Candidate surname | Other names

Pearson Edexcel
International GCSE

Centre Number | Candidate Number

Tuesday 15 January 2019

Morning (Time: 2 hours 30 minutes) | Paper Reference **4MB0/02**

Mathematics B
Paper 2

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

Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   Lauren owns a Shetland pony.
    She uses this rule to calculate how much food to give her pony each day.

Give 8 grams of food for each kilogram of the pony's weight.

    Lauren's pony's weight is 180 kg.

    (a) Calculate the weight, in grams, of food that Lauren must give her pony each day.

    (2)

    Lauren thinks that her pony is overweight.
    She discovers that her pony needs to lose 16% of its weight of 180 kg to reach a healthy weight.

    (b) Calculate, in kg, the pony's healthy weight.

    (2)

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Question 1 continued

(Total for Question 1 is 4 marks)

2 Solve the equation $\dfrac{3x-2}{x+7} = \dfrac{x+5}{x-1}$

Give your solutions to 3 significant figures.
Show your working clearly.

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

Question 2 continued

(Total for Question 2 is 7 marks)

Turn over ▶

3 (a) Find the inverse of the matrix $\begin{pmatrix} 6 & -2 \\ -4 & 1 \end{pmatrix}$

(2)

(b) Hence, or otherwise, find the value of x and the value of y that satisfy

$$\begin{pmatrix} 6 & -2 \\ -4 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

(4)

$$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad - bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix} \right]$$

(Total for Question 3 is 6 marks)
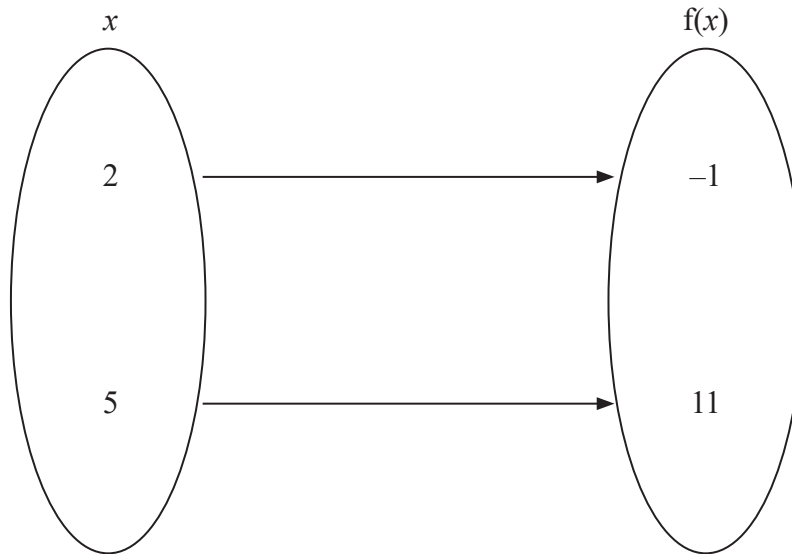
4

Figure 1

Information about the function f is shown in Figure 1.

Given that f is the mapping $f: x \mapsto px + q$, where p and q are constants,

(a) use the information in Figure 1 to write down two equations in p and q.

(2)

(b) Solve your two equations to find the value of p and the value of q.

(3)

(c) Using your values of p and q, find the composite function ff.
Give your answer in the form $ff: x \mapsto cx + d$, where c and d are integers.

(2)

(d) Hence find the value of x for which $f(x) = ff(x)$.

(2)

Question 4 continued

(Total for Question 4 is 9 marks)

P5 5 9 4 7 A 0 9 3 6

5

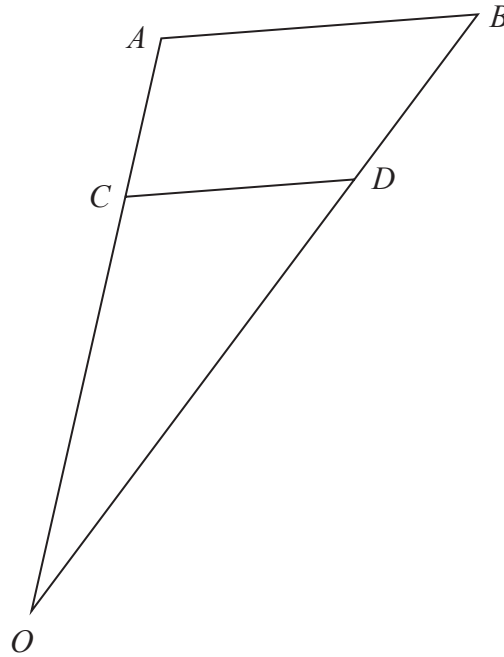

Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows the triangle OAB in which $\overrightarrow{OA} = 6\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

The point C lies on OA such that $OC:OA = 2:3$

(a) Find, in terms of $\mathbf{a}$ and $\mathbf{b}$ or $\mathbf{a}$ or $\mathbf{b}$, simplifying your answer where possible,

  (i) $\overrightarrow{OC}$

  (ii) $\overrightarrow{AB}$

(2)

Given that CD is parallel to AB,

(b) use a vector method to show that $\overrightarrow{DB} = \dfrac{4}{3}\mathbf{b}$

  Show your working clearly.

(4)

Question 5 continued

(Total for Question 5 is 6 marks)

6 A particle, P, is moving along a straight line. At time t seconds, the displacement, s metres, of P from a fixed point O on the line is given by

$$s = 4t^3 - 18t^2 + 5t + 10 \qquad t \geqslant 0$$

At time t seconds, the velocity of P is v m/s and the acceleration of P is a m/s^2

(a) Find an expression, in terms of t, for

   (i) v,

   (ii) a.

(4)

(b) Find the range of values of t for which the acceleration of P is positive.

(2)

Question 6 continued

(Total for Question 6 is 6 marks)

Turn over

7 The table gives information about the times taken, in minutes, by 160 runners to complete a race.

Time taken (*t* minutes)	$0 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 30$	$30 < t \leqslant 45$	$45 < t \leqslant 50$
Frequency	70	21	4	45	20

(a) Work out the number of runners who took more than 30 minutes to complete the race.

(1)

(b) On the grid opposite, draw a histogram for this information.

(5)

One of these runners is to be chosen at random.

(c) Calculate an estimate of the probability that this runner took between 18 minutes and 34 minutes to complete the race.
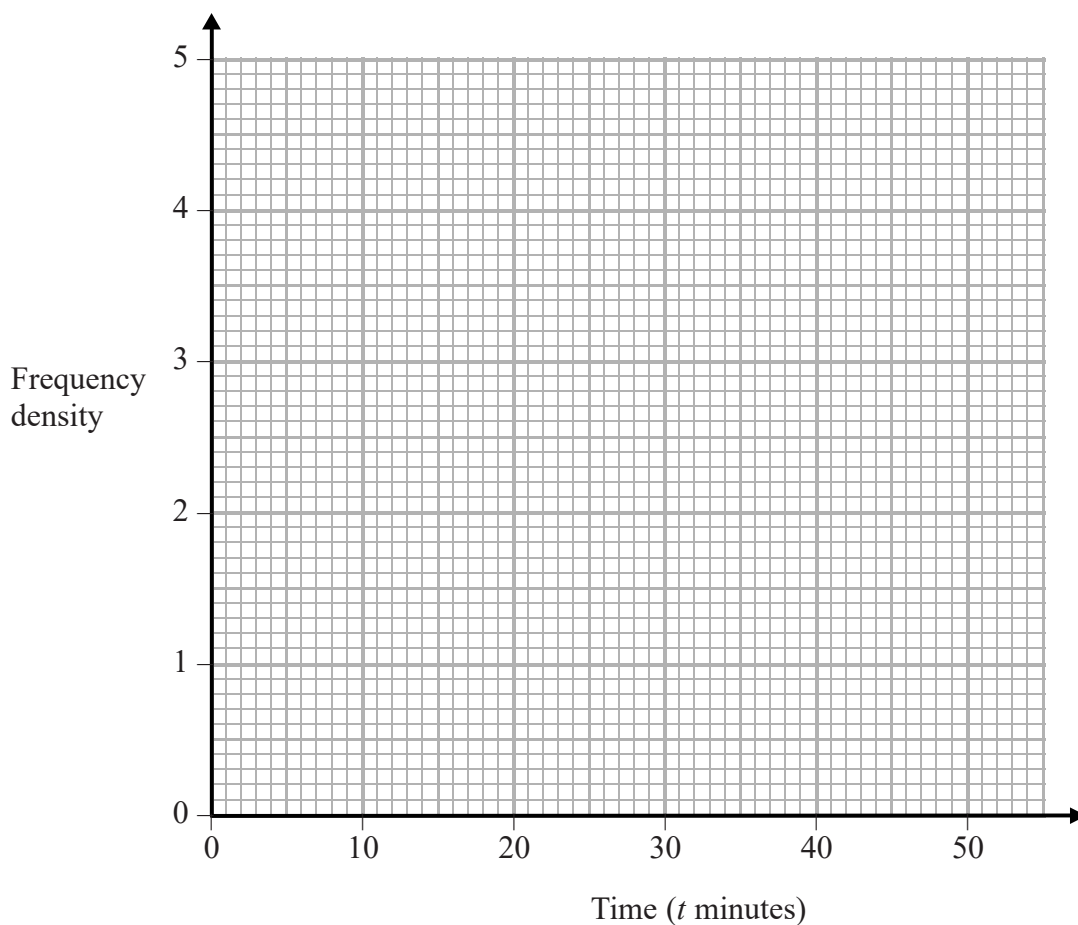
(4)

