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/

P 7 1 6 4 1 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: $a^2 = b^2 + c^2 - 2bc\cos A$

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

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

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

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

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

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

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

Logarithms

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

P 7 1 6 4 1 A 0 2 3 6

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)

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)

Question 2 continued

(Total for Question 2 is 7 marks)

3

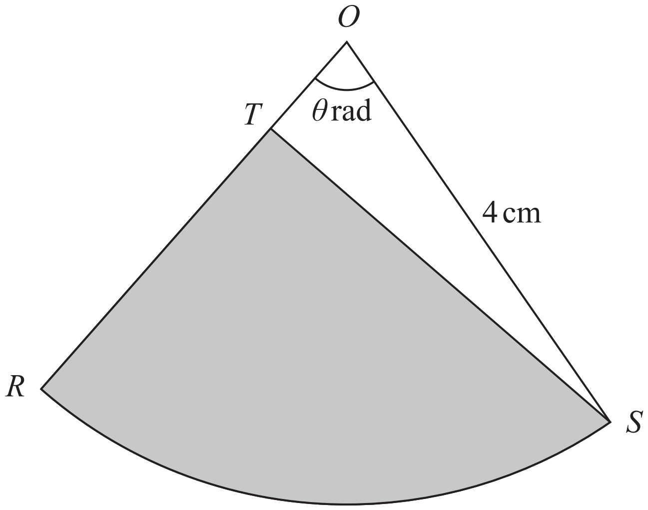

Figure 1

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)

Question 3 continued

(Total for Question 3 is 6 marks)

4

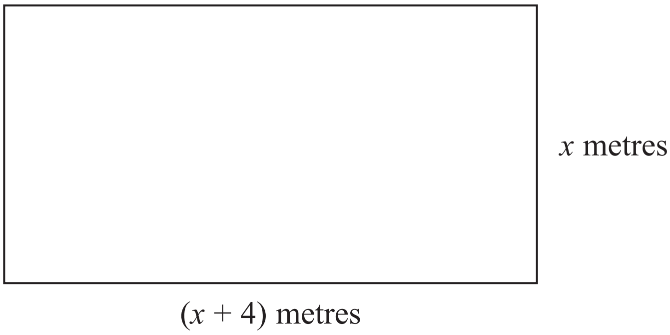

Figure 2

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 $A\,\text{m}^2$

(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 $12\,\text{m}^2$

(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)

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)

Question 5 continued

(Total for Question 5 is 8 marks)

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

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

(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

Question 6 continued

Question 6 continued

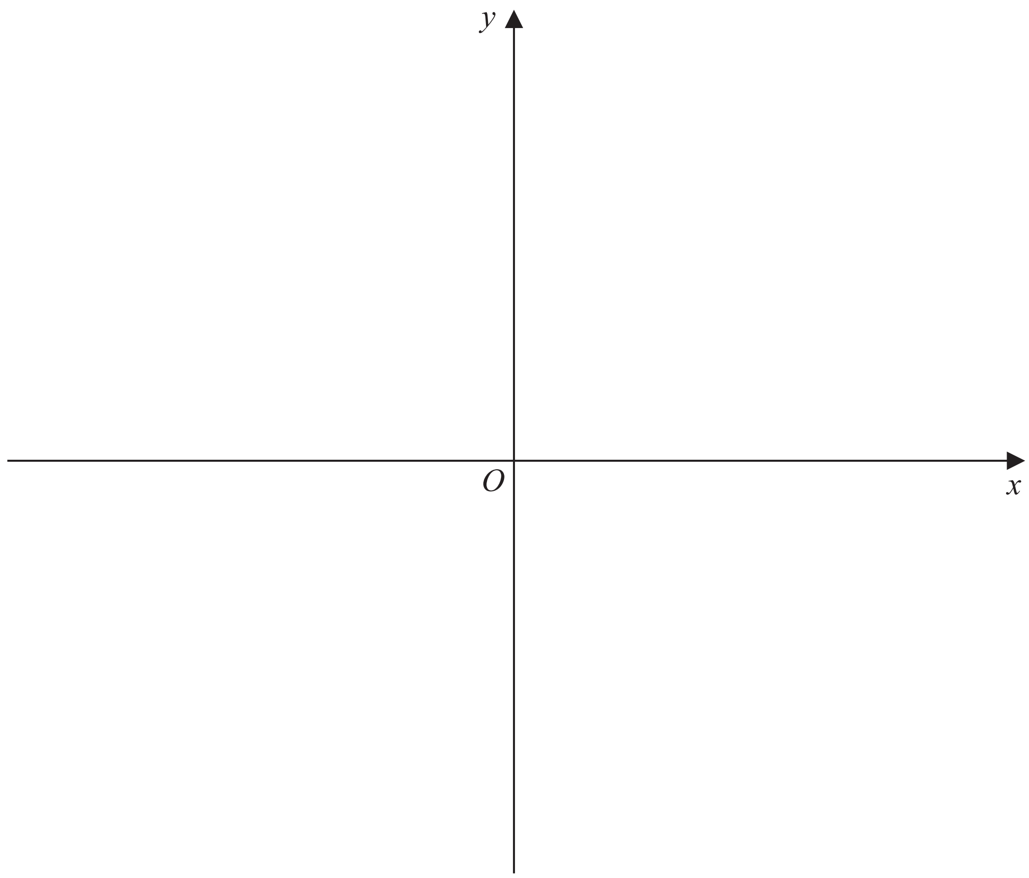
(Total for Question 6 is 8 marks)

