Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
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Centre Number

Candidate Number

# Pearson Edexcel International Advanced Level

## Thursday 18 January 2024

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA14/01**

# Mathematics

## International Advanced Level
## Pure Mathematics P4

**You must have:**
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations. 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).
- **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.
- Inexact answers should be given to three significant figures unless otherwise stated.

## Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. The total mark for this paper is 75.
- 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

*Turn over*







Pearson

**1.** Find, in ascending powers of $x$ up to and including the term in $x^3$, the binomial expansion of

$$(1-4x)^{-3} \qquad |x| < \frac{1}{4}$$

fully simplifying each term.

**(4)**

**Question 1 continued**

**(Total for Question 1 is 4 marks)**

**2.** Given that

$$\frac{3x+4}{(x-2)(2x+1)^2} \equiv \frac{A}{x-2} + \frac{B}{2x+1} + \frac{C}{(2x+1)^2}$$

(a) find the values of the constants $A$, $B$ and $C$.

**(4)**

(b) Hence find the exact value of

$$\int_7^{12} \frac{3x+4}{(x-2)(2x+1)^2}\,\mathrm{d}x$$

giving your answer in the form $p\ln q + r$ where $p$, $q$ and $r$ are rational numbers.

**(6)**

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**Question 2 continued**

Question 2 continued

Question 2 continued

(Total for Question 2 is 10 marks)

**3.**

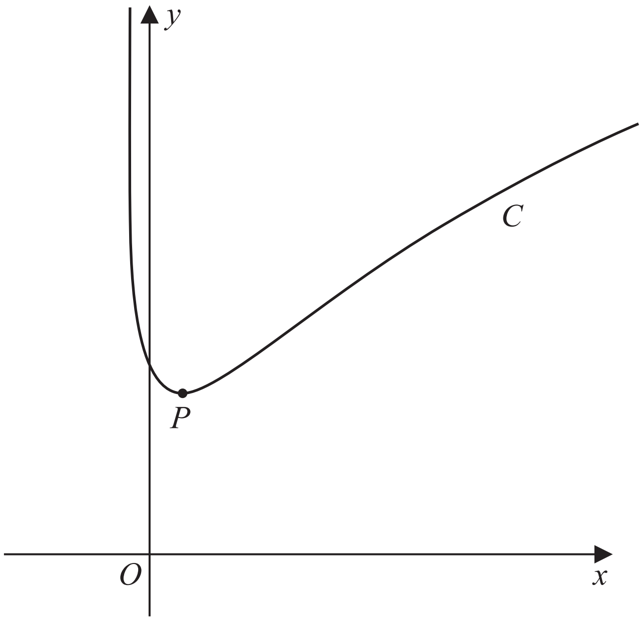


**Figure 1**

The curve $C$, shown in Figure 1, has equation

$$y^2 x + 3y = 4x^2 + k \qquad y > 0$$

where $k$ is a constant.

(a) Find $\dfrac{dy}{dx}$ in terms of $x$ and $y$

**(5)**

The point $P(p, 2)$, where $p$ is a constant, lies on $C$.

Given that $P$ is the minimum turning point on $C$,

(b) find

(i) the value of $p$

(ii) the value of $k$

**(4)**


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Question 3 continued

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**Question 3 continued**

**(Total for Question 3 is 9 marks)**

**4.**

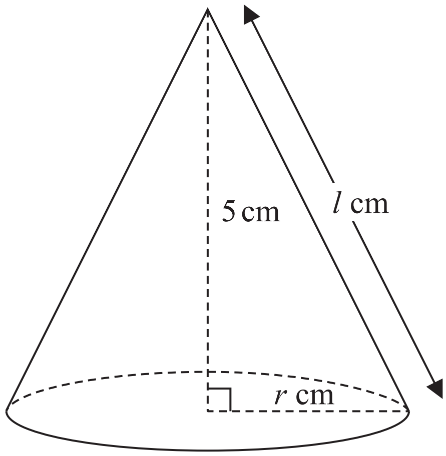


**Figure 2**

A cone, shown in Figure 2, has

- fixed height 5 cm
- base radius $r$ cm
- slant height $l$ cm

(a) Find an expression for $l$ in terms of $r$

**(1)**

Given that the base radius is increasing at a constant rate of 3 cm per minute,

(b) find the rate at which the total surface area of the cone is changing when the radius of the cone is 1.5 cm. Give your answer in cm$^2$ per minute to one decimal place.

[*The total surface area, S, of a cone is given by the formula* $S = \pi r^2 + \pi r l$]

**(4)**

Question 4 continued

(Total for Question 4 is 5 marks)

5. (a) Find $\int x^2 \cos 2x \, dx$

**(4)**

(b) Hence solve the differential equation

$$\frac{dy}{dt} = \left(\frac{t\cos t}{y}\right)^2$$

giving your answer in the form $y^n = f(t)$ where $n$ is an integer.