Frequency
density

Time (*t* minutes)

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

Question 7 continued

Question 7 continued

Only use this grid if you need to redraw your histogram.

Frequency density (vertical axis, 0 to 5)
Time (*t* minutes) (horizontal axis, 0 to 50)
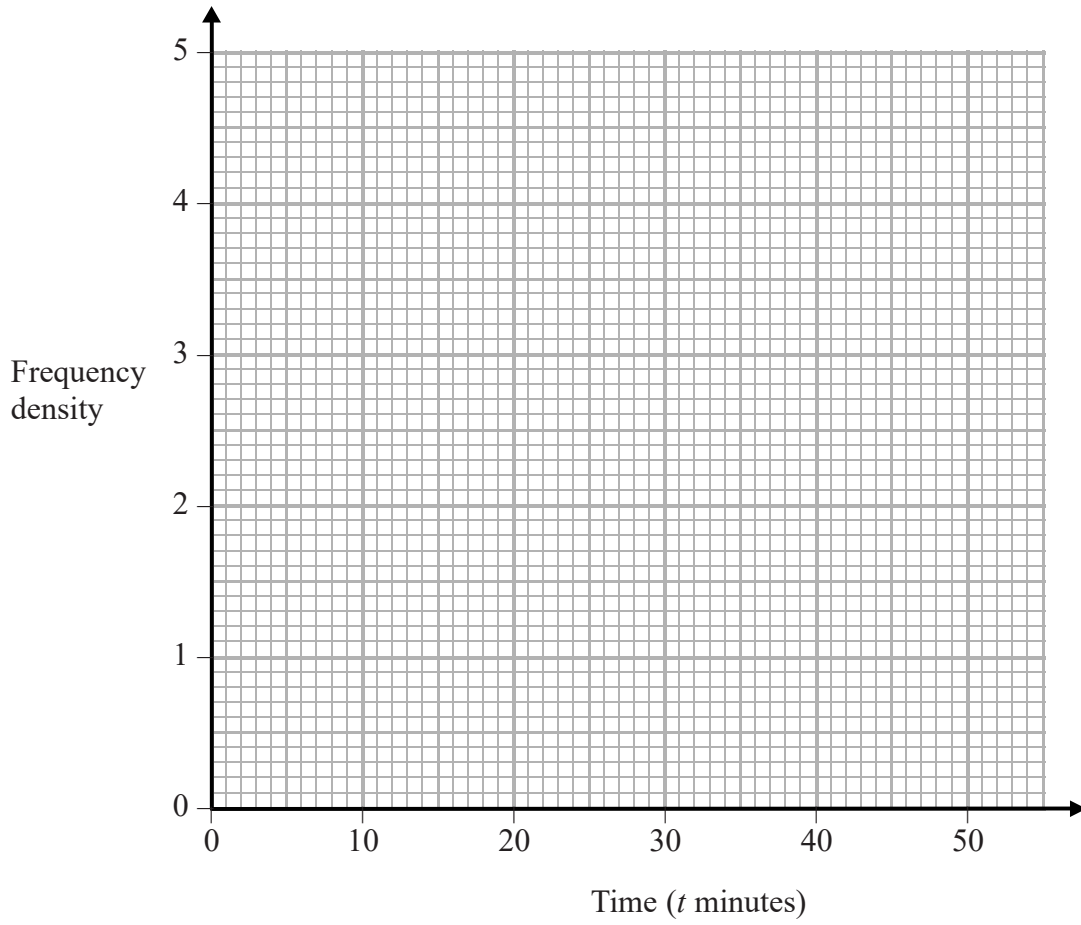
(Total for Question 7 is 10 marks)

