

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
Level 3 GCE**

Centre Number

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Candidate Number

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Wednesday 14 October 2020

Afternoon (Time: 2 hours)

Paper Reference **9MA0/02****Mathematics****Advanced****Paper 2: Pure Mathematics 2****You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 16 questions in this question paper. 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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2. Relative to a fixed origin, points P , Q and R have position vectors \mathbf{p} , \mathbf{q} and \mathbf{r} respectively.

Given that

- P , Q and R lie on a straight line
- Q lies one third of the way from P to R

show that

$$\mathbf{q} = \frac{1}{3}(\mathbf{r} + 2\mathbf{p})$$

(3)

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3. (a) Given that

$$2\log(4 - x) = \log(x + 8)$$

show that

$$x^2 - 9x + 8 = 0$$

(3)

(b) (i) Write down the roots of the equation

$$x^2 - 9x + 8 = 0$$

(ii) State which of the roots in (b)(i) is **not** a solution of

$$2\log(4 - x) = \log(x + 8)$$

giving a reason for your answer.

(2)

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4. In the binomial expansion of

$$(a + 2x)^7 \quad \text{where } a \text{ is a constant}$$

the coefficient of x^4 is 15 120

Find the value of a .

(3)

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5. The curve with equation $y = 3 \times 2^x$ meets the curve with equation $y = 15 - 2^{x+1}$ at the point P .
Find, using algebra, the exact x coordinate of P .

(4)

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 7 marks)



7.

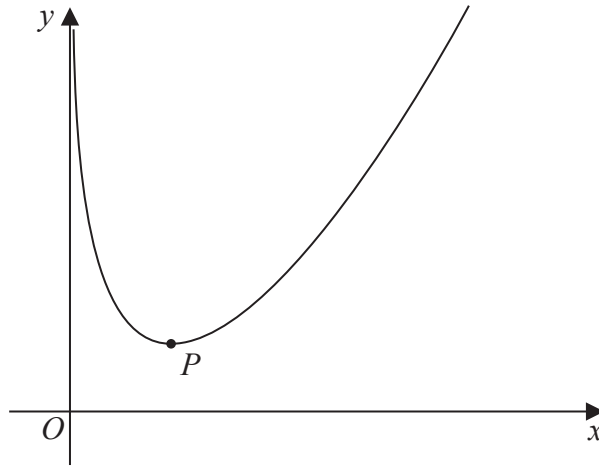


Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = \frac{4x^2 + x}{2\sqrt{x}} - 4 \ln x \quad x > 0$$

(a) Show that

$$\frac{dy}{dx} = \frac{12x^2 + x - 16\sqrt{x}}{4x\sqrt{x}} \tag{4}$$

The point P , shown in Figure 1, is the minimum turning point on C .

(b) Show that the x coordinate of P is a solution of

$$x = \left(\frac{4}{3} - \frac{\sqrt{x}}{12} \right)^2 \tag{3}$$

(c) Use the iteration formula

$$x_{n+1} = \left(\frac{4}{3} - \frac{\sqrt{x_n}}{12} \right)^2 \quad \text{with } x_1 = 2$$

to find (i) the value of x_2 to 5 decimal places,

(ii) the x coordinate of P to 5 decimal places.

(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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Question 8 continued

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(Total for Question 8 is 6 marks)



Question 10 continued

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Question 11 continued

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Question 11 continued

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12.

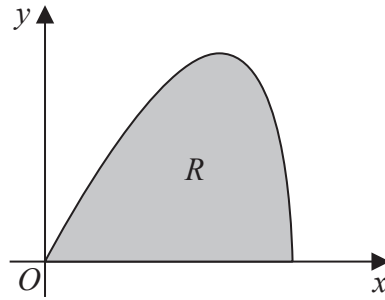


Figure 3

The curve shown in Figure 3 has parametric equations

$$x = 6 \sin t \quad y = 5 \sin 2t \quad 0 \leq t \leq \frac{\pi}{2}$$

The region R , shown shaded in Figure 3, is bounded by the curve and the x -axis.

(a) (i) Show that the area of R is given by $\int_0^{\frac{\pi}{2}} 60 \sin t \cos^2 t \, dt$ (3)

(ii) Hence show, by algebraic integration, that the area of R is exactly 20 (3)

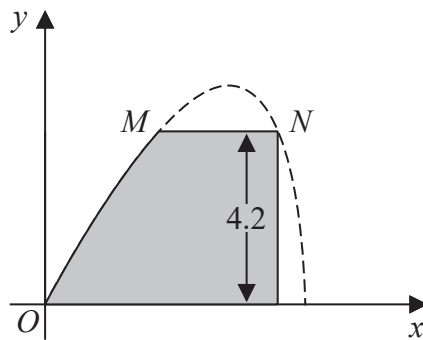


Figure 4

Part of the curve is used to model the profile of a small dam, shown shaded in Figure 4. Using the model and given that

- x and y are in metres
- the vertical wall of the dam is 4.2 metres high
- there is a horizontal walkway of width MN along the top of the dam

(b) calculate the width of the walkway. (5)

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Question 12 continued

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Question 12 continued

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(Total for Question 12 is 11 marks)



13. The function g is defined by

$$g(x) = \frac{3 \ln(x) - 7}{\ln(x) - 2} \quad x > 0 \quad x \neq k$$

where k is a constant.

(a) Deduce the value of k .

(1)

(b) Prove that

$$g'(x) > 0$$

for all values of x in the domain of g .

(3)

(c) Find the range of values of a for which

$$g(a) > 0$$

(2)

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Question 13 continued

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Question 13 continued

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Question 13 continued

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(Total for Question 13 is 6 marks)



14. A circle C with radius r

- lies only in the 1st quadrant
- touches the x -axis and touches the y -axis

The line l has equation $2x + y = 12$

(a) Show that the x coordinates of the points of intersection of l with C satisfy

$$5x^2 + (2r - 48)x + (r^2 - 24r + 144) = 0 \quad (3)$$

Given also that l is a tangent to C ,

(b) find the two possible values of r , giving your answers as fully simplified surds. (4)

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Question 14 continued

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(Total for Question 14 is 7 marks)



15.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

A geometric series has common ratio r and first term a .

Given $r \neq 1$ and $a \neq 0$

(a) prove that

$$S_n = \frac{a(1 - r^n)}{1 - r} \tag{4}$$

Given also that S_{10} is four times S_5

(b) find the exact value of r . (4)



Question 15 continued

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