

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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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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 : $a^2 = b^2 + c^2 - 2bc \cos A$

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

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

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

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

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

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

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

Logarithms

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

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Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** In triangle ABC , $AB = 2x$ cm, $BC = 3x$ cm and $AC = 4x$ cm

The area of triangle ABC is 50 cm^2

Find, to 2 decimal places, the value of x

(4)

(Total for Question 1 is 4 marks)



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)

3 (a) Show that $\sum_{r=1}^n (5r - 3) = \frac{n}{2}(5n - 1)$ (3)

(b) Hence, or otherwise, evaluate $\sum_{r=31}^{60} (5r - 3)$ (2)

Given that $\sum_{r=1}^n (5r - 3) = 3783$

(c) find the value of n (3)

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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)

5 A particle P is moving along the x -axis.

At time t seconds ($t \geq 0$) the acceleration, a m/s², of P is given by $a = 3t - 4$

When $t = 0$, P is at rest.

(a) Find the velocity of P when $t = 4$

(3)

At time T seconds, $T > 0$, P is instantaneously at rest.

(b) Find the value of T

(2)

When $t = 0$, P is at the point with coordinates $(-10, 0)$

(c) Find the displacement of P from the origin when $t = 3$

(4)

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Question 5 continued

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(Total for Question 5 is 9 marks)

- (7)

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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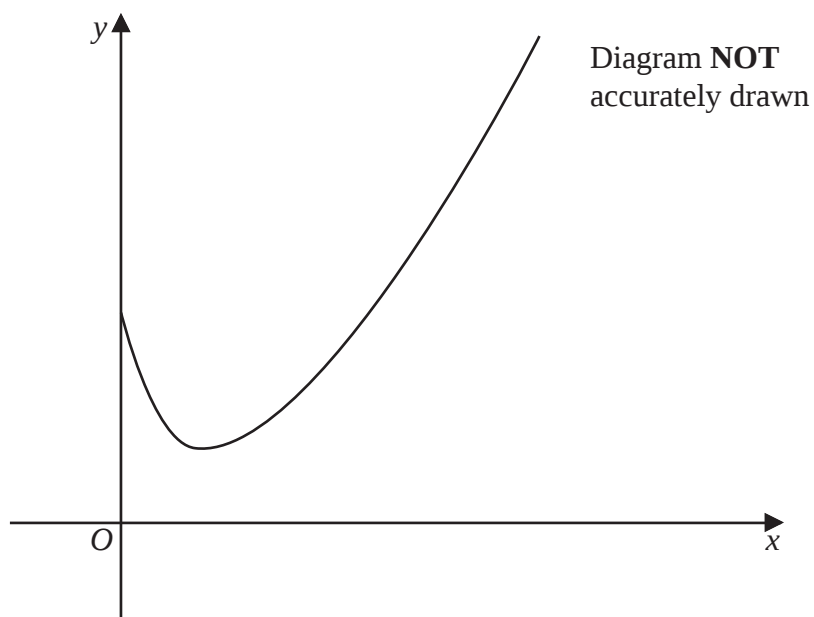


Figure 1

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)

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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

$$S_n > 426.6 \quad (4)$$

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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)

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- (c) Hence solve the equation $3x \log_2 x - 4 \log_{16} 8 + 6x \log_4 8 - \log_2 x = 0$ (3)

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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10 The curve C has equation $y = \frac{ax - 5}{b - x}$ where a and b are integers and $x \neq b$

One intersection of C with the coordinate axes is at the point with coordinates $\left(\frac{5}{4}, 0\right)$

The asymptote parallel to the y -axis has equation $x = 3$

(a) Find the value of a and the value of b

(2)

(b) Sketch C , showing clearly the asymptotes with their equations and the coordinates of the points of intersection with the coordinate axes.

(5)

The straight line l with equation $4y - 7x = k$ has no points of intersection with C

(c) Show, using algebra, that the range of possible values of k can be written as

$$m < k < n$$

where m and n are integers to be found.

(9)

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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