


Please check the examination details below before entering your candidate information

Candidatesurname					Other names						
Pearson Edexcel International GCSE		Centre Number					Candidate Number				
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Time 2 hours		Paper reference		4PM1/02							
Further Pure Mathematics											
PAPER 2											
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.
- Good luck with your examination.

Turn over ►

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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

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

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

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

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2

$$f(x) = 2 + \frac{4}{5}x - \frac{1}{25}x^2$$

Given that $f(x)$ can be expressed in the form $A - B(x + C)^2$ where A , B and C are constants,

(a) find the value of A , the value of B and the value of C . (4)

(b) Hence write down

(i) the maximum value of $f(x)$,

(ii) the value of x for which this maximum occurs. (2)

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Question 2 continued

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(Total for Question 2 is 6 marks)



3

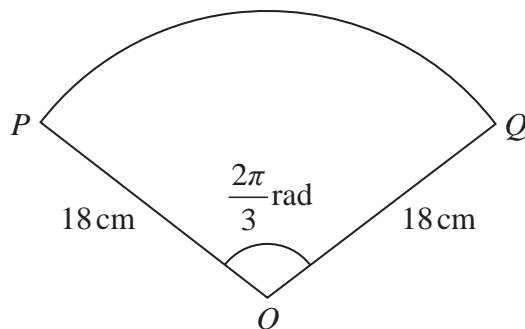


Diagram NOT accurately drawn

Figure 1

Figure 1 shows a sector OPQ of a circle with centre O .

The radius of the circle is 18 cm and the angle POQ is $\frac{2\pi}{3}$ radians.

(a) Find the length of the arc PQ , giving your answer as a multiple of π

(2)

Figure 2 below shows the sector OPQ and the kite $OPTQ$.

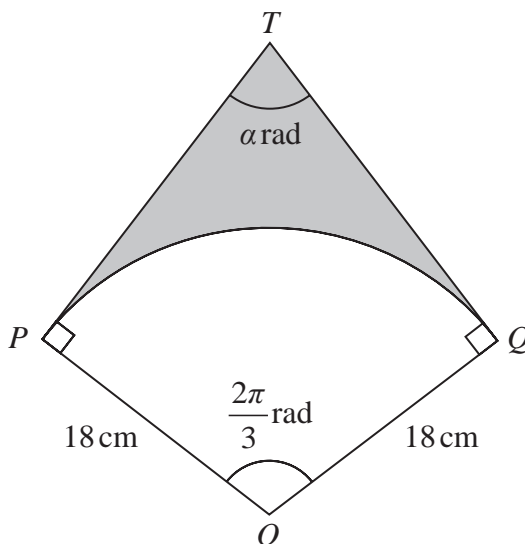


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Figure 2

PT is the tangent to the circle at P and QT is the tangent at Q , such that angle $PTQ = \alpha$ radians.

(b) (i) Find α in terms of π

(1)

(ii) Calculate, to 3 significant figures, the area of the region, shown shaded in Figure 2, which is bounded by the arc PQ and the tangents PT and QT .

(6)

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Question 3 continued

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Question 3 continued

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(Total for Question 3 is 9 marks)



Question 4 continued

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Question 4 continued

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(Total for Question 4 is 16 marks)



5 The n th term of a geometric series with common ratio r is u_n

Given that $u_2 + u_4 = 212.5$ and that $u_3 + u_4 = 62.5$

(a) find the two possible values of r .

(5)

Given that the series is convergent with sum to infinity S ,

(b) find the exact value of S .

(2)

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Question 5 continued

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(Total for Question 5 is 7 marks)



6

$$f(x) = x^3 + (p + 1)x^2 - 10x + q$$

where p and q are integers.

Given that $(x - 3)$ is a factor of $f(x)$

(a) show that $9p + q + 6 = 0$ (3)

Given that $(x + p)$, where $p > 0$, is also a factor of $f(x)$

(b) show that $p^2 + 10p + q = 0$ (3)

(c) Hence find the value of p and the value of q . (5)

(d) Using your values of p and q , factorise $f(x)$ completely. (2)

