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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

Paper reference **4PM1/01R**

Further Pure Mathematics
PAPER 1R



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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Q:1/1/1/1/

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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

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

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 An arithmetic series has 5th term 16 and 100th term 301

Find the sum of the first 50 terms of the series.

(5)

(Total for Question 1 is 5 marks)

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2 A particle P is moving along a straight line, which passes through the fixed point O.

At time t seconds ($t \geqslant 0$), the velocity, v m/s, of P is given by

$$v = t^2 - 3t + 4$$

At time t seconds the acceleration of P is a m/s^2

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

(2)

The displacement of P from O is 7 m when $t = 2$

(b) Find the exact displacement of P from O when $t = 4$

(5)

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Question 2 continued

(Total for Question 2 is 7 marks)

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3

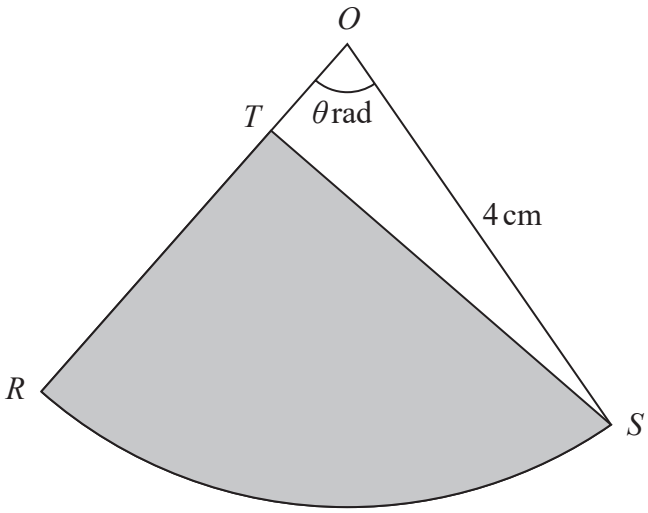

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Figure 1

Figure 1 shows sector ORS of a circle with centre O and radius 4 cm.
The size of angle ROS is θ radians.

The area of sector ORS is 2π cm^2

(a) Find the exact value of θ

(2)

(b) Find the perimeter, in cm to 3 significant figures, of the sector ORS.

(2)

The point T lies on OR such that $OT : TR = 1 : 3$

The region shown shaded in Figure 1 is bounded by the line TR, the line TS and the arc RS of the sector.

The area of this region is A cm^2

(c) Find the exact value of A

(2)

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Question 3 continued

(Total for Question 3 is 6 marks)

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4

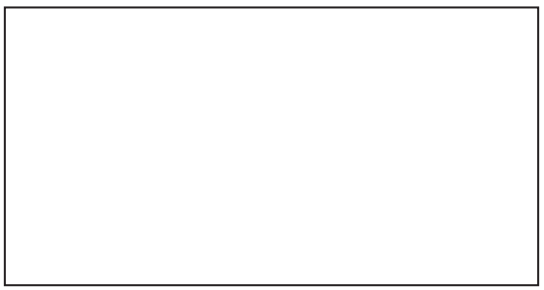

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Figure 2

Figure 2 shows a rectangle with width x metres and length $(x + 4)$ metres.

The perimeter of the rectangle is P metres and the area of the rectangle is $A\,m^2$

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

(i) P (ii) A

(2)

The perimeter of the rectangle has to be less than 30 metres.
The area of the rectangle has to be greater than $12\,m^2$

(b) Find the set of possible values for x
Give your answer in the form $a < x < b$

(5)

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Question 4 continued

(Total for Question 4 is 7 marks)

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5 Differentiate with respect to x

(a) $e^{4x}(6x+2)^{\frac{3}{2}}$

Give your answer in the form $e^{4x}\left(\sqrt{6x+2}\right)(Ax+B)$ where A and B are integers.

(5)

(b) $\dfrac{\sin 3x}{(2x-4)^3}$

(3)

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Question 5 continued

(Total for Question 5 is 8 marks)

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6 Given that $\dfrac{a+\sqrt{5}}{\sqrt{5}-2} = 11 + 5\sqrt{5}$

(a) without using a calculator, find the value of a
Show your working clearly.

(2)

Triangle PQR is such that

$PR = (x + 3)\,\text{cm}$ $QR = x\,\text{cm}$ angle $QPR = 30°$ angle $PQR = 45°$

(b) Show that $x = 3 + 3\sqrt{2}$

(3)

Given that $\sin 105° = \dfrac{\sqrt{6}+\sqrt{2}}{4}$ and that the area of triangle PQR is $A\,\text{cm}^2$

(c) find the exact value of A in the form $\dfrac{9}{8}\left(p\sqrt{6} + q\sqrt{2} + r\sqrt{3} + s\right)$
where p, q, r and s are integers.

(3)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 8 marks)

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7 A curve C has equation $y = \log_{10}(x + 2)$

(a) Using the axes below, sketch the graph of C.
Label the coordinates of the points of intersection of C with the coordinate axes.

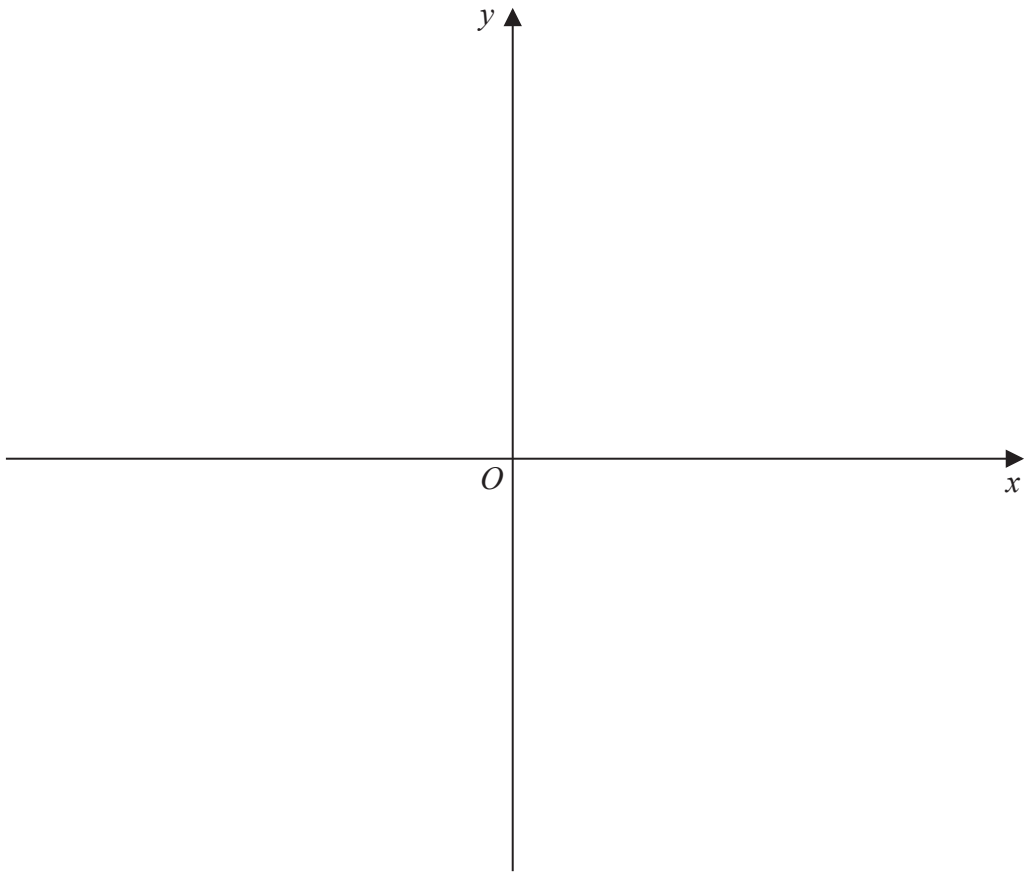
(2)

(b) Solve the equation $2\left(\log_a 4 + \log_a 16\right) = 1$

(3)

(c) Solve the equation $5\log_q 16 + 4\log_2 q = 24$

(6)



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Question 7 continued

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Question 7 continued

(Total for Question 7 is 11 marks)

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8 (a) Using the binomial expansion, or otherwise, find the complete expansion of

$$(x + y)^3$$

(1)

The quadratic equation

$$2x^2 + 3x + 4 = 0$$

has roots α and β

(b) Without solving the equation, find the value of

$$\alpha^3 + \beta^3$$

(4)

(c) Hence, form a quadratic equation with integer coefficients that has roots

$$\frac{\alpha}{\beta^2} \text{ and } \frac{\beta}{\alpha^2}$$

(5)

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 10 marks)

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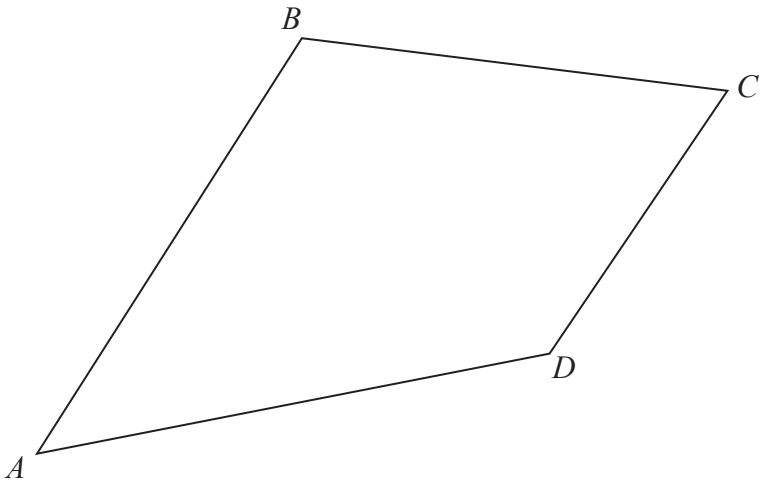

