Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Tuesday 28 October 2025

Morning (Time: 2 hours)

Paper reference **4PM1/01**

Further Pure Mathematics

PAPER 1

Calculators 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

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.

Turn over ▶

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P 7 8 9 6 4 A 0 1 3 6

Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

Surface area of sphere $= 4\pi r^2$

Curved surface area of cone $= \pi r \times$ slant height

Volume of sphere $= \frac{4}{3}\pi r^3$

Series

Arithmetic series

Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric series

Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$

Sum to infinity, $S_\infty = \frac{a}{1-r} \quad |r| < 1$

Binomial series

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots \quad \text{for} \quad |x| < 1, n \in \mathbb{Q}$$

Calculus

Quotient rule (differentiation)

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{f}(x)}{\mathrm{g}(x)}\right) = \frac{\mathrm{f}'(x)\mathrm{g}(x) - \mathrm{f}(x)\mathrm{g}'(x)}{[\mathrm{g}(x)]^2}$$

Trigonometry

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

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$\sin(A+B) = \sin A \cos B + \cos A \sin B$ $\quad$ $\sin(A-B) = \sin A \cos B - \cos A \sin B$

$\cos(A+B) = \cos A \cos B - \sin A \sin B$ $\quad$ $\cos(A-B) = \cos A \cos B + \sin A \sin B$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} \qquad \tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Logarithms

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Expand $\left(1-\frac{x}{4}\right)^{-2}$ in ascending powers of x up to and including the term in x^3

Where appropriate, express each coefficient as an exact fraction in its lowest terms.

(3)

(Total for Question 1 is 3 marks)

2 $f(x) = 2x^2 - 10x + 7$

Given that $f(x)$ can be written in the form $f(x) = a(x+b)^2 + c$ where a, b and c are rational numbers,

(a) find the value of a, the value of b and the value of c

(3)

(b) Hence, or otherwise, write down

(i) the minimum value of $f(x)$

(ii) the value of x at which this minimum value occurs.

(2)

Question 2 continued

(Total for Question 2 is 5 marks)

3

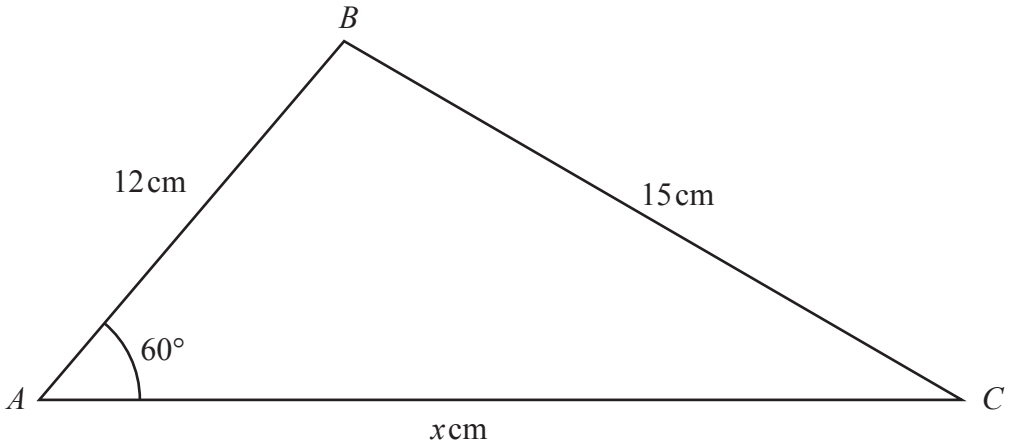

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows triangle ABC where

$AB = 12$ cm $\quad BC = 15$ cm $\quad AC = x$ cm $\quad \angle BAC = 60°$

(a) Show that x satisfies the equation

$$x^2 - 12x - 81 = 0$$

(3)

(b) Hence find the exact area, in cm^2, of triangle ABC

Give your answer in the form $9\left(p\sqrt{q} + \sqrt{r}\right)$ where p, q and r are integers.

(3)

Question 3 continued

(Total for Question 3 is 6 marks)

4 Given that $\sum_{r=1}^{n}(4r+A)=\frac{n}{2}(4n-6)$ where A is a constant

(a) show that $A=-5$

(3)

Hence, or otherwise,

(b) (i) evaluate $\sum_{21}^{60}(4r-5)$

(2)

(ii) find the greatest value of n such that

$$\sum_{r=1}^{n}(4r-5)<3418$$

(3)

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Question 4 continued

Question 4 continued

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Question 4 continued

(Total for Question 4 is 8 marks)

5 (a) On the grid opposite, draw the line with equation

(i) $3x - 4y = 12$ (ii) $y + 6 + 3x = 0$ (iii) $3y = 18 - x$

(3)

(b) Show, by shading on the grid, the region R defined by the inequalities

$3x - 4y \leqslant 12$ $y + 6 + 3x \geqslant 0$ $3y \leqslant 18 - x$

(1)

For all points in R, with coordinates (x, y)

$$P = 3x - 2y$$

Using values from your graph,

(c) find the least value of P and the greatest value of P

(4)

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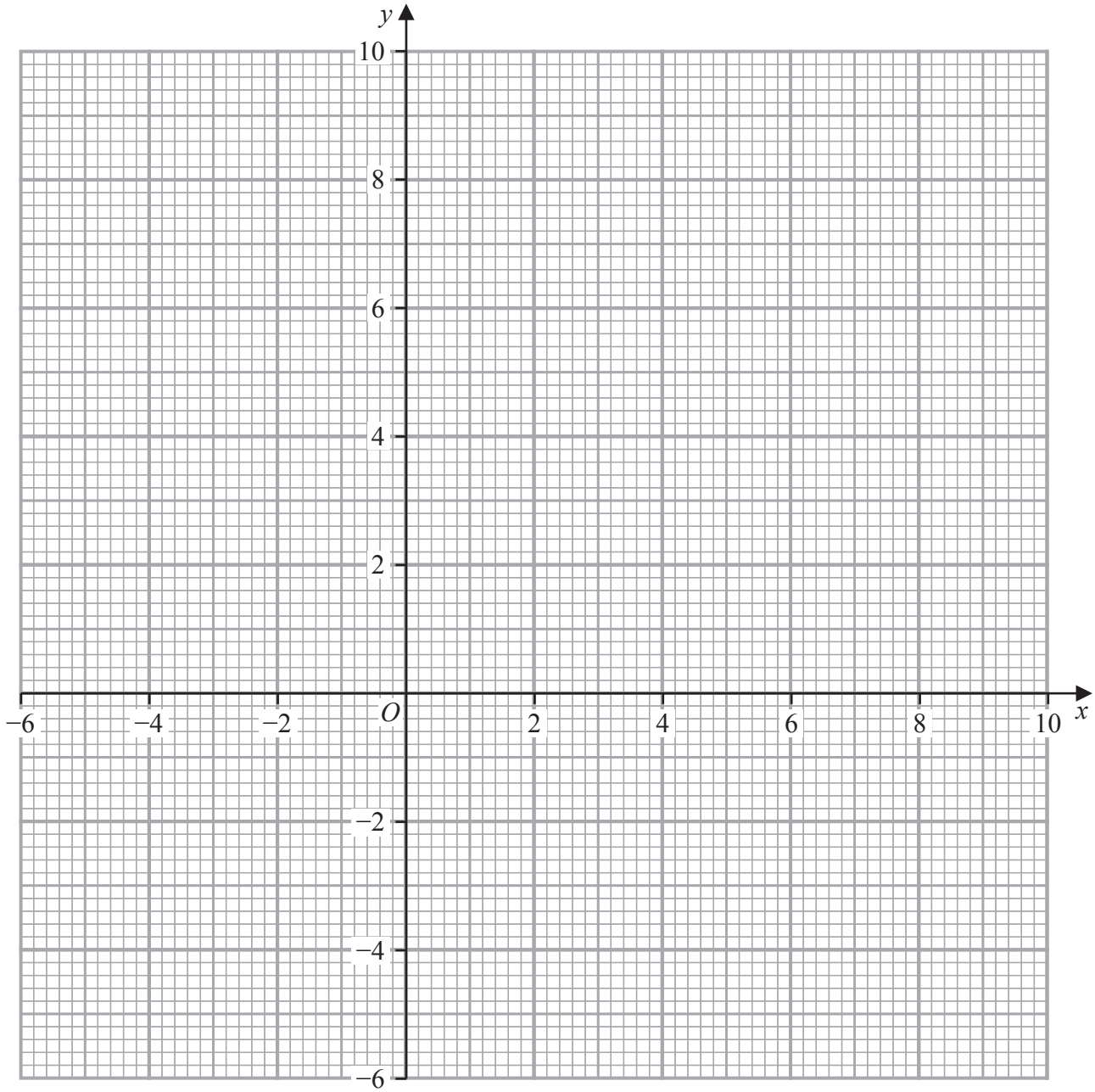
Question 5 continued



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

Question 5 continued

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Question 5 continued

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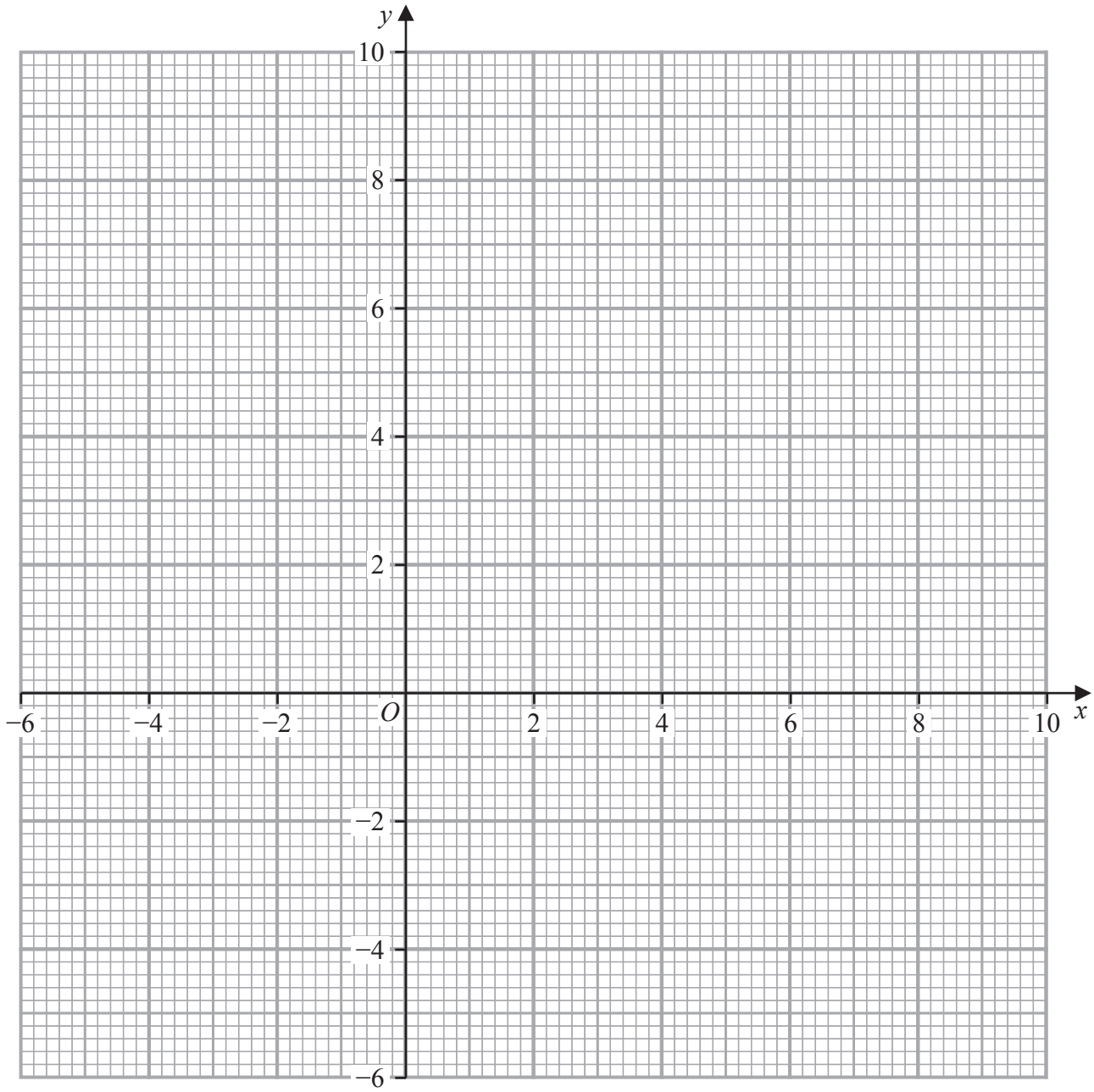

(Total for Question 5 is 8 marks)

6 $y = e^{4x} \cos 3x$

Show that

$$\frac{d^2y}{dx^2} + Ay = B\frac{dy}{dx}$$ where A and B are integers to be found.

(8)

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Question 6 continued

(Total for Question 6 is 8 marks)

7 (a) Show that $(\alpha+\beta)(\alpha^2-\alpha\beta+\beta^2)=\alpha^3+\beta^3$

(1)

The equation $2x^2+8x-k=0$ has roots α and β and where k is a constant

Given that $\alpha^3+\beta^3=-94$

(b) show that $k=5$

(4)

Given that $\alpha>\beta$ and without solving the equation $2x^2+8x-k=0$

(c) (i) show that $\alpha-\beta=\sqrt{26}$

(3)

(ii) hence find the exact value of $\alpha^3-\beta^3$

(2)

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Question 7 continued

Question 7 continued

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Question 7 continued

(Total for Question 7 is 10 marks)

8 (a) Complete the table of values for $y = 3^x - 2$ giving your answers to one decimal place.

x	−1	−0.5	0	0.25	0.5	0.75	1	1.5	2
y	−1.7		−1				1	3.2	7

(2)

(b) On the grid opposite, draw the graph of $y = 3^x - 2$ for $-1 \leqslant x \leqslant 2$

(2)

(c) Use your graph to obtain an estimate, to one decimal place, of the value of $\log_3 4.5$

Show clearly how you have used your graph.

(3)

(d) By drawing a straight line on your grid obtain an estimate, to one decimal place, of the root of the equation $\log_3(8 - 3x) - x = 0$ in the interval $-1 \leqslant x \leqslant 2$

(5)

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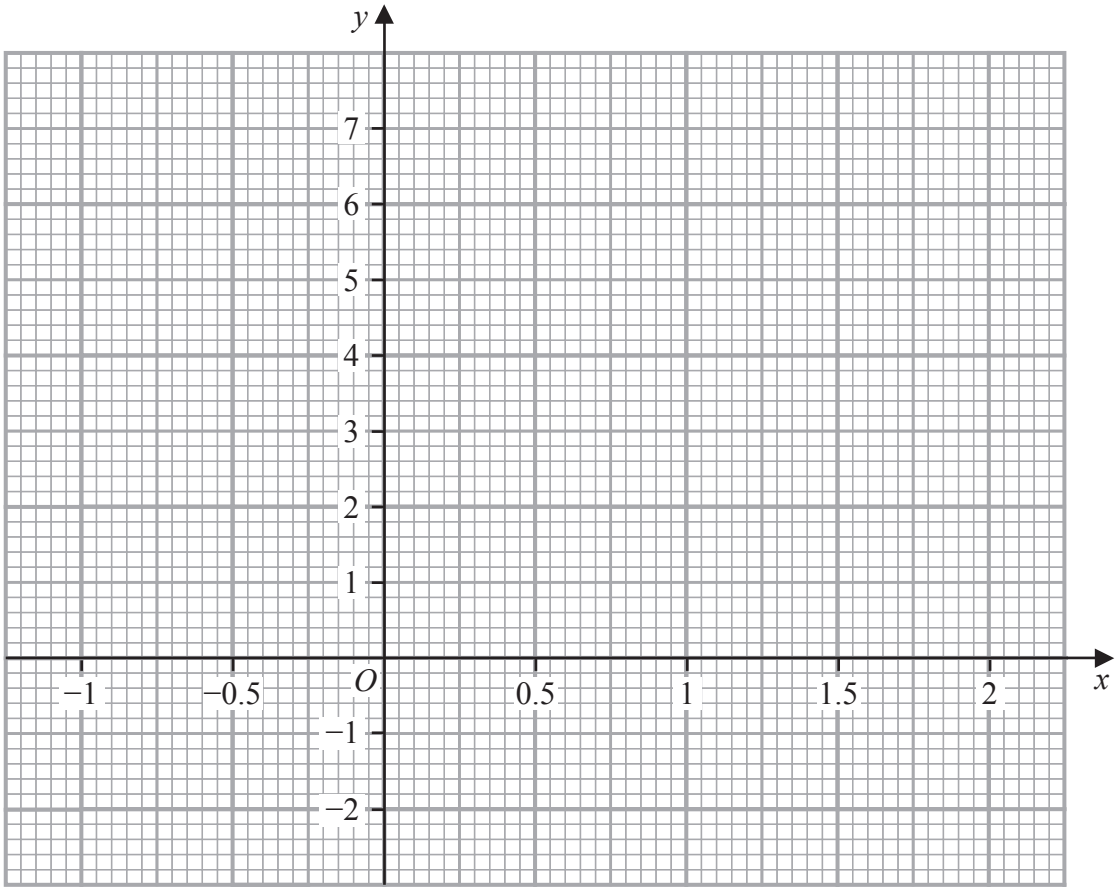
Question 8 continued



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

Question 8 continued

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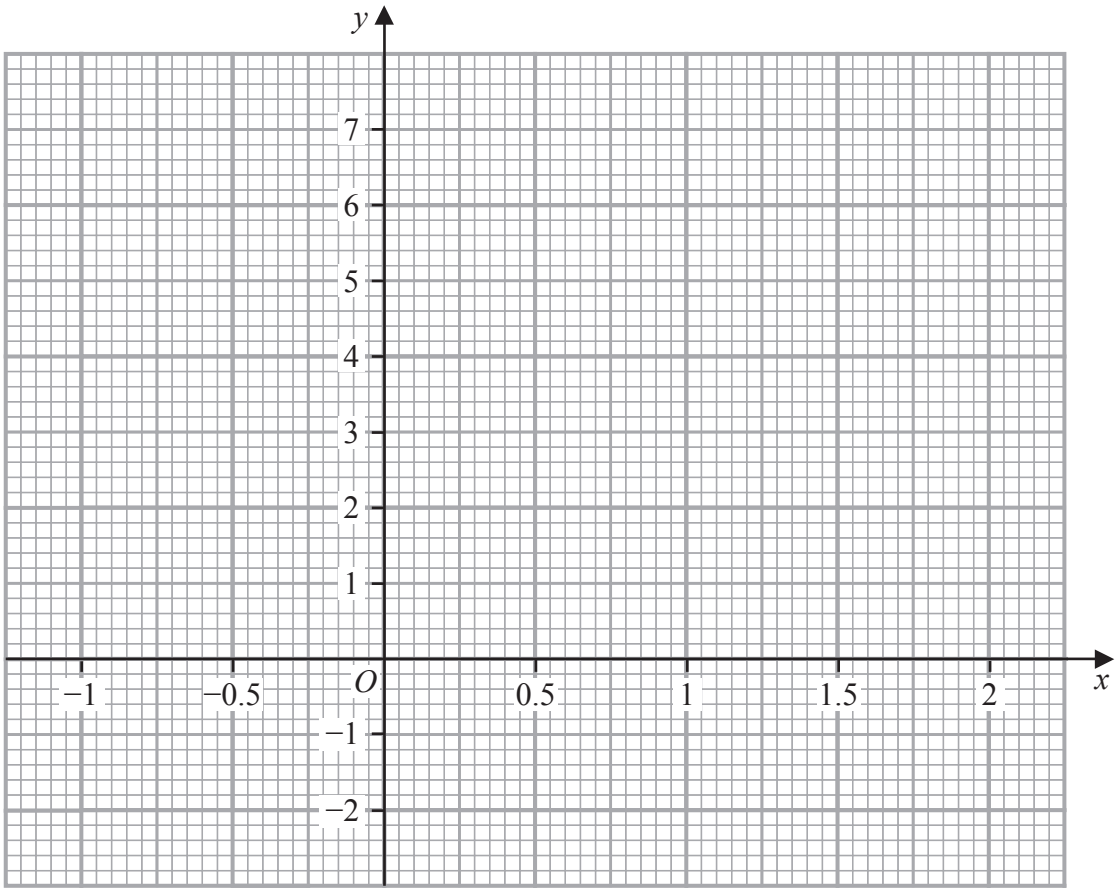
Question 8 continued