P 5 5 9 4 7 A 0 1 7 3 6

8
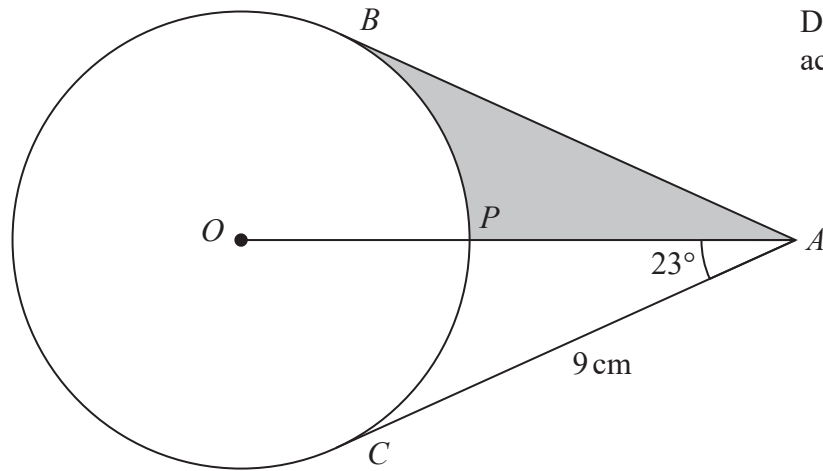
Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a circle *BPC* with centre *O*.

The point *A* is such that *AC* = 9 cm and *AC* and *AB* are tangents to the circle. *APO* is a straight line and ∠*OAC* = 23°

Calculate the length, in cm to 3 significant figures, of

(a) *OA*,

(2)

(b) *AP*,

(3)

(c) the chord *BP*.

(3)

(d) Calculate the size, in degrees, of ∠*ACP*.

(2)

(e) Find the area, in cm² to 3 significant figures, of the shaded region *BAP*.

(4)

$$\left[\begin{array}{l} \text{Cosine rule: } a^2 = b^2 + c^2 - 2bc\cos A \\ \text{Sine rule: } \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} \\ \text{Area of a triangle } = \dfrac{1}{2}bc\sin A \end{array} \right]$$

Question 8 continued

P 5 5 9 4 7 A 0 1 9 3 6

Question 8 continued

Question 8 continued

(Total for Question 8 is 14 marks)

P 5 5 9 4 7 A 0 2 1 3 6

9 Two triangles, *A* and *B*, are shown on the grid on the next page.

(a) Describe the single transformation that maps triangle *A* onto triangle *B*.

(2)

Triangle *B* is transformed to triangle *C* under the transformation with matrix **T** where

$$\mathbf{T} \quad \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$$

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

(3)

