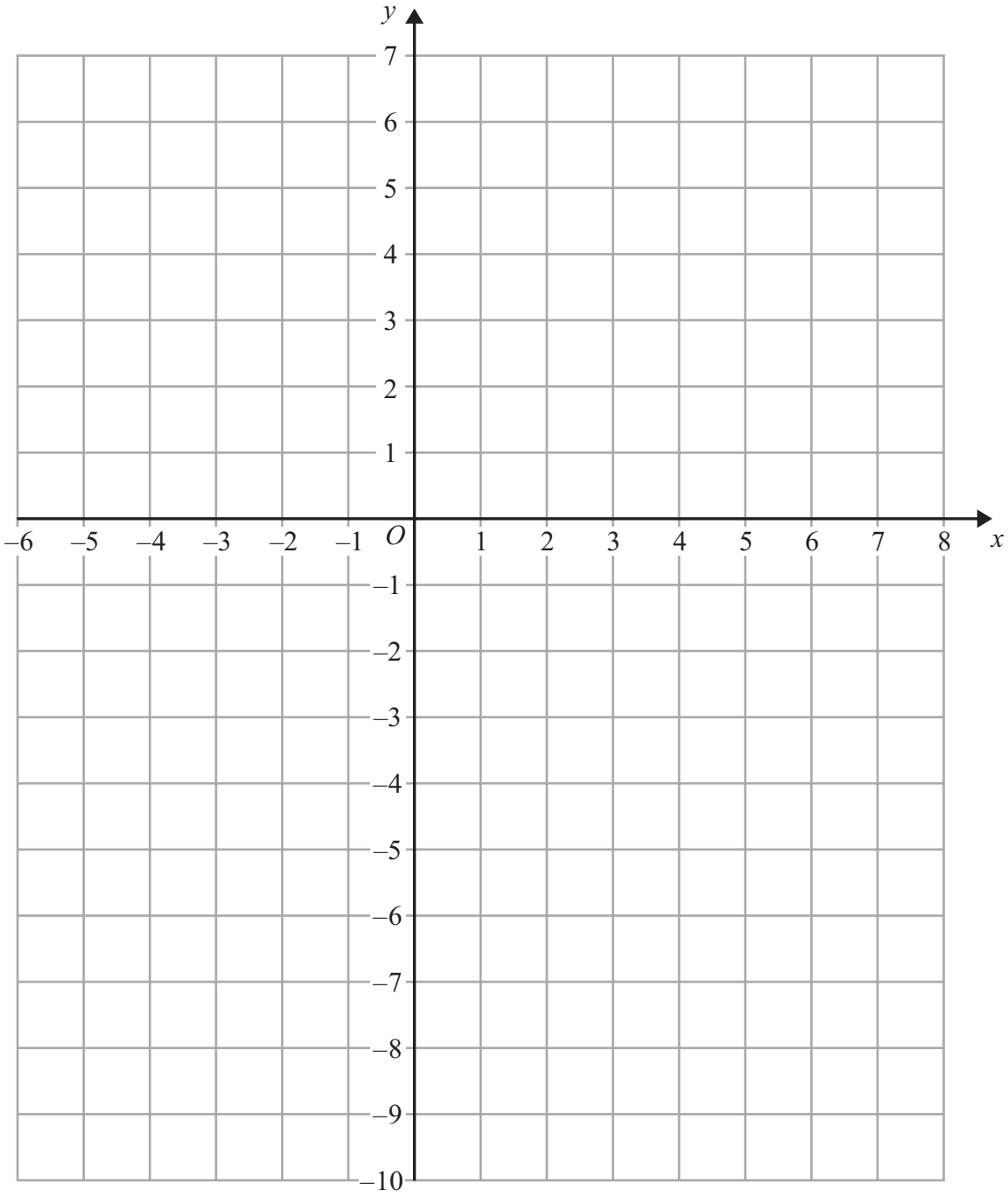
(f) Describe fully the transformation with matrix $\mathbf{M}$.

(2)

(g) Describe fully the **single** transformation that maps triangle D onto triangle A.

(3)

Question 10 continued



Question 10 continued

Question 10 continued

(Total for Question 10 is 14 marks)

11 (a) Factorise fully $2t^3 - 13t^2 + 20t$

(3)

A particle, P, is moving along a straight line so that, at time t seconds, the displacement, s metres, of P from a fixed point O of the line is given by

$$s = 4t^3 - 26t^2 + 40t$$

The particle starts at the point O when $t = 0$

(b) Write down the values of t when P passes through O.

(2)

(c) Find an expression for the velocity, v m/s, of P at time t.

(3)

(d) Find the values of t when the velocity of P is zero.

(4)

(e) Find the acceleration of P when $t = 3$

(4)

Question 11 continued

Question 11 continued

(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS