OXFORD

INTERNATIONAL AQA EXAMINATIONS

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INTERNATIONAL AS
MATHEMATICS

(9660/MA01) Pure Mathematics Unit P1

Tuesday 15 January 2019 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.
- 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 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	
10	
TOTAL	

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

1 The line L_1 has equation $3x - 2y + 5 = 0$

1 (a) (i) Find the x-coordinate of the point where L_1 crosses the x-axis.

Circle your answer.

[1 mark]

$-\frac{5}{3}$ $\quad -\frac{3}{5}$ $\quad \frac{3}{5}$ $\quad \frac{5}{3}$

1 (a) (ii) Find the gradient of L_1

Circle your answer.

[1 mark]

-3 $\quad -\frac{3}{2}$ $\quad \frac{3}{2}$ $\quad 3$

1 (b) The line L_2 is perpendicular to L_1. Both lines cross the y-axis at the same point.

Find the equation of L_2, giving your answer in the form $y = mx + c$

[2 marks]

$y =$ ____________________

4

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2 (a) Given that $p^4 = 16a^{20} b^8$, where $p > 0$, find p in terms of a and b, giving your answer in its simplest form.

[2 marks]

$p =$ ______________________

2 (b) Let $y = \sqrt[3]{x}$ and $z = \left(\dfrac{x}{y}\right)^2$

Express z in the form x^k, where k is rational.

[3 marks]

$z =$ ______________________

5

Turn over ►

3 It is given that $f(x) = 2x^2 - 16x + 38$

3 (a) Express $f(x)$ in the form $a(x - b)^2 + c$, where a, b and c are positive integers.

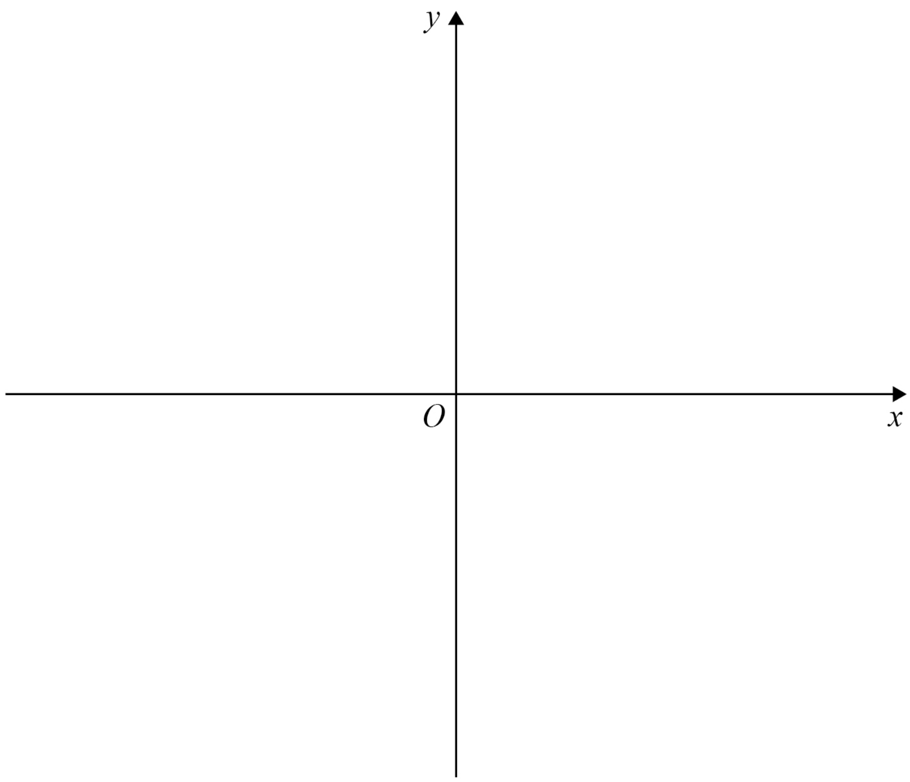
[3 marks]

$f(x) =$ ______________________

3 (b) The curve *C* with equation $y = f(x)$ crosses the y-axis at the point *A* and has a vertex at *B*.

Sketch the graph of *C*, showing the coordinates of *A* and *B*.

[3 marks]



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3 (c) The line with equation $y = 4x + 20$ intersects C at the points P and Q.

3 (c) (i) Show that the x-coordinates of P and Q satisfy the equation

$$x^2 - 10x + 9 = 0$$

[1 mark]

3 (c) (ii) Find the length of the line segment PQ.

Give your answer in the form $m\sqrt{n}$ where m is an integer and n is prime.

[4 marks]

Answer ______________________

11

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4 (a) The first four terms of the binomial expansion of $(1 - 3x)^6$ are

$$1 - 18x + px^2 + qx^3$$

where p and q are constants.