Triangle *B* is transformed to triangle *D* by the enlargement with scale factor 2 and centre (−3, 1).
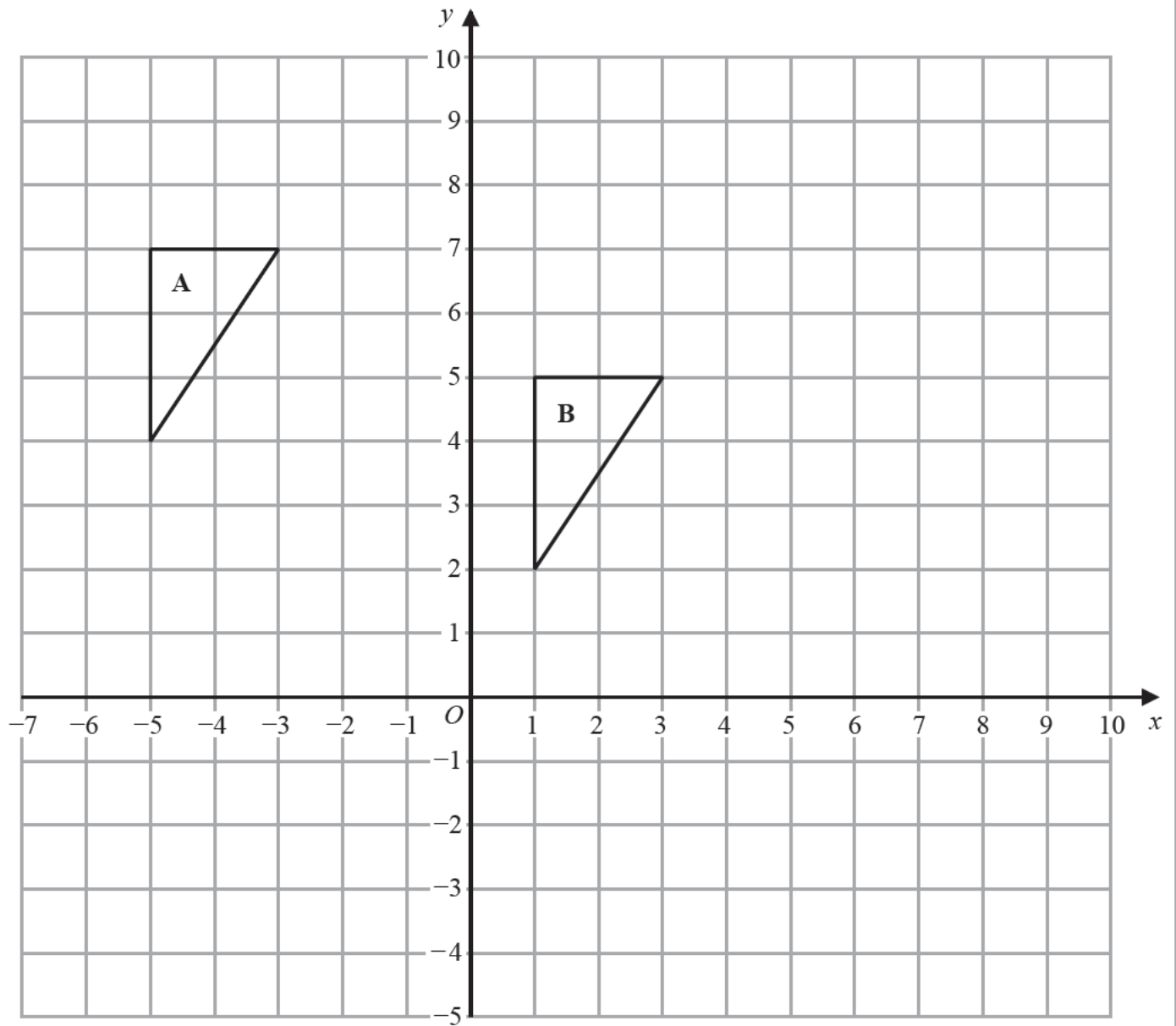
(c) On the grid, draw and label triangle *D*.

(3)

Triangle *C* is transformed to triangle *E* by a reflection in the *y*-axis.

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

(2)

(e) Describe fully the single transformation that maps triangle *A* onto triangle *E*.

(3)