**(5)**

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**Question 5 continued**

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**Question 5 continued**

**(Total for Question 5 is 9 marks)**

6. Relative to a fixed origin $O$, the lines $l_1$ and $l_2$ are given by the equations

$$l_1 : \mathbf{r} = (3\mathbf{i} + p\mathbf{j} + 7\mathbf{k}) + \lambda(2\mathbf{i} - 5\mathbf{j} + 4\mathbf{k})$$

$$l_2 : \mathbf{r} = (8\mathbf{i} - 2\mathbf{j} + 5\mathbf{k}) + \mu(4\mathbf{i} + \mathbf{j} + 2\mathbf{k})$$

where $\lambda$ and $\mu$ are scalar parameters and $p$ is a constant.

Given that $l_1$ and $l_2$ intersect,

(a) find the value of $p$,

**(4)**

(b) find the position vector of the point of intersection.

**(2)**

(c) Find the acute angle between $l_1$ and $l_2$

Give your answer in degrees to one decimal place.

**(3)**

The point $A$ lies on $l_1$ with parameter $\lambda = 2$

The point $B$ lies on $l_2$ with $\overrightarrow{AB}$ perpendicular to $l_2$

(d) Find the coordinates of $B$

**(5)**

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Question 6 continued

**Question 6 continued**

**Question 6 continued**

**(Total for Question 6 is 14 marks)**

**7.** (a) Using the substitution $u = 4x + 2\sin 2x$, or otherwise, show that

$$\int_0^{\frac{\pi}{2}} e^{4x+2\sin 2x}\cos^2 x\,dx = \frac{1}{8}\left(e^{2\pi} - 1\right)$$

**(5)**

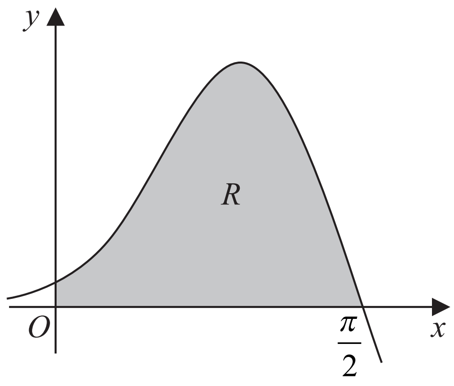


**Figure 3**

The curve shown in Figure 3, has equation

$$y = 6e^{2x+\sin 2x}\cos x$$

The region $R$, shown shaded in Figure 3, is bounded by the positive $x$-axis, the positive $y$-axis and the curve.

The region $R$ is rotated through $2\pi$ radians about the $x$-axis to form a solid.

(b) Use the answer to part (a) to find the volume of the solid formed, giving the answer in simplest form.

**(3)**

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**Question 7 continued**

Question 7 continued

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**Question 7 continued**

**(Total for Question 7 is 8 marks)**

**8.** Use proof by contradiction to prove that the curve with equation

$$y = 2x + x^3 + \cos x$$

has no stationary points.

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**Question 8 continued**

**(Total for Question 8 is 4 marks)**

**9.**

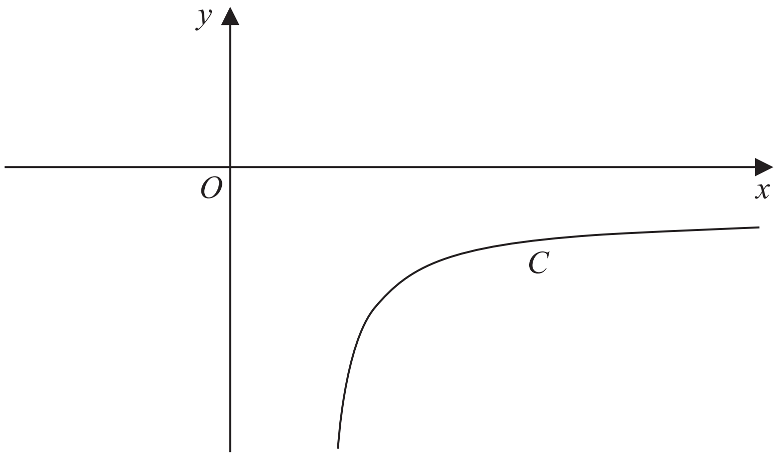


**Figure 4**

Figure 4 shows a sketch of the curve $C$ with parametric equations

$$x = \sec t \qquad y = \sqrt{3}\tan\left(t + \frac{\pi}{3}\right) \qquad \frac{\pi}{6} < t < \frac{\pi}{2}$$

(a) Find $\frac{dy}{dx}$ in terms of $t$

**(3)**

(b) Find an equation for the tangent to $C$ at the point where $t = \frac{\pi}{3}$

Give your answer in the form $y = mx + c$, where $m$ and $c$ are constants.

**(4)**

(c) Show that all points on $C$ satisfy the equation

$$y = \frac{Ax^2 + B\sqrt{3x^2 - 3}}{4 - 3x^2}$$

where $A$ and $B$ are constants to be found.

**(5)**

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**Question 9 continued**

**Question 9 continued**

Question 9 continued

**Question 9 continued**



**(Total for Question 9 is 12 marks)**

**TOTAL FOR PAPER IS 75 MARKS**