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



(Total for Question 8 is 12 marks)

9

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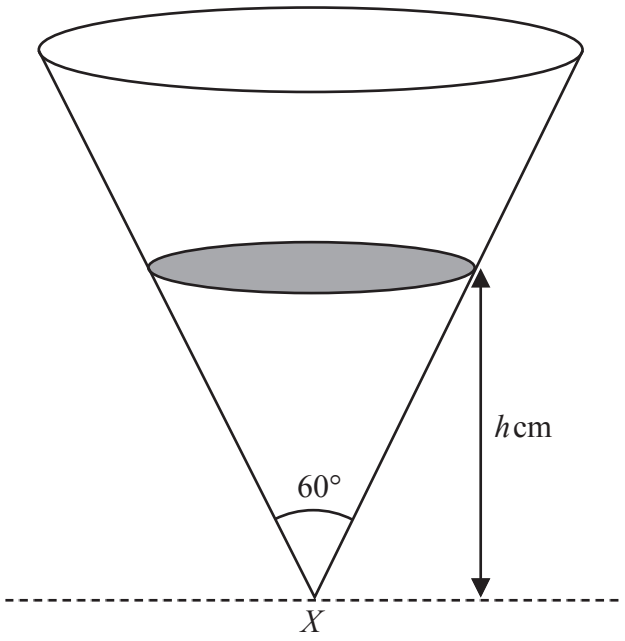

Figure 2

Figure 2 shows a hollow right circular cone fixed with its axis of symmetry vertical.

The vertical angle of the cone is 60°
Initially the cone is empty.

At time $t = 0$ liquid starts to fill the cone at a constant rate of $0.2\,\text{cm}^3/\text{s}$
At time t seconds after the liquid starts to fill the cone, the height of the liquid is h cm above X

(a) Show that $h = \sqrt[3]{\frac{9t}{5\pi}}$

(5)

The surface area of the liquid, shown shaded in Figure 2, is increasing at a constant rate of $p\,\text{cm}^2/\text{s}$ when $t = 6$

(b) Find, to 3 significant figures, the value of p

(8)

Question 9 continued

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Question 9 continued

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Question 9 continued

(Total for Question 9 is 13 marks)

10 The equation of the line L_1 is $y - 3x + a = 0$

The point A with coordinates $(a, 10)$ lies on L_1

(a) Show that $a = 5$

(2)

Line L_1 crosses the y-axis at the point B

(b) Write down the coordinates of B

(1)

The point C with coordinates $(50, -5)$ lies on L_2

Given that L_2 passes through A

(c) (i) show that L_1 and L_2 are perpendicular

(3)

(ii) hence find an equation for L_2 giving your answer in the form $y = px + q$

(2)

The point D has coordinates (m, n)

The length of CD is $15\sqrt{10}$ and the gradient of BD is -3

(d) Find the value of m and the value of n

(6)

(e) Find the area of quadrilateral $ABCD$

(3)

Question 10 continued

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Question 10 continued

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Question 10 continued

(Total for Question 10 is 17 marks)

11 (a) Using a formula on page 2, show that

$$\frac{1-\cos 2A}{1+\cos 2A} = \tan^2 A$$

(3)

(b) Hence, or otherwise, solve in degrees to one decimal place

$$\frac{3-3\cos 4x}{1+\cos 4x} + \frac{5\sin 2x}{\cos 2x} = 2 \quad \text{for } -90^\circ < x < 90^\circ$$

(7)

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Question 11 continued

Question 11 continued

(Total for Question 11 is 10 marks)

TOTAL FOR PAPER IS 100 MARKS

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