

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL AS MATHEMATICS

(9660/MA01) Unit P1 Pure Mathematics

Wednesday 17 May 2023 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the Oxford International AQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	



Answer **all** questions in the spaces provided.

1 (a) It is given that

$$m = 8a^{\frac{4}{3}} \text{ and } n = 2a^{\frac{1}{2}}$$

where a is a positive constant.

1 (a) (i) Find mn

Circle your answer.

[1 mark]

$$10a^{\frac{2}{3}}$$

$$16a^{\frac{2}{3}}$$

$$10a^{\frac{11}{6}}$$

$$16a^{\frac{11}{6}}$$

1 (a) (ii) Find $\sqrt{\frac{m}{n}}$

Circle your answer.

[1 mark]

$$2a^{\frac{5}{12}}$$

$$\sqrt{6} a^{\frac{5}{12}}$$

$$2a^{\frac{5}{6}}$$

$$\sqrt{6} a^{\frac{5}{6}}$$



- 1 (b) (i)** Find the value of p for which $500x^6 \times (5x^2)^p$ is constant for all non-zero values of x

[2 marks]

$p =$ _____

- 1 (b) (ii)** Use the value of p found in **part (b)(i)** to calculate $500x^6 \times (5x^2)^p$

[1 mark]

Answer _____

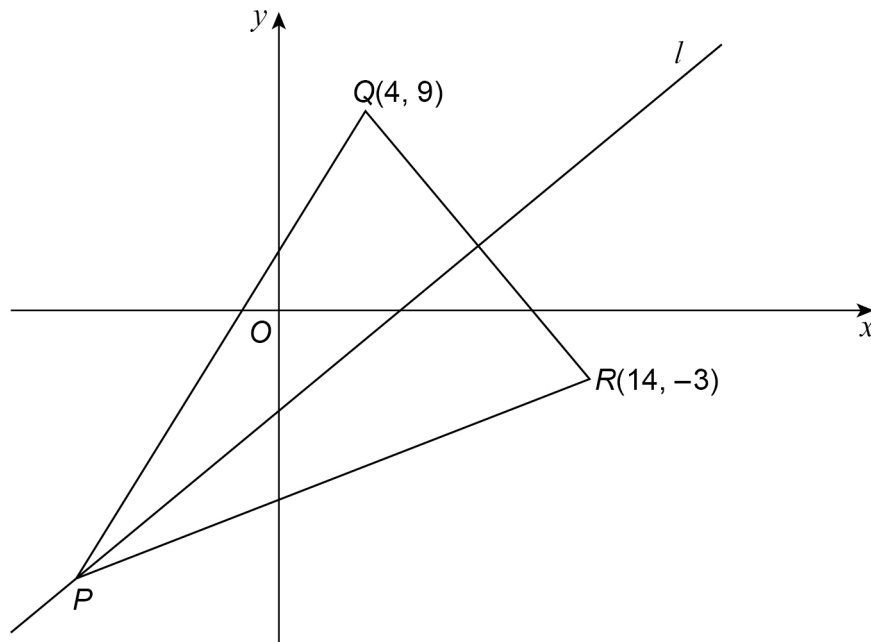
5

Turn over for the next question

Turn over ►



- 2** The line l and an isosceles triangle with vertices at the points P , Q and R are shown in the diagram.



The coordinates of Q are $(4, 9)$

The coordinates of R are $(14, -3)$

- 2 (a)** Find the exact length of the line segment QR

[2 marks]

Answer _____



Show that l has the equation $y = \frac{5}{6}x - \frac{9}{2}$

[illegible]

Find the value of k and the value of d

[illegible]
$$k = \underline{\hspace{2cm}} \quad d = \underline{\hspace{2cm}}$$


3 An arithmetic sequence has first term a , common difference d and n th term u_n

The sum of the first n terms of the sequence is S_n

For this sequence $S_{30} - S_{10} = 522$

3 (a) Show that $10a + 195d = 261$

[3 marks]

3 (b) It is also given that $u_{36} = 5u_9 + 27$

Find a formula in terms of n for the n th term of the arithmetic sequence.

