

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 **4PM1/01**

**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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**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,  $S_\infty = \frac{a}{1 - r}$   $|r| < 1$

**Binomial series**

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

**Calculus**

**Quotient rule (differentiation)**

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

**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**

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



Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Using calculus find the exact value of  $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \cos 4\theta \, d\theta$

Give your answer in the form  $-\frac{\sqrt{a}}{b}$  where  $a$  is a prime number and  $b$  is an integer.

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(Total for Question 1 is 4 marks)





### Question 2 continued

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(Total for Question 2 is 7 marks)



3 A geometric series  $G$  has first term  $a$  and common ratio  $r$

The 2nd term of  $G$  is  $\frac{5}{16}$  and the 5th term of  $G$  is  $\frac{135}{1024}$

(a) Find

(i) the value of  $r$

(ii) the value of  $a$

(5)

Given that  $G$  is convergent with sum to infinity  $S$

(b) find the exact value of  $S$

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**Question 3 continued**

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**(Total for Question 3 is 7 marks)**



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

(i)  $y = 2x - 4$

(ii)  $2x + 3y = 12$

(iii)  $y + 2x + 2 = 0$

(3)

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

$$y \geq 2x - 4$$

$$2x + 3y \leq 12$$

$$y + 2x + 2 \geq 0$$

(1)

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

$$P = x - 2y$$

(c) find the least value of  $P$

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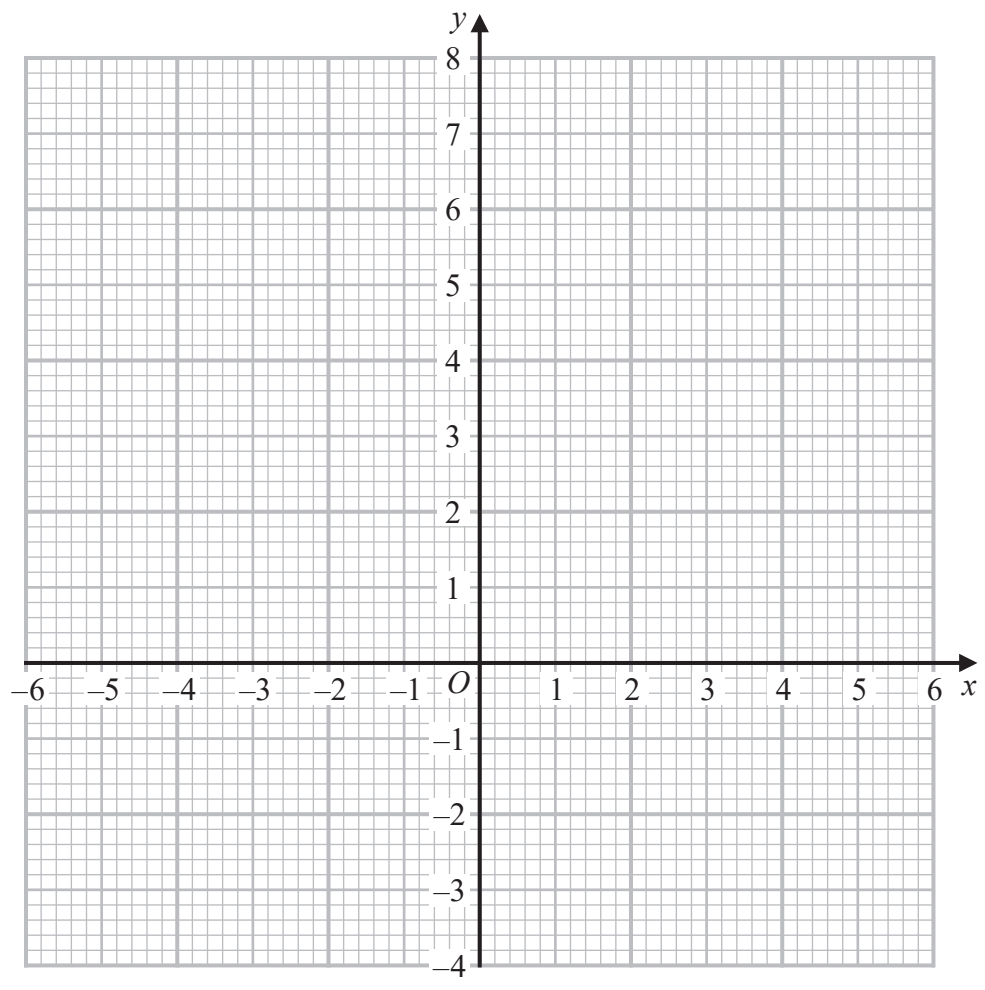
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### Question 4 continued



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



Question 4 continued

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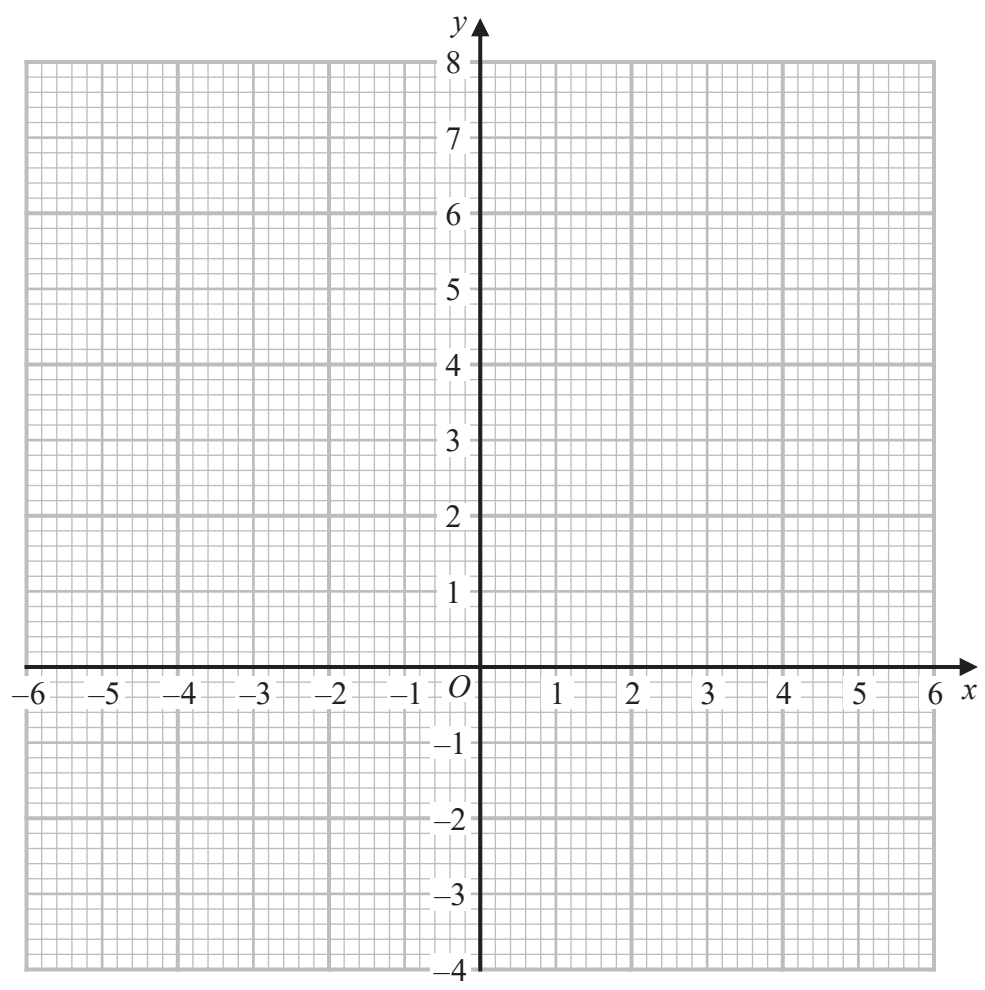
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Question 4 continued

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



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(Total for Question 4 is 8 marks)





**Question 5 continued**

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





### Question 6 continued

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Question 6 continued

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**Question 6 continued**

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**(Total for Question 6 is 10 marks)**





**Question 7 continued**

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





### Question 8 continued

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Question 8 continued

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**Question 8 continued**

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**(Total for Question 8 is 10 marks)**







### Question 9 continued

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Question 9 continued

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**Question 9 continued**

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**(Total for Question 9 is 11 marks)**



10 The equation of the line  $L_1$  is  $y - 2x - 6 = 0$

The point  $P$  with coordinates  $(2, a)$  lies on  $L_1$

(a) Find the value of  $a$

(1)

The line  $L_2$  is perpendicular to  $L_1$  and passes through  $P$

(b) Show that an equation of  $L_2$  is  $x + 2y - 22 = 0$

(4)

Line  $L_1$  crosses the  $x$ -axis at the point  $A$  and line  $L_2$  crosses the  $x$ -axis at the point  $B$

The point  $C$  has coordinates  $(m, n)$  such that  $m > 0$  and  $n < 0$

The length of  $AC$  is  $5\sqrt{2}$  and the gradient of  $BC$  is  $\frac{1}{4}$

(c) Find the value of  $m$  and the value of  $n$

(9)

(d) Find the area of quadrilateral  $ACBP$

(3)

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### Question 10 continued

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**Question 10 continued**

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**(Total for Question 10 is 17 marks)**



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11 Given that

$$y = \frac{e^{4x}}{32} (8x^2 - 4x + 1)$$

(a) show that  $\frac{dy}{dx} = x^2 e^{4x}$

(5)

Diagram NOT accurately drawn

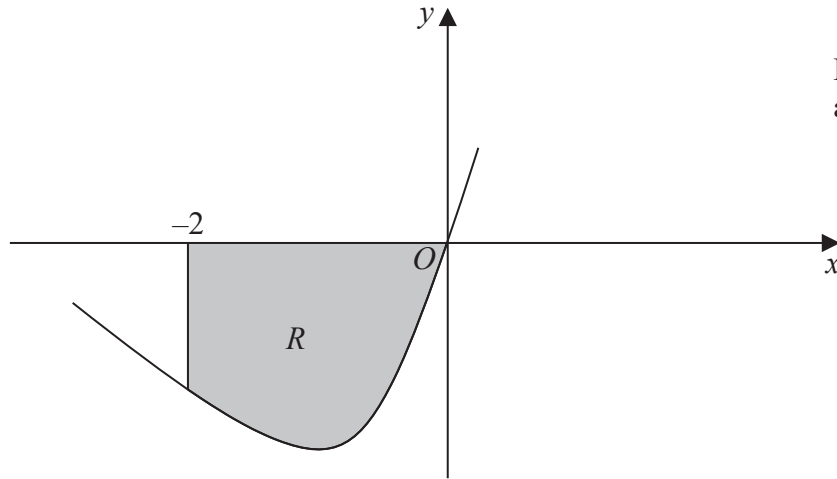


Figure 2

Figure 2 shows part of the curve  $C$  with equation  $y = 3xe^{2x}$

The finite region  $R$  bounded by  $C$ , the straight line with equation  $x = -2$  and the  $x$ -axis, shown shaded in Figure 2, is rotated through  $360^\circ$  about the  $x$ -axis.

(b) Using part (a), find the volume, to 2 significant figures, of the solid formed.

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### Question 11 continued

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**(Total for Question 11 is 9 marks)**

**TOTAL FOR PAPER IS 100 MARKS**



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