Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number

Candidate Number

Core Mathematics C34

Advanced

Sample Assessment Material
Time: 2 hours 30 minutes

Paper Reference
WMA02/01

You must have:
Mathematical Formulae and Statistical Tables (Blue)

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 125.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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PEARSON

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1. (a) Express $5\cos 2\theta - 12\sin 2\theta$ in the form $R\cos(2\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$
Give the value of α to 2 decimal places.

(3)

(b) Hence solve, for $0 \leqslant \theta < 180°$, the equation

$$5\cos 2\theta - 12\sin 2\theta = 10$$

giving your answers to 1 decimal place.

(5)

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Question 1 continued

Q1

(Total 8 marks)

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2.

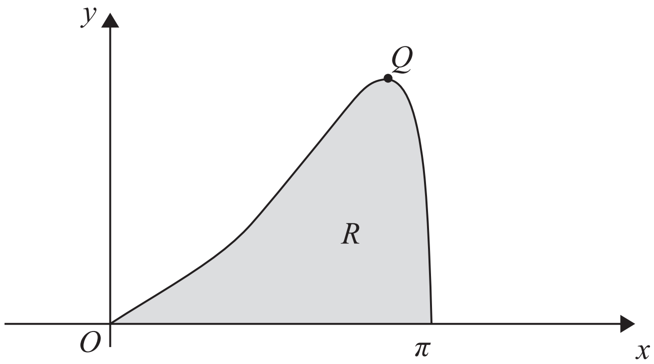

Figure 1

Figure 1 shows a sketch of the curve with equation $y = e^x\sqrt{\sin x}$, $0 \leqslant x \leqslant \pi$.

The finite region R, shown shaded in Figure 1, is bounded by the curve and the x-axis.

(a) Complete the table below with the values of y corresponding to $x = \frac{\pi}{4}$ and $x = \frac{\pi}{2}$, giving your answers to 5 decimal places.

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π
y	0			8.87207	0

(2)

(b) Use the trapezium rule, with all the values of y in the completed table, to obtain an estimate for the area of the region R. Give your answer to 4 decimal places.

(3)

The curve $y = e^x\sqrt{\sin x}$, $0 \leqslant x \leqslant \pi$, has a maximum turning point at Q, shown in Figure 1.

(c) Find the x coordinate of Q.

(6)

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Question 2 continued

Leave blank

Question 2 continued

Leave blank

Question 2 continued

Q2

(Total 11 marks)

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3. Using the substitution $u = \cos x + 1$, or otherwise, show that

$$\int_0^{\frac{\pi}{2}} e^{(\cos x + 1)} \sin x \, dx = e(e - 1)$$

(6)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

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4. (a) Use the binomial theorem to expand

$$(2 - 3x)^{-2}, \qquad |x| < \frac{2}{3}$$

in ascending powers of x, up to and including the term in x^3. Give each coefficient as a simplified fraction.

(5)

$$f(x) = \frac{a + bx}{(2 - 3x)^2}, \quad |x| < \frac{2}{3}, \quad \text{where } a \text{ and } b \text{ are constants.}$$

In the binomial expansion of f(x), in ascending powers of x, the coefficient of x is 0 and the coefficient of x^2 is $\dfrac{9}{16}$

Find

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

(5)

(c) the coefficient of x^3, giving your answer as a simplified fraction.

(3)

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Question 4 continued

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Q4

(Total 13 marks)

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5. The functions f and g are defined by

$$\mathrm{f} : x \mapsto \mathrm{e}^{-x} + 2, \qquad x \in \mathbb{R}$$
$$\mathrm{g} : x \mapsto 2 \ln x, \qquad x > 0$$

(a) Find $\mathrm{fg}(x)$, giving your answer in its simplest form.
(3)

(b) Find the exact value of x for which $\mathrm{f}(2x + 3) = 6$
(4)

(c) Find f^{-1}, stating its domain.
(3)

(d) On the same axes, sketch the curves with equation $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$, giving the coordinates of all the points where the curves cross the axes.
(4)

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Question 5 continued

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Question 5 continued

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Question 5 continued

(Total 14 marks)

Q5

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6. The curve C has equation

$$16y^3 + 9x^2y - 54x = 0$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of x and y.

(5)

(b) Find the coordinates of the points on C where $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$

(7)

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Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Q6

(Total 12 marks)

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7. (a) Show that

$$\cot x - \cot 2x \equiv \operatorname{cosec} 2x, \qquad x \neq \frac{n\pi}{2}, \quad n \in \mathbb{Z}$$

(5)

(b) Hence, or otherwise, solve for $0 \leqslant \theta \leqslant \pi$

$$\operatorname{cosec}\left(3\theta + \frac{\pi}{3}\right) + \cot\left(3\theta + \frac{\pi}{3}\right) = \frac{1}{\sqrt{3}}$$

You must show your working.
(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(5)

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total 10 marks)

Q7

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8. $$h(x) = \frac{2}{x+2} + \frac{4}{x^2+5} - \frac{18}{(x^2+5)(x+2)}, \qquad x \geqslant 0$$

(a) Show that $h(x) = \dfrac{2x}{x^2+5}$ **(4)**

(b) Hence, or otherwise, find $h'(x)$ in its simplest form. **(3)**

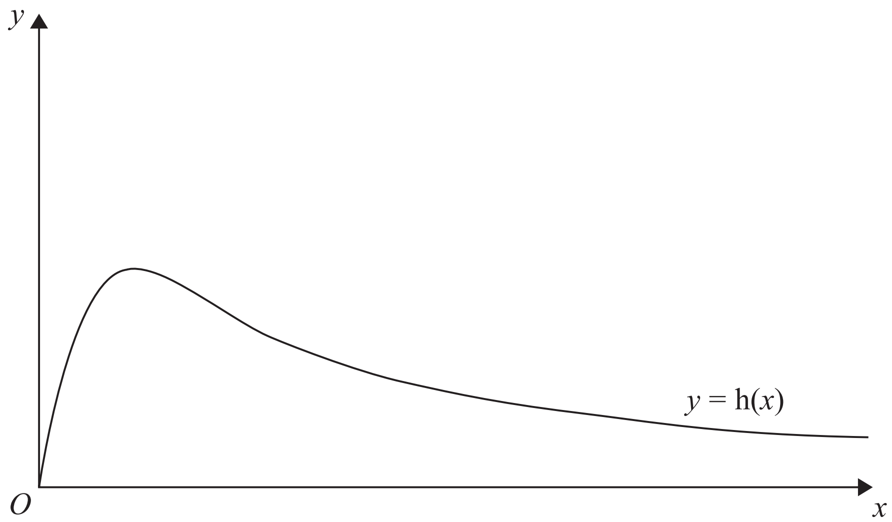

Figure 2

Figure 2 shows a graph of the curve with equation $y = h(x)$.

(c) Calculate the range of $h(x)$. **(5)**

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 12 marks)

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9. The line l_1 has equation $\mathbf{r} = \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$, where λ is a scalar parameter.

The line l_2 has equation $\mathbf{r} = \begin{pmatrix} 0 \\ 9 \\ -3 \end{pmatrix} + \mu \begin{pmatrix} 5 \\ 0 \\ 2 \end{pmatrix}$, where μ is a scalar parameter.

Given that l_1 and l_2 meet at the point C, find

(a) the coordinates of C.

(3)

The point A is the point on l_1 where $\lambda = 0$ and the point B is the point on l_2 where $\mu = -1$

(b) Find the size of the angle ACB. Give your answer in degrees to 2 decimal places.

(4)

(c) Hence, or otherwise, find the area of the triangle ABC.

(5)

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Question 9 continued

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Question 9 continued

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Question 9 continued

(Total 12 marks)

Q9

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10.

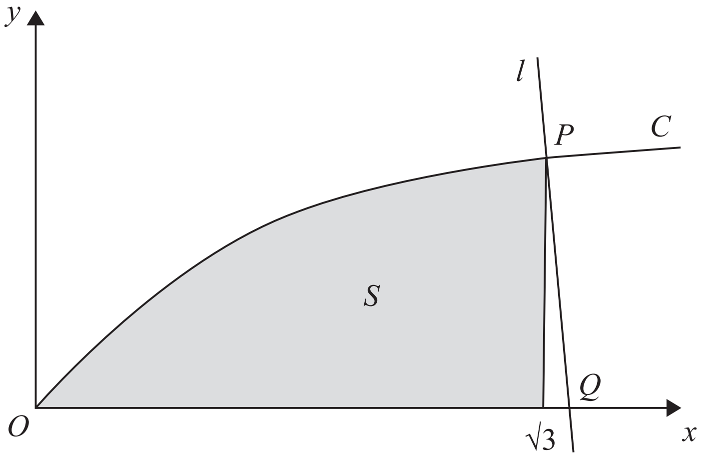

Figure 3

Figure 3 shows part of the curve C with parametric equations

$$x = \tan\theta, \qquad y = \sin\theta, \qquad 0 \leqslant \theta \leqslant \frac{\pi}{2}$$

The point P lies on C and has coordinates $\left(\sqrt{3}, \frac{1}{2}\sqrt{3}\right)$

(a) Find the value of θ at the point P.

(2)

The line l is a normal to C at P. The normal cuts the x-axis at the point Q.

(b) Show that Q has coordinates $\left(k\sqrt{3}, 0\right)$, giving the value of the constant k.

(6)

The finite shaded region S shown in Figure 3 is bounded by the curve C, the line $x = \sqrt{3}$ and the x-axis. This shaded region is rotated through 2π radians about the x-axis to form a solid of revolution.

(c) Find the volume of the solid of revolution, giving your answer in the form $p\pi\sqrt{3} + q\pi^2$, where p and q are constants.

(7)

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Question 10 continued

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Question 10 continued

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Question 10 continued

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Question 10 continued

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Question 10 continued

Q10

(Total 15 marks)

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11. A team of conservationists is studying the population of meerkats on a nature reserve. The population is modelled by the differential equation

$$\frac{\mathrm{d}P}{\mathrm{d}t} = \frac{1}{15}P(5 - P), \qquad t \geqslant 0$$

where P, in thousands, is the population of meerkats and t is the time measured in years since the study began.

Given that when $t = 0$, $P = 1$,

(a) solve the differential equation, giving your answer in the form

$$P = \frac{a}{b + c\mathrm{e}^{-\frac{1}{3}t}}$$

where a, b and c are integers.

(11)

(b) Hence show that the population cannot exceed 5000

(1)

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Question 11 continued

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Question 11 continued

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Question 11 continued

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Question 11 continued

Q11

(Total 12 marks)

TOTAL FOR PAPER: 125 MARKS

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