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Question 6 continued

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Question 6 continued

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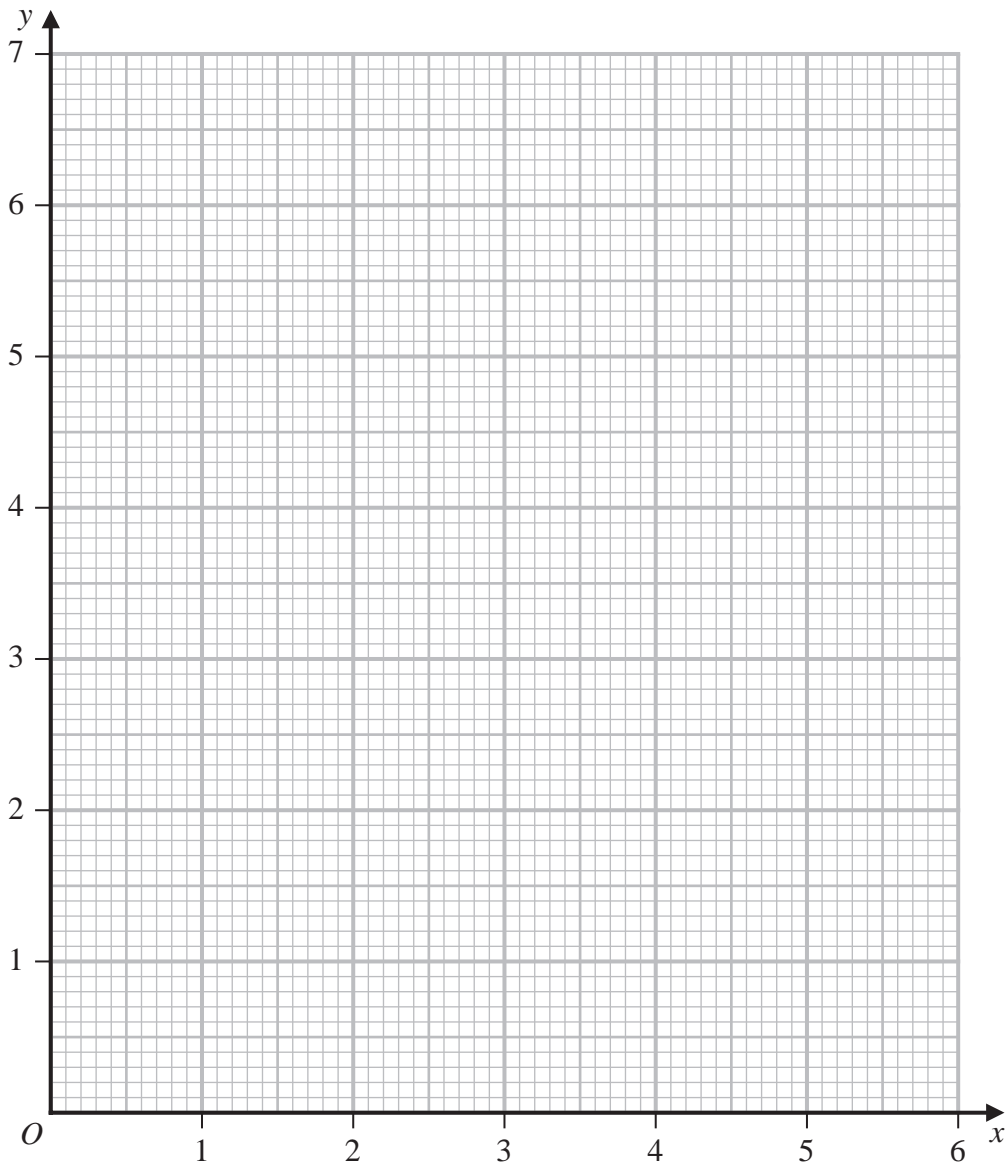
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(Total for Question 6 is 13 marks)



