

Please check the examination details below before entering your candidate information


Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE

Friday 26 May 2023

Afternoon (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** $= \pi r \times \text{slant height}$ **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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You must write down all the stages in your working.

1 (a) Show that $\sum_{r=1}^n (3r + 2) = \frac{n}{2}(3n + 7)$ (3)

(b) Hence, or otherwise, evaluate $\sum_{r=10}^{40} (3r + 2)$

(Total for Question 1 is 5 marks)



2

$$y = (\sin 2x) \sqrt{3 + 2x}$$

Show that $\frac{dy}{dx} = \frac{\sin 2x + (A + Bx) \cos 2x}{\sqrt{3 + 2x}}$ where A and B are integers to be found. (5)

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Question 2 continued

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(Total for Question 2 is 5 marks)



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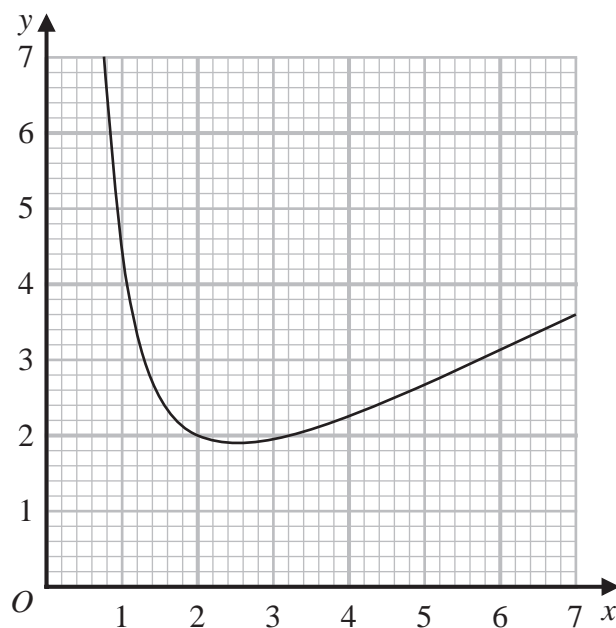


Figure 1

Figure 1 shows part of the curve with equation $y = \frac{x}{2} + \frac{4}{x^2}$ in the interval $0.8 < x < 7$

By drawing a suitable straight line on the grid, obtain an estimate, to one decimal place, of the roots of the equation $3x^3 - 12x^2 + 8 = 0$ in the interval $0.8 < x < 7$

(5)

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Question 3 continued

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(Total for Question 3 is 5 marks)



- 4 A particle P is moving along the x -axis. At time t seconds, $t \geq 0$, the velocity, v m/s, of P is given by $v = 2t^2 - 16t + 30$

(a) Find the acceleration, in m/s^2 , of P when $t = 5$

(2)

P comes to instantaneous rest at the points M and N at times t_1 seconds and t_2 seconds where $t_2 > t_1$

(b) Find the exact distance MN

(8)

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Question 4 continued

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(Total for Question 4 is 10 marks)



- 5 A solid cuboid has width x cm, length $4x$ cm and height h cm.
The volume of the cuboid is 75 cm^3 and the surface area of the cuboid is $S\text{ cm}^2$

(a) Show that $S = 8x^2 + \frac{375}{2x}$ (4)

Given that x can vary, using calculus,

- (b) (i) find to 3 significant figures, the value of x for which S is a minimum, (5)
(ii) justify that this value of x gives a minimum value of S

- (c) Find, to 3 significant figures, the minimum value of S (2)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 11 marks)



6 Solve the equation

$$\log_2 x^3 + \log_4 x^2 - 3 \log_x 2 = 0$$

giving your answers to 3 significant figures.

(8)

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Question 6 continued

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(Total for Question 6 is 8 marks)

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7 The equation of a curve is $y = \sqrt{\frac{e^{4x}}{2x-3}}$

When x is increased to $(x + \delta x)$, y increases to $(y + \delta y)$ where δx and δy are small.

(a) Show that $\delta y \approx \frac{e^{2x}(4x-7)}{(2x-3)^{\frac{3}{2}}} \delta x$ (7)

Given that $x = 2.5$

(b) find an estimate, to 2 significant figures, of the value of δy when the value of x increases by 0.2% (3)

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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 10 marks)

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8

$$f'(x) = 18x^2 - 2x + 13$$

Given that $(2x - 1)$ is a factor of $f(x)$

show that the curve with equation $y = f(x)$ has only one intersection with the x -axis.

(9)

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9 (a) Using the formulae on page 2, show that

$$(i) \cos^2 A = \frac{\cos 2A + 1}{2}$$

$$(ii) \sin^2 A = \frac{1 - \cos 2A}{2}$$

(4)

(b) Show that

$$(2 \sin x - \cos x)(\sin x - 3 \cos x) = \frac{1}{2}(\cos 2x - 7 \sin 2x + 5)$$

(5)

$$y = (2 \sin x - \cos x)(\sin x - 3 \cos x)$$

(c) Solve, for $0^\circ \leq x \leq 180^\circ$ the equation, $\frac{dy}{dx} = 0$

Give your answers to the nearest whole number.

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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 13 marks)

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10 O , A and B are fixed points such that

$$\vec{OA} = (b+1)\mathbf{i} + b\mathbf{j}$$

$$\vec{AB} = 3\mathbf{i}$$

The unit vector parallel to \vec{OB} is $\frac{\sqrt{17}}{34}[(3a+2)\mathbf{i} + b\mathbf{j}]$

Given that a and b are constants where $a > 0$ and $b > 0$

find the exact value of

(i) a

(ii) b

(10)

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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 10 marks)

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11

$$f(x) = 10 + 6x - x^2$$

Given that $f(x)$ can be written in the form $A(x + B)^2 + C$ 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, or otherwise, find

(i) the value of x for which $f(x)$ has its greatest value

(ii) the greatest value of $f(x)$ (2)

The curve C has equation $y = f(x)$

The curve S with equation $y = x^2 - x + 13$ intersects curve C at two points.

(c) Find the x coordinate of each of these two points. (3)

(d) Use algebraic integration to find the exact area of the finite region bounded by the curve C and the curve S . (5)

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Question 11 continued

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Question 11 continued

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(Total for Question 11 is 14 marks)

TOTAL FOR PAPER IS 100 MARKS