Show that $p = 135$ and find the value of q.

[3 marks]

$q =$ ____________________

Do not write outside the box

4 (b) Find the coefficient of x^3 in the expansion of

$$\left(1 + \frac{x}{5}\right)(1 - 3x)^6$$

[3 marks]

Answer ______________________

6

Turn over for the next question

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5 The curve C has equation $y = x^3 + 2x^2 - 15x + 20$

The point $P(2, 6)$ lies on C.

5 (a) Find an equation for the normal to C at the point P.

[5 marks]

Answer

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5 (b) The point $A(-3, 56)$ lies on the curve C.

5 (b) (i) Verify that A is a stationary point.

[1 mark]

5 (b) (ii) Find the value of $\dfrac{d^2y}{dx^2}$ at A.

[2 marks]

Answer

5 (b) (iii) Using your answer to part **(b)(ii)**, explain whether A is a maximum or a minimum.

[1 mark]

5 (c) The point $B\left(1\frac{2}{3}, 5\frac{5}{27}\right)$ is the only other stationary point of C.

State the possible values of x for which $f(x) = x^3 + 2x^2 - 15x + 20$ is a decreasing function.

[1 mark]

Answer

10

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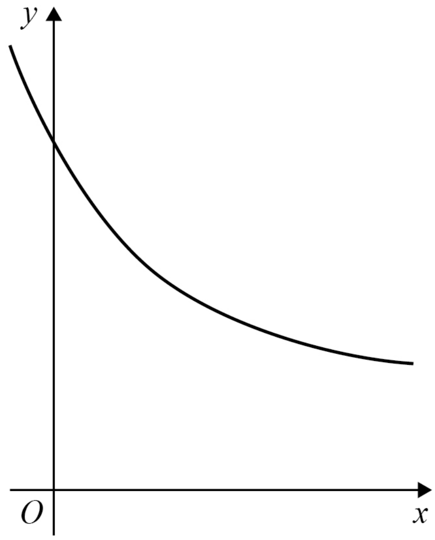
6 The diagram shows part of the curve with equation $y = 1 + 0.3^x$



6 (a) Use the trapezium rule with four ordinates to find an approximate value for

$$\int_{0.5}^{2} \left(1 + 0.3^x\right) \mathrm{d}x$$

Give your answer to three decimal places.

[4 marks]

Answer ______________________

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6 (b) (i) State, with a reason, whether your approximation in part **(a)** is an over-estimate or an under-estimate of the value of the integral.

[2 marks]

6 (b) (ii) Explain how you could obtain a better approximation to the value of the integral using the trapezium rule.

[1 mark]

7

Turn over for the next question

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7 The curve with equation

$$y = 2ax^3 - 7bx$$

where a and b are constants, is translated by the vector $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$ to give the curve C.

7 (a) Show that the equation of C can be written as

$$y = 2ax^3 - 6ax^2 + (6a - 7b)x - 2a + 7b + 4$$

[3 marks]

Do not write outside the box

7 (b) The point $P(2, 8)$ lies on C and the tangent to C at P has gradient 20

Find the value of a and the value of b.

[7 marks]

$a =$ ______ $b =$ ______

10

Turn over ►

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8 An arithmetic series has first term 3, common difference d and nth term u_n

It is given that $u_5 = p + 4$ and $u_9 = (2p - 1)^2$, where p is a constant.

8 (a) Show that p satisfies

$$2p^2 - 3p - 2 = 0$$

[4 marks]

8 (b) Given that $p > 0$:

8 (b) (i) find the value of d;

[3 marks]

$d =$ __________

Do not write outside the box

8 (b) (ii) find the value of k for which

$$\sum_{n=1}^{k} u_n = 138$$

[4 marks]

$k =$ ______

11

Turn over for the next question

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9 The polynomial $p(x)$ is given by

$$p(x) = x^3 + ax^2 - x - 21$$

where a is a constant.

The remainder when $p(x)$ is divided by $(x + 2)$ is -7

9 (a) Use the Remainder Theorem to show that $a = 5$

[2 marks]

9 (b) Use the Factor Theorem to show that $(x + 3)$ is a factor of $p(x)$.

[2 marks]

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9 (c) Given that $x > 0$, use your answer to part **(b)** to find

$$\int \frac{x^3 + 5x^2 - x - 21}{\sqrt{x}\left(x+3\right)}\,\mathrm{d}x$$

[6 marks]

Answer ______________________

10

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10 A geometric series has positive common ratio $(k^4 - 4k^2 - 11)$, where the constant k is real.

The sum to infinity of this series does not exist.

10 (a) By substituting $y = k^2$, show that

$$y^2 - 4y - 12 \geq 0$$

[2 marks]

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10 (b) Hence find the possible values of k.

Fully justify your answer.

[4 marks]

Answer

6

END OF QUESTIONS

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