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows quadrilateral $ABCD$ such that

$$\overrightarrow{AD} = 2\mathbf{a} + \mathbf{b} \qquad \overrightarrow{BC} = \frac{1}{3}\mathbf{b} \qquad \overrightarrow{BD} = -4\mathbf{a} - \mathbf{b}$$

(a) Prove that $\overrightarrow{AB}$ is parallel to $\overrightarrow{DC}$

(4)

The diagonals, AC and BD, of the quadrilateral intersect at the point Y.

(b) Using a vector method, find $\overrightarrow{AY}$ as a simplified expression in terms of **a** and **b**

(6)

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Question 9 continued

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Question 9 continued

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10 Using suitable results for $\sin(A + B)$ and $\sin(A - B)$ from the formulae page,

(a) show that $2\sin 4x \cos x = \sin 5x + \sin 3x$

(3)

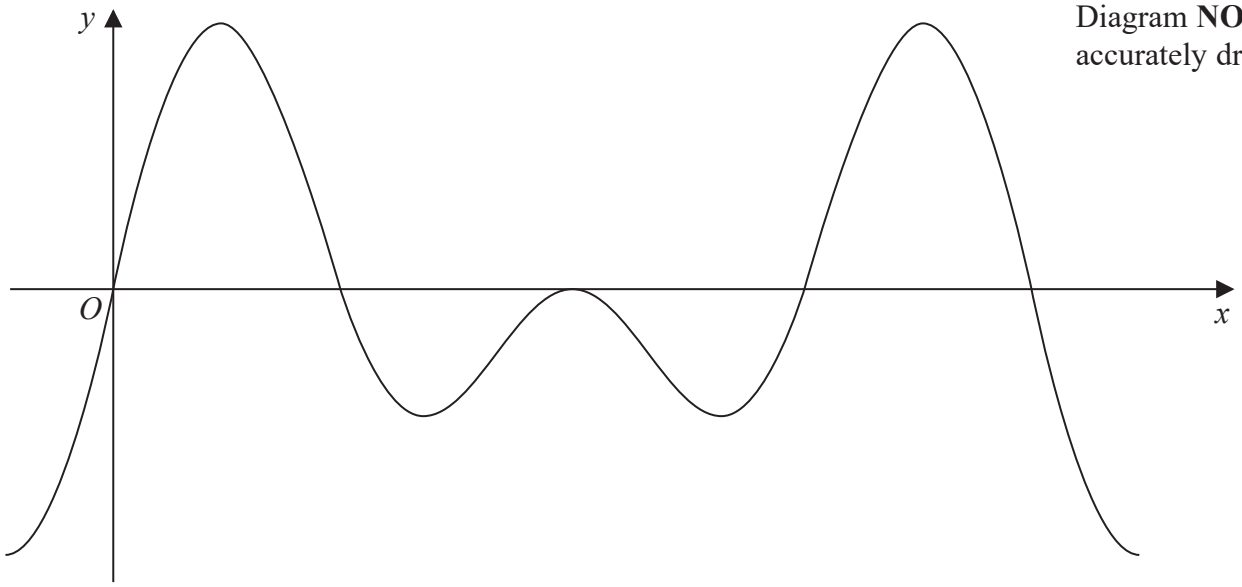

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Figure 4

Figure 4 shows part of a sketch of the curve $y = 6\sin 4x \cos x$

(b) Using calculus, find the total area bounded by the curve and the x-axis between $x = 0$ and $x = \frac{\pi}{2}$

Give your answer to 3 significant figures.

(8)

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Question 10 continued

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Question 10 continued

(Total for Question 10 is 11 marks)

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11 An equation of the straight line l is $y - 3x = 3$

The point A on l lies on the y-axis.
The point B on l has coordinates $(10, b)$, where b is an integer.
The point C divides AB in the ratio $2:3$

The straight line k passes through C and is perpendicular to l

(a) Show that an equation of k is

$$3y + x - 49 = 0$$

(6)

The point D with coordinates (p, q), where q is positive, is such that AD is parallel to k and the length of AD is $12\sqrt{10}$

(b) Find the coordinates of D

(6)

The point E lies on k such that DE is parallel to the y-axis.
The point F lies on l such that DF is parallel to the y-axis.

(c) Find the exact area of triangle ECF.

(5)

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Question 11 continued

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Question 11 continued

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TOTAL FOR PAPER IS 100 MARKS

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