OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

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INTERNATIONAL AS
MATHEMATICS

(9660/MA01) Unit P1 − Pure Mathematics

Specimen 2018 Morning Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the booklet of formulae and statistical tables.
- You may use a graphics 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 each question in the space provided for that question. If you require extra space, use a supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box or around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that 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.
- You do not necessarily need to use all the space provided.

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

1 (a) (i) Given that $\frac{1}{8} = 2^q$, state the value of q.

Circle your answer.

[1 mark]

-3 $\quad -\frac{1}{3}$ $\quad \frac{1}{3}$ $\quad 3$

(a) (ii) Given that $\sqrt{2} = 2^r$, state the value of r.

Circle your answer.

[1 mark]

$-\frac{1}{2}$ $\quad 0$ $\quad \frac{1}{2}$ $\quad 2$

(b) Find the value of x for which $\sqrt{2} \times 2^x = \frac{1}{8}$

[2 marks]

Answer _____

2 The line AB has equation $7x + 3y = 13$

(a) Find the gradient of AB.

[2 marks]

Answer _____

(b) The point C has coordinates $(-1, 3)$

(b) (i) Find an equation of the line which passes through the point C and which is parallel to AB.

[2 marks]

Answer _____

(b) (ii) The point $(1\frac{1}{2}, -1)$ is the midpoint of AC.

Find the coordinates of the point A.

[2 marks]

Answer _____

(c) The line AB intersects the line with equation $3x + 2y = 12$ at the point B.

Find the coordinates of B.

[3 marks]

Answer _____

3 (a) The expression $(2 + x^2)^3$ can be written in the form

$$8 + px^2 + qx^4 + x^6$$

Show that $p = 12$ and find the value of the integer q.

[3 marks]

$q =$ _____

(b) (i) Hence find $\int \frac{(2 + x^2)^3}{x^4} \, dx$

[5 marks]

Answer _____

(b) (ii) Hence find the exact value of $\int_1^2 \frac{(2 + x^2)^3}{x^4} \, dx$

[2 marks]

Answer _____

4 A geometric series has third term 36 and sixth term 972

(a) (i) Show that the common ratio of the series is 3.

[2 marks]

Answer _____

(a) (ii) Find the first term of the series.

[2 marks]

Answer _____

(b) The nth term of the series is u_n

Show that $\sum_{n=1}^{20} u_n = 2(3^{20} - 1)$

[2 marks]

5 Use the trapezium rule with four ordinates (three strips) to find an approximate value for

$\int_0^{1.5} \sqrt{27x^3 + 4}\,\mathrm{d}x$. Give your answer to three significant figures.

[4 marks]

Answer _____

6 The polynomial p(x) is given by $\mathrm{p}(x) = x^3 - 2x^2 + 3$

(a) Use the Remainder Theorem to find the remainder when p(x) is divided by $x - 3$

[2 marks]

Answer _____

(b) Use the Factor Theorem to show that $x + 1$ is a factor of p(x).

[2 marks]

(c) (i) Express $p(x) = x^3 - 2x^2 + 3$ in the form $(x + 1)(x^2 + bx + c)$, where b and c are integers.

[2 marks]

Answer _____

(c) (ii) Hence show that the equation $p(x) = 0$ has exactly one real root.

[2 marks]

7 An arithmetic series has first term a and common difference d.

The sum of the first 25 terms of the series is 3500.

(a) Show that $a + 12d = 140$

[3 marks]

(b) The fifth term of the series is 100.

Find the value of d and the value of a.

[4 marks]

$d =$ _____

$a =$ _____

(c) The nth term of the series u_n

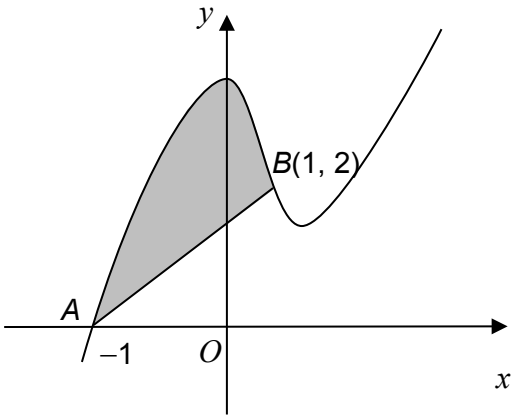
Given that $33\left(\sum_{n=1}^{25} u_n - \sum_{n=1}^{k} u_n\right) = 67\sum_{n=1}^{k} u_n$

find the value of $\sum_{n=1}^{k} u_n$

[3 marks]

Answer _____

8 The curve with equation $y = x^3 - 2x^2 + 3$ is sketched below.



(a) Show that $\int_{-1}^{1} (x^3 - 2x^2 + 3)\mathrm{d}x = 4\frac{2}{3}$

[5 marks]

Answer _____

(b) Hence find the area of the shaded region bounded by the curve $y = x^3 - 2x^2 + 3$ and the line AB.

[3 marks]

Answer _____

Turn over for the next question

9 At the point (x, y), where $x > 0$, the gradient of a curve is given by

$$\frac{dy}{dx} = 3x^2 - \frac{4}{x^2} - 11$$

The point $P(2, 1)$ lies on the curve.

(a) (i) Verify that $\frac{dy}{dx} = 0$ when $x = 2$

[1 mark]

(a) (ii) Find the value of $\frac{d^2y}{dx^2}$ when $x = 2$

[4 marks]

Answer _____

(a) (iii) Hence state whether P is a maximum point or a minimum point, giving a reason for your answer.

[1 mark]

P is a _____

Reason _____

(b) Find the equation of the curve.

[4 marks]

Answer _____

10 (a) (i) Express $4 - 10x - x^2$ in the form $p - (x + q)^2$

[2 marks]

Answer _____

(a) (ii) Hence write down the equation of the line of symmetry of the curve with equation $y = 4 - 10x - x^2$

[1 mark]

Answer _____

(b) The curve *C* has equation $y = 4 - 10x - x^2$ and the line *L* has equation $y = k(4x - 13)$

(b) (i) Show that x-coordinates of any points of intersection of the curve *C* with the line *L* satisfy the equation

$$x^2 + 2(2k + 5)x - (13k + 4) = 0$$

[1 mark]

(b) (ii) Given that curve *C* and the line *L* intersect in two distinct points, show that

$$4k^2 + 33k + 29 > 0$$

[3 marks]

(b) (iii) Solve the inequality $4k^2 + 33k + 29 > 0$

[4 marks]

Answer _____

END OF QUESTIONS

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