Question 7 continued



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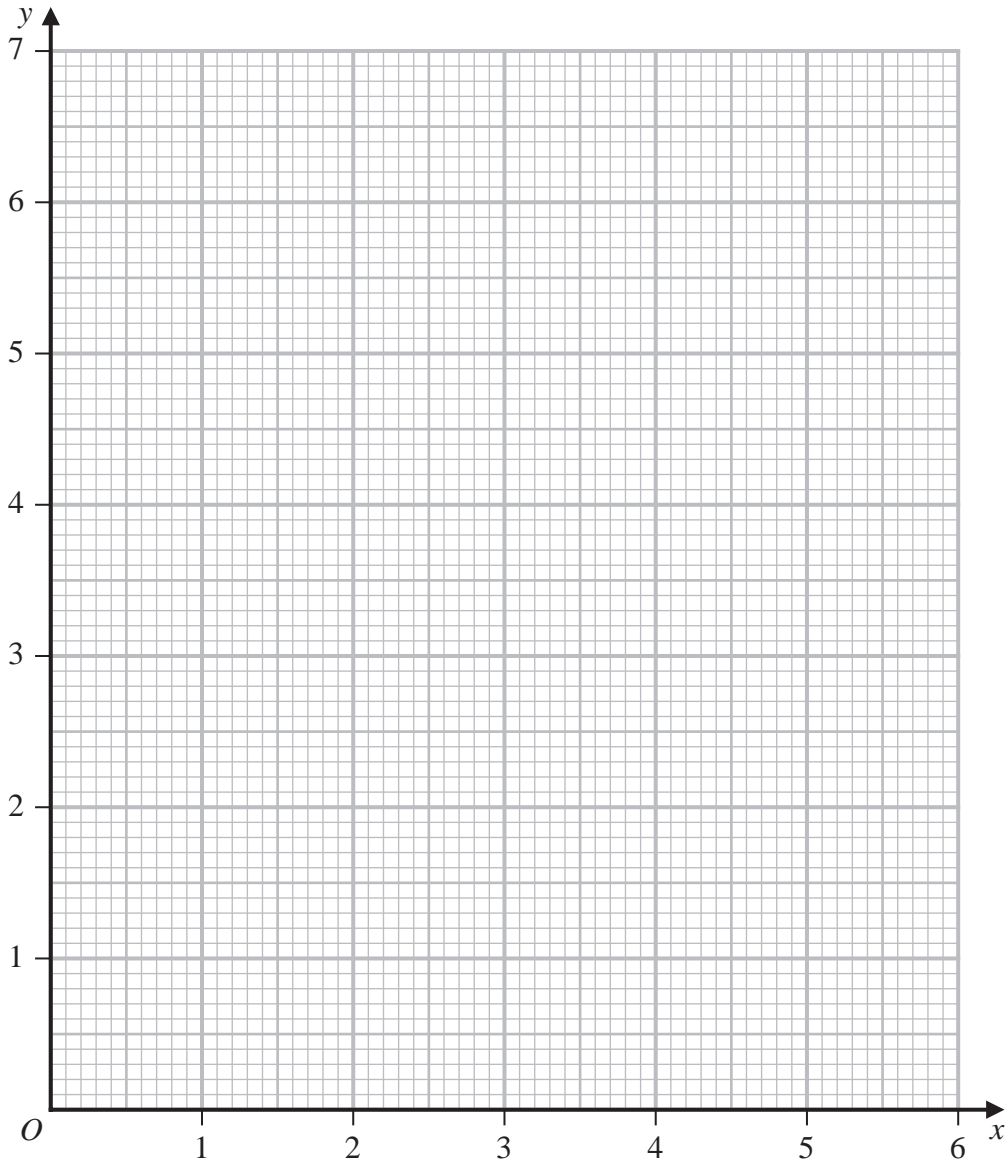
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Turn over for a spare grid if you need to redraw your graph.



Question 7 continued

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



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(Total for Question 7 is 9 marks)



8 Use an algebraic method to solve the simultaneous equations

$$\log_4 a + 3 \log_8 b = \frac{5}{2}$$

$$2^a = \frac{16^4}{4^{b^2}}$$

(8)

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Question 8 continued

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(Total for Question 8 is 8 marks)



Question 9 continued

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Area for writing answers, consisting of multiple horizontal dotted lines.



Question 9 continued

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A large rectangular area containing numerous horizontal dotted lines for writing answers.

(Total for Question 9 is 8 marks)



Question 10 continued

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Question 10 continued

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(Total for Question 10 is 10 marks)



11

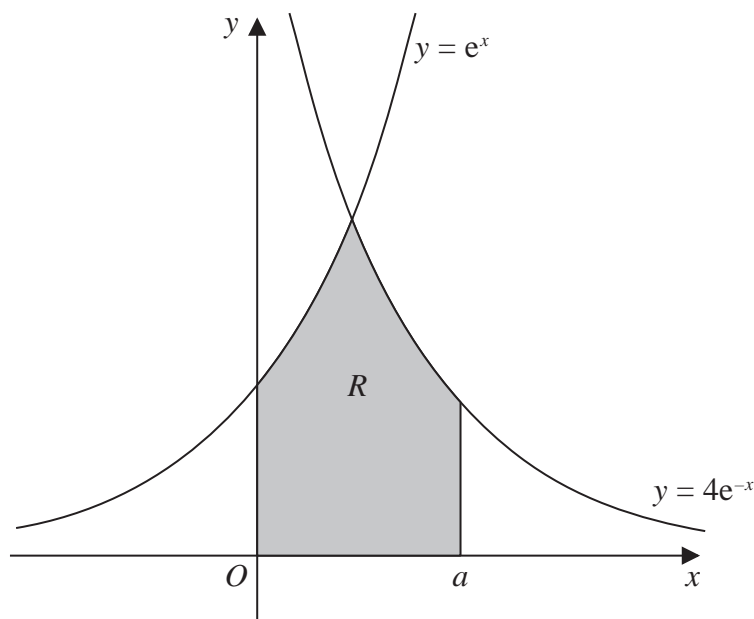


Diagram NOT accurately drawn

Figure 4

The region R , shown shaded in Figure 4, is bounded by the curve with equation $y = e^x$, the curve with equation $y = 4e^{-x}$, the straight line with equation $x = a$, the x -axis and the y -axis.

When the region R is rotated through 360° about the x -axis, the volume of the solid generated is

$$k - 8\pi e^{-4}$$

where k is a constant.

Using algebraic integration, find a possible value of a and the exact corresponding value of k .

(8)

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Question 11 continued

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