Question 9 continued

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

Turn over ▶

Question 9 continued

Only use this grid if you need to redraw your triangles.
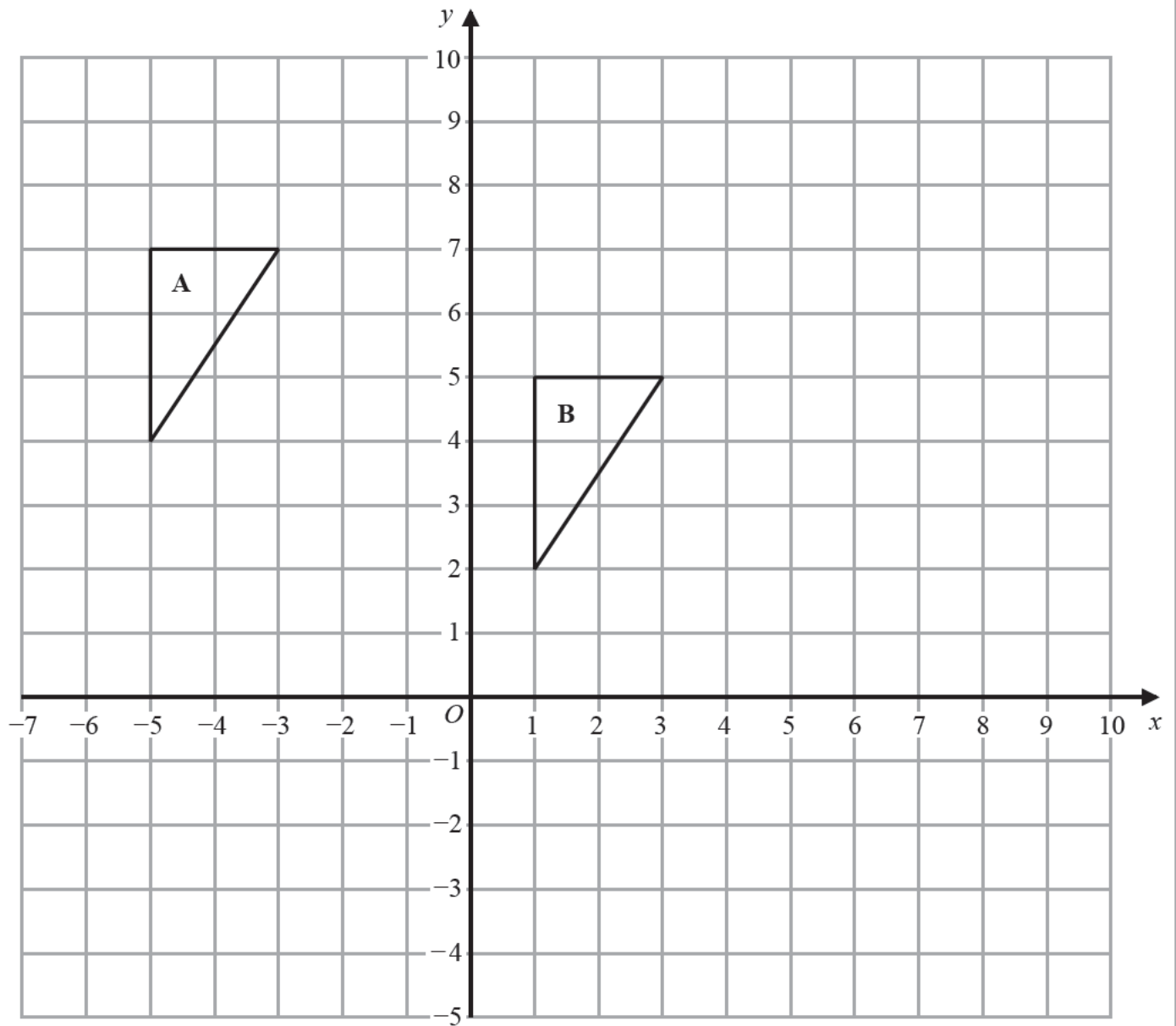
(Total for Question 9 is 13 marks)
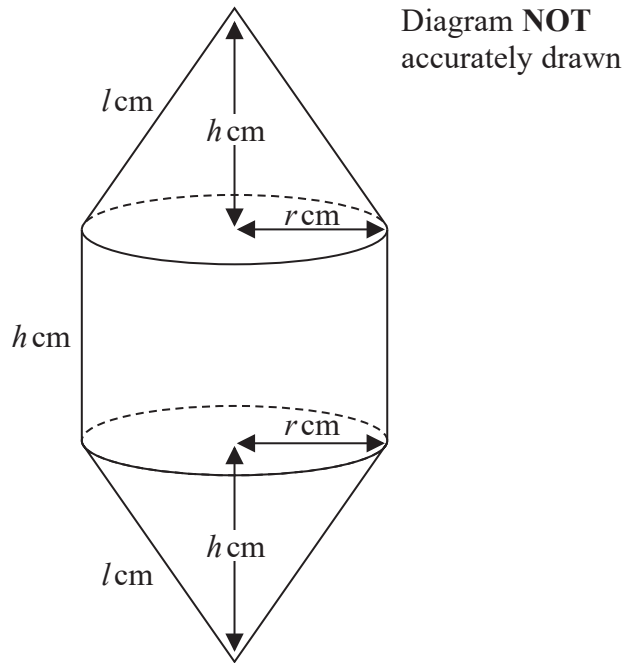
10

Diagram **NOT** accurately drawn

Figure 4

A solid is made by joining a solid right circular cone, with base radius r cm, height h cm and slant height l cm, to each circular face of a solid right circular cylinder, with radius r cm and height h cm, as shown in Figure 4

The centre of the base of each cone coincides with the centre of the circular face of the cylinder to which it is joined.

The total external surface area of the solid is S cm^2

(a) Show that $S = 2\pi r(h + l)$

(2)

Given that $S = 60$ and that $l = 4$

(b) show that $h = \dfrac{30}{\pi r} - 4$

(2)

The total volume of the solid is V cm^3

(c) Show that $V = 50r - \dfrac{20}{3}\pi r^2$

(4)

(d) Using calculus, find the maximum volume, in cm^3 to 3 significant figures, of the solid.

(5)

$$\left[\begin{array}{c} \text{Area of a circle} = \pi r^2 \\ \text{Curved surface area of right circular cylinder} = 2\pi rh \\ \text{Curved surface area of a right circular cone} = \pi rl \\ \text{Volume of a right circular cone} = \frac{1}{3}\pi r^2 h \end{array} \right]$$

Question 10 continued

Turn over ▶

Question 10 continued

Question 10 continued

(Total for Question 10 is 13 marks)

Turn over ▶

11 (a) Complete the following table of values for $y = 2x^3 - x^2 - 6x$

x	0	0.5	1	1.5	2	2.5	3
y	0		−5		0	10	

(3)

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

(3)

(c) Using your graph, find an estimate, to 1 decimal place, of the minimum value of $2x^3 - x^2 - 6x$ in the interval $0 \leqslant x \leqslant 3$

(1)

(d) On your grid, draw the straight line with equation $y = 4x - 7$
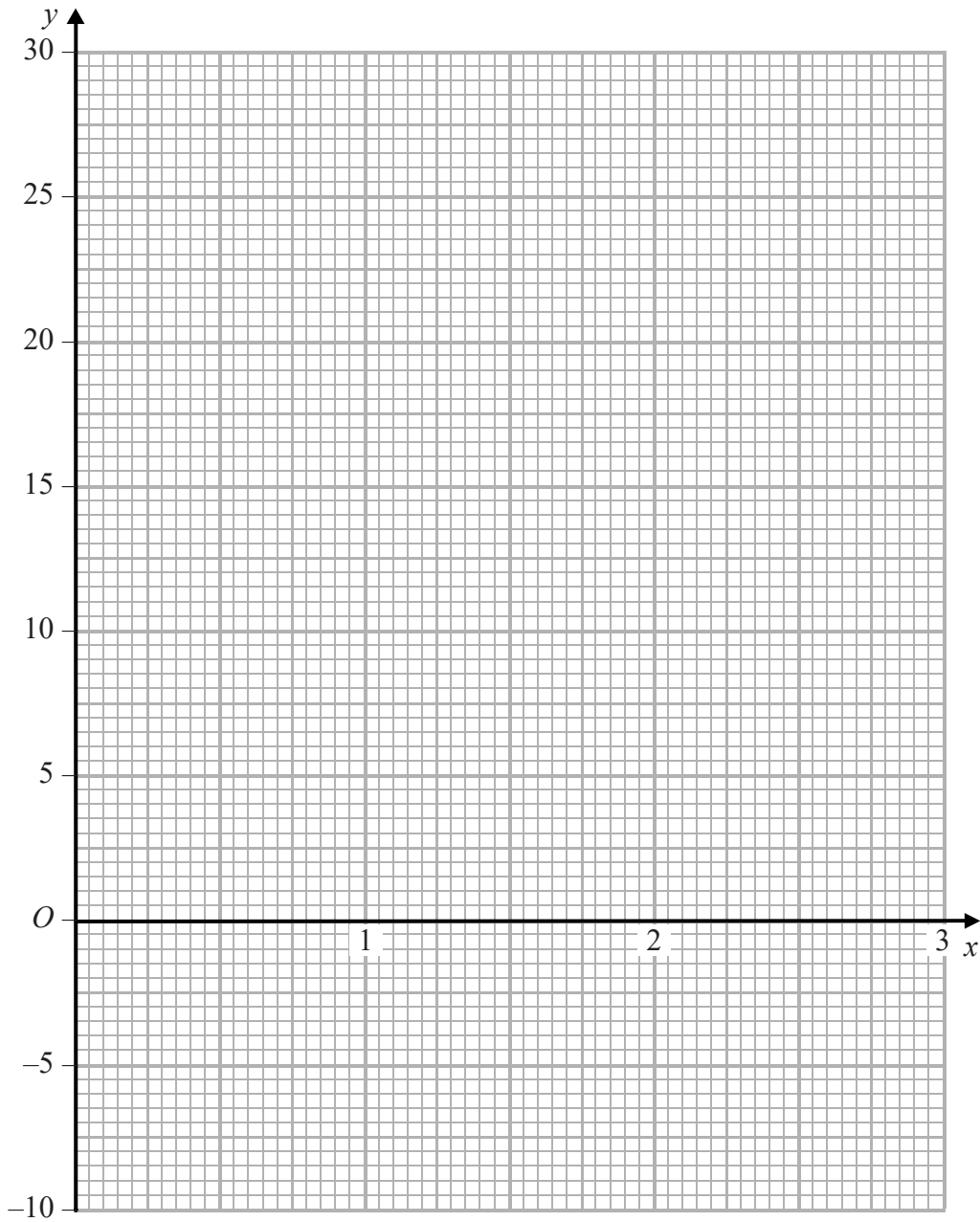
(1)

(e) Use your graphs to find the range of values, to 1 decimal place, of x in $0 \leqslant x \leqslant 3$ for which $2x^3 - x^2 - 10x + 7 < 0$

(4)

Question 11 continued

Turn over for a spare grid if you need to redraw your graph.
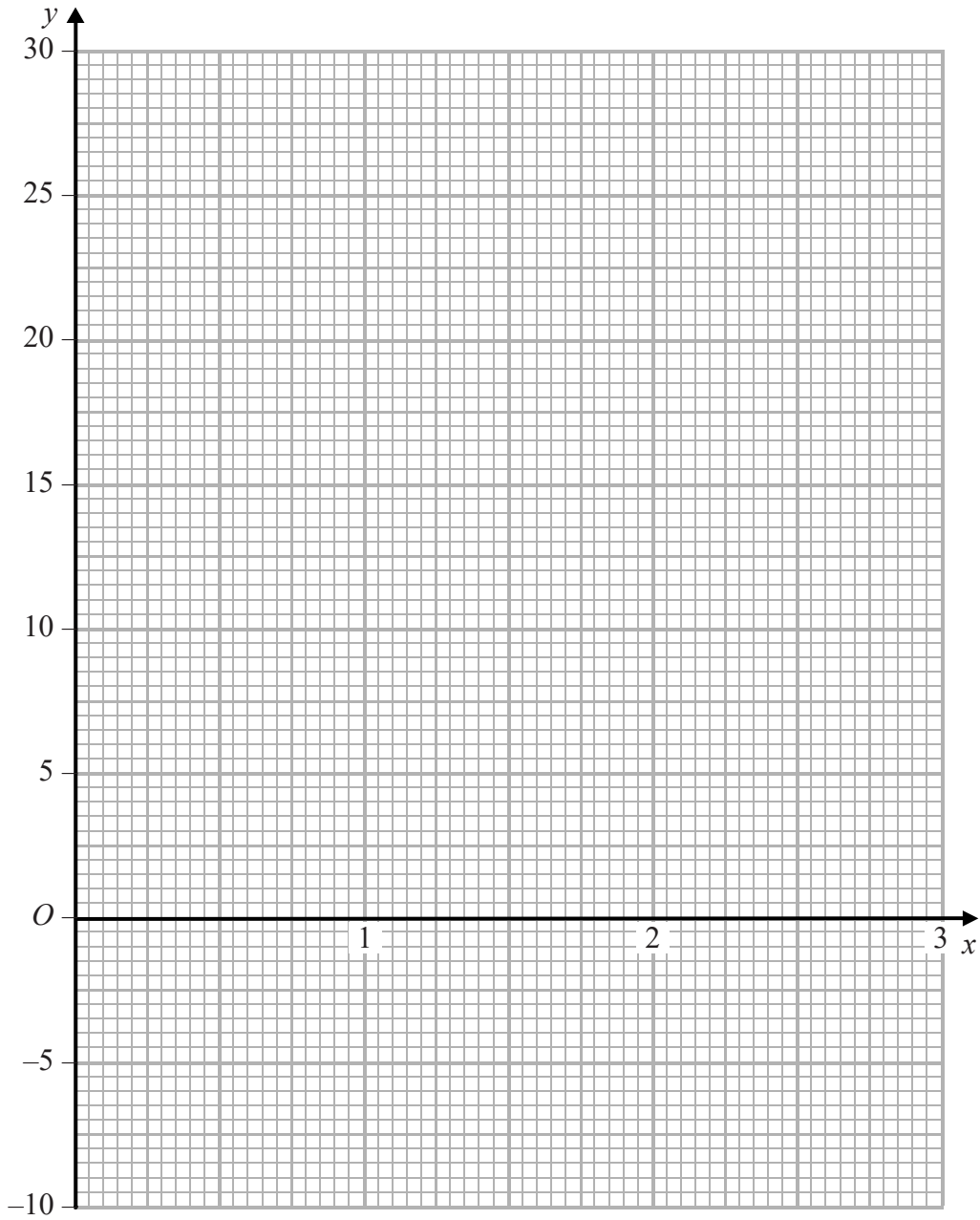
P 5 5 9 4 7 A 0 3 1 3 6

Question 11 continued

Question 11 continued

Only use this grid if you need to redraw your graph.

(Total for Question 11 is 12 marks)

TOTAL FOR PAPER IS 100 MARKS

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