

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International GCSE

Tuesday 21 May 2024

Morning (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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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

$$f(x) = 2x^2 + 4x + 9$$

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

(a) find the value of A , the value of B and the value of C (3)

(b) Hence, or otherwise, find

(i) the value of x for which $\frac{1}{f(x)}$ is a maximum

(ii) the maximum value of $\frac{1}{f(x)}$ (2)

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Question 2 continued

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(Total for Question 2 is 5 marks)



Question 3 continued

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(Total for Question 3 is 8 marks)



4 The surface area of a sphere with radius r cm is increasing at a constant rate of 50π cm²/s

Find, in cm³, the exact volume of the sphere at the instant when the rate of increase

of r is $\frac{5}{12}$ cm/s

(8)

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Question 4 continued

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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)



P 7 6 5 0 6 A 0 1 1 3 2

6 The line l passes through the point A with coordinates $(-2, 2)$ and the point B with coordinates $(3, 12)$

The point C with coordinates (p, q) lies on l such that $AC : CB = 3 : 2$

- (a) Find the value of p and the value of q (2)

The line k is perpendicular to l and passes through the point C

- (b) Show that an equation of k is $2y + x - 17 = 0$ (4)

The line k crosses the x -axis at the point D

- (c) Find the exact length of CD (3)

The point X with coordinates (m, n) lies on l such that

$$\text{area of triangle } DXC = 80 \text{ units}^2$$

Given that $m > 0$

- (d) find the value of m and the value of n (7)

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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 16 marks)



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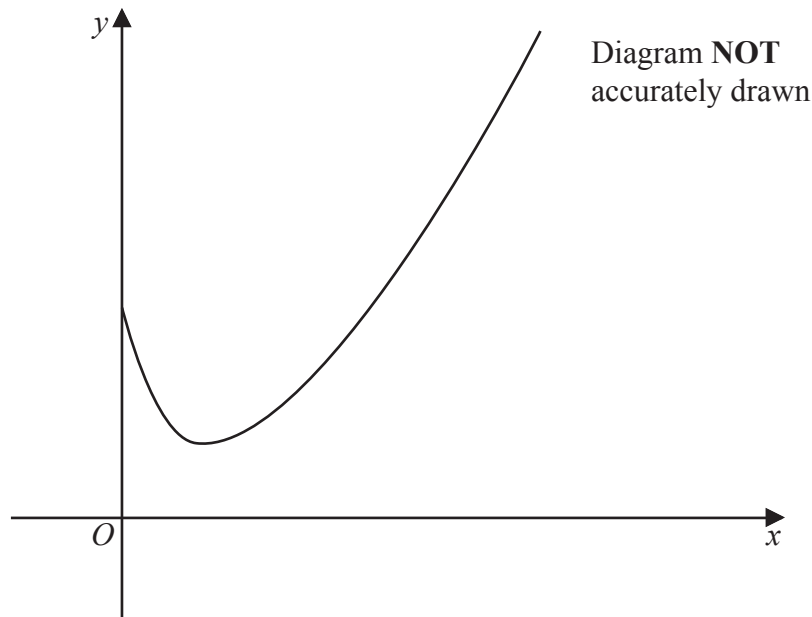


Figure 1

Figure 1 shows a sketch of part of the curve C with equation

$$y = \frac{x^2}{4} - 3\sqrt{x} + 8$$

The point P lies on C and has coordinates $(4, a)$

(a) Show that $a = 6$ (1)

The line L is the normal to C at the point P

(b) Show that an equation of L is $5y + 4x - 46 = 0$ (6)

The finite region R is bounded by the curve C , the line L , the x -axis and the line with equation $x = 1$

(c) Use calculus to find the exact area of R (6)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 13 marks)



P 7 6 5 0 6 A 0 1 9 3 2

8 The sum of the first and second terms of a geometric series G is 400

The sum of the second and third terms of G is 100

(a) Show that the common ratio of G is $\frac{1}{4}$ (4)

(b) Show that the first term of G is 320 (2)

(c) Find the sum to infinity of G (2)

The sum to n terms of G is S_n

(d) Find, using logarithms, the least value of n such that

$$S_n > 426.6$$

(4)

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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 12 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 9 marks)



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Question 10 continued

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Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS