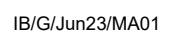
Give your answer in the form $u_n = pn - q$ where p and q are positive constants.

[5 marks]



3 (c) Find the number of terms in the arithmetic sequence that have a value less than 140
[2 marks]

10



[3 marks]

[illegible]
$$a = \underline{\hspace{2cm}} \quad b = \underline{\hspace{2cm}}$$

4 (b)

$$\left(\frac{1}{2} - kx\right)(1+6x)^7 \quad \text{where } k \text{ is a constant}$$

the coefficient of x^3 is 1512

Find the value of k

[3 marks]

[illegible]

$$k = \underline{\hspace{10cm}}$$

6

Turn over for the next question



Turn over ►

5 (a) Use the trapezium rule with six ordinates (five strips) to find an approximate value for

$$\int_1^3 8^{\sqrt{x}} \, dx$$

Give your answer to one decimal place.

[4 marks]

[illegible]

Answer _____



- 5 (b) (i) Describe the transformation which maps the graph of $y = 8^{\sqrt{x}}$ onto the graph of

$$y = 8^{\left(\frac{1}{3} + \sqrt{x}\right)}$$

[3 marks]

- 5 (b) (ii) Use your answers to **part (a)** and **part (b)(i)** to find an approximate value for

$$\int_1^3 8^{\left(\frac{1}{3} + \sqrt{x}\right)} dx$$

Give your answer to one decimal place.

[2 marks]

Answer _____

9



6 The function f is given by

$$f(x) = x^3 + ax^2 - 6bx + 7$$

where a and b are constants.

When $f(x)$ is divided by $(x-4)$ the remainder is 23

6 (a) Use the Remainder Theorem to show that $2a - 3b = -6$

[2 marks]

6 (b) The value of the gradient of the tangent of the curve $y = f(x)$ at the point where $x = -5$ is 21

Use the value of the gradient to find an equation of the form $pa + qb = r$ where p , q and r are integers.

[3 marks]

Answer _____



$$a = \qquad \qquad \qquad b =$$

The function g is given by $g(x) = 9 + 48x + x^2 - \frac{1}{3}x^3$

[illegible]

Answer

12



7

$$y = x \left(x - 6x^{\frac{1}{3}} \right) + 16$$

where $x > -4$

7 (a) Find $\frac{dy}{dx}$

[2 marks]

$$\frac{dy}{dx} =$$

7 (b) The curve has two stationary points P and Q

Show that the coordinates of P are $(0, 16)$ and find the coordinates of Q

[5 marks]

Q



7 (c) (i) Find $\frac{d^2y}{dx^2}$

[1 mark]

$$\frac{d^2y}{dx^2} = \underline{\hspace{10cm}}$$

7 (c) (ii) Use your answers to **part (b)** and **part (c)(i)** to show that Q is a minimum.

[1 mark]

7 (d) (i) Explain why it is **not** possible to use the x -coordinate of P with your answer to **part (c)(i)** to determine whether P is a minimum or a maximum.

[1 mark]

7 (d) (ii) Calculate the values of the gradient of the curve at the points where $x = -0.1$ and $x = 0.1$ and hence deduce that P is a maximum.

[2 marks]



Find the values of a for which

[7 marks]

[illegible]

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Answer

Turn over for the next question



9

$$u_1 = 27^{2p+1}, \quad u_2 = 3^{18p} \quad \text{and} \quad u_3 = 3^{6p+1}$$

where p is a constant.

9

Show that $p = \frac{1}{6}$

[4 marks]

[illegible]

Show that for any positive integer k

$$54 \sum_{n=k+1}^{6k} u_n = b^{c-k} (1 - b^{dk})$$

[6 marks]

[illegible]

10



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