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 $2(\log_a 4 + \log_a 16) = 1$
(3)

(c) Solve the equation $5\log_q 16 + 4\log_2 q = 24$
(6)



Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 11 marks)

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

$\dfrac{\alpha}{\beta^2}$ and $\dfrac{\beta}{\alpha^2}$

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)

9

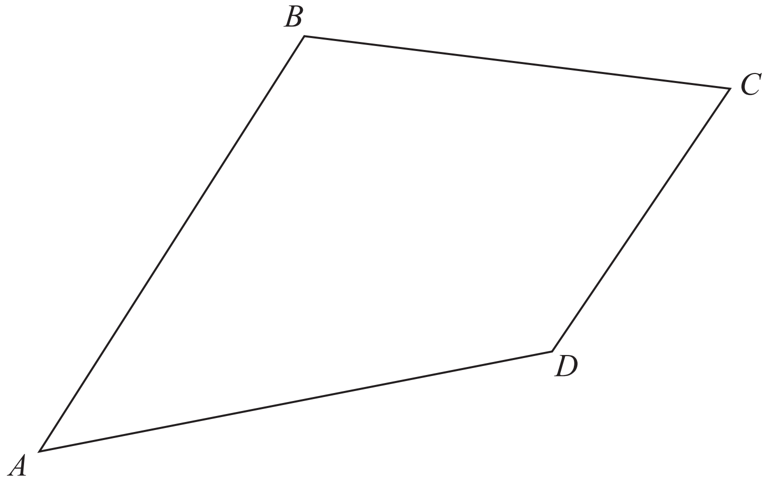


Diagram **NOT** accurately drawn

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

Question 9 continued

Question 9 continued

(Total for Question 9 is 10 marks)

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)

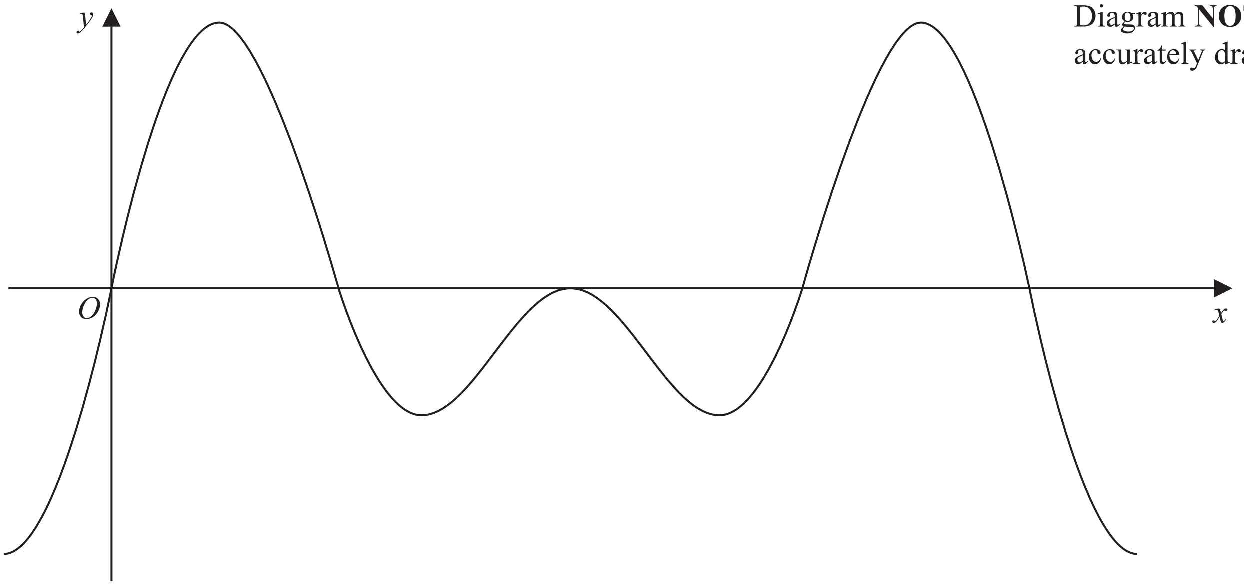

Diagram **NOT** accurately drawn

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 $x = \dfrac{\pi}{2}$

Give your answer to 3 significant figures.

(8)

Question 10 continued

Question 10 continued

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Question 10 continued

(Total for Question 10 is 11 marks)

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)

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS