OXFORD

INTERNATIONAL AQA EXAMINATIONS

Please write clearly in block capitals.

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Candidate signature _____

INTERNATIONAL AS
MATHEMATICS

(9660/MA01) Unit P1 − Pure Mathematics

Monday 20 May 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 (enclosed).
- 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 first three terms of a sequence are u_1, u_2 and u_3

The nth term of the sequence is u_n where

$$u_{n+1} = u_n + 7$$

The fifth term $u_5 = 40$

1 (a) (i) Find the value of u_1

Circle your answer.

[1 mark]

5 7 12 19

1 (a) (ii) Find the value of n for which $u_n = 75$

Circle your answer.

[1 mark]

7 10 15 68

Do not write outside the box

1 (b) The nth term of the sequence can be written in the form

$$u_n = pn + q$$

where p and q are integers.

Find the value of p and the value of q.

[2 marks]

$p =$ _____ $q =$ _____

4

Turn over for the next question

Do not write outside the box

2 The polynomial $\mathrm{p}(x)$ is given by

$$\mathrm{p}(x) = (x + 6)(x^2 + bx + c)$$

where b and c are integers.

2 (a) The remainder when $\mathrm{p}(x)$ is divided by $(x - 2)$ is -8

Use the Remainder Theorem to show that

$$2b + c = -5$$

[2 marks]

2 (b) Given that $(x - 1)$ is a factor of $\mathrm{p}(x)$, use the Factor Theorem to show that

$$b + c = -1$$

[2 marks]

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2 (c) Using parts **(a)** and **(b)**, find the value of b and the value of c.

[2 marks]

$b =$ _____ $c =$ _____

2 (d) Hence calculate the coefficient of x in the expansion of $\mathrm{p}(x)$.

[1 mark]

Answer _____

7

Turn over for the next question

Do not write outside the box

3 Harry uses the quadratic formula to solve the equation

$$ax^2 + (k - 6)x + c = 0$$

where a, c and k are real numbers.

Harry knows the values of a and c, but does not know the value of k.

He substitutes $(k - 6)$ and the values of a and c into the quadratic formula and correctly finds that

$$x = \frac{-(k-6) \pm \sqrt{(k-6)^2 - 64}}{16}$$

3 (a) Find the value of a and the value of c that Harry uses.

[2 marks]

$a =$ _____ $c =$ _____

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3 (b) Given that the equation has real roots, find the range of values for k.

Show clearly each step of your working.

[4 marks]

Answer _____

6

Turn over for the next question

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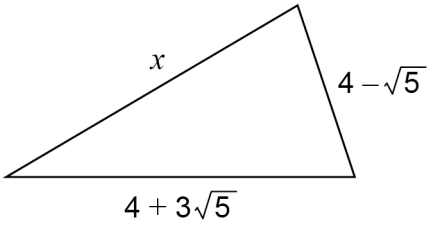
4 The diagrams below show a rectangle and a triangle.

The rectangle has length $3+2\sqrt{5}$ and area $16+7\sqrt{5}$

The triangle has sides of length $4+3\sqrt{5}$, $4-\sqrt{5}$, and x.

The perimeter of the rectangle is equal to the perimeter of the triangle.



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Find the value of x in the form $a+b\sqrt{5}$, where a and b are integers.

Show clearly each step of your working.

[7 marks]

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$x =$ _____

7

Turn over for the next question

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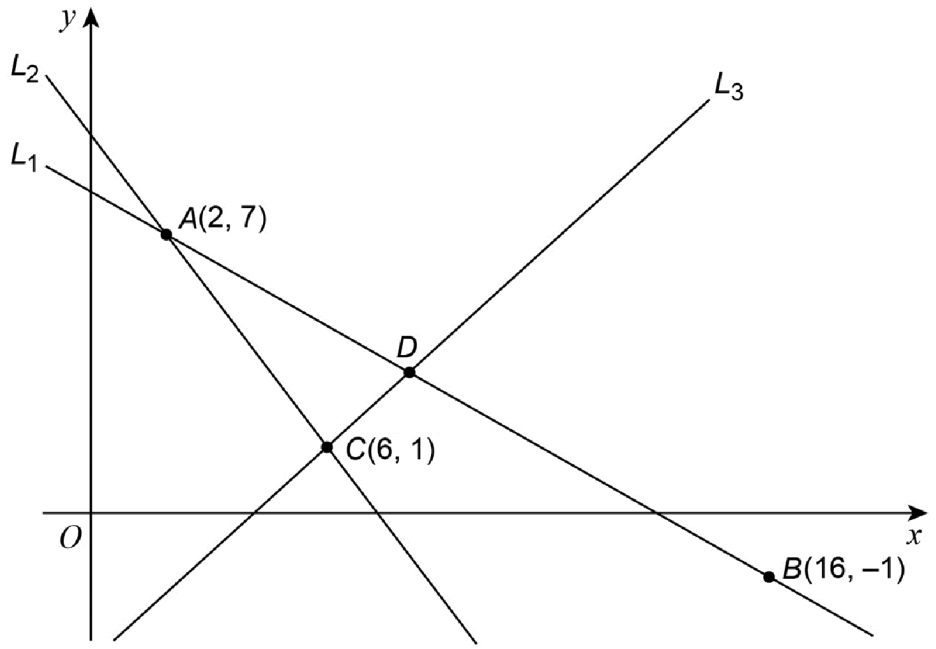
5 The points $A(2, 7)$, $B(16, -1)$, $C(6, 1)$ and D, and the lines L_1, L_2 and L_3 are shown in the diagram below.

L_1 passes through A, D and B.

L_2 passes through A and C.

L_3 passes through C and D.



5 (a) Show that the line L_1 has the equation

$$4x + 7y - 57 = 0$$

[2 marks]

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5 (b) The equation of L_2 is $3x + 2y - 20 = 0$

The equation of L_3 is $2x - 3y - 9 = 0$

Show that the lines L_2 and L_3 are perpendicular.

[3 marks]

5 (c) The length of the line segment AC is $2\sqrt{13}$

Find the area of the triangle ACD.

[6 marks]

Answer _____

11

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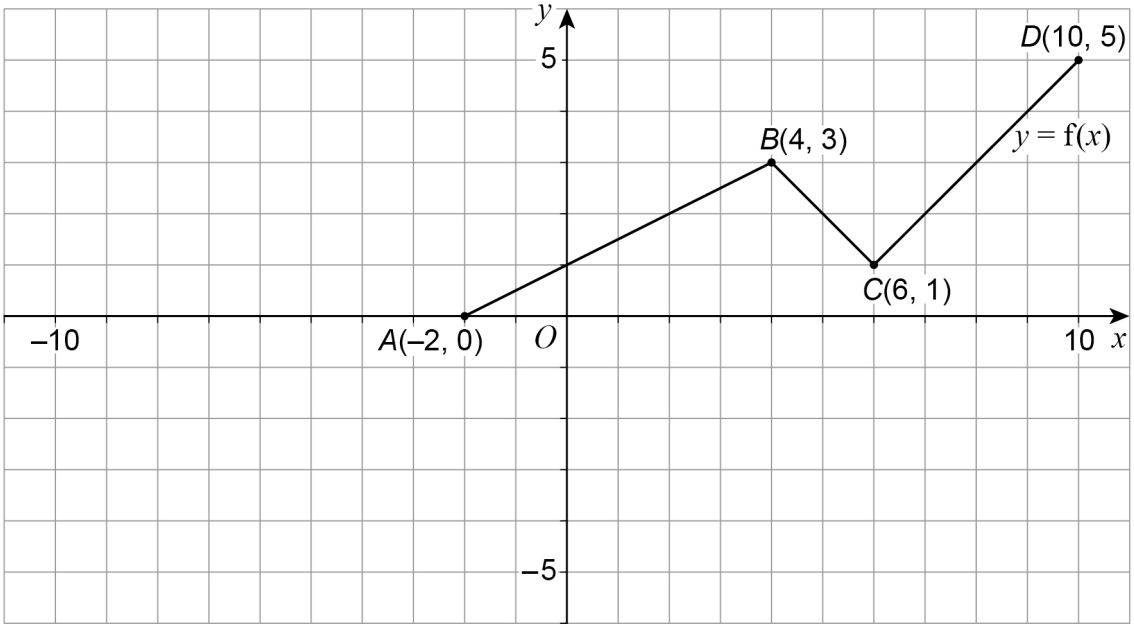
6 The diagram below shows the graph of a function with equation $y = f(x)$.
The graph consists of straight line segments joining the points $A(-2, 0)$, $B(4, 3)$, $C(6, 1)$ and $D(10, 5)$.



6 (a) State the number of roots of the equation $f(x) = 2.5$

Give a reason for your answer.

[2 marks]

6 (b) Describe fully the transformation that maps the graph of $y = f(x + 2) - 5$ onto the graph of $y = f(x)$.

[2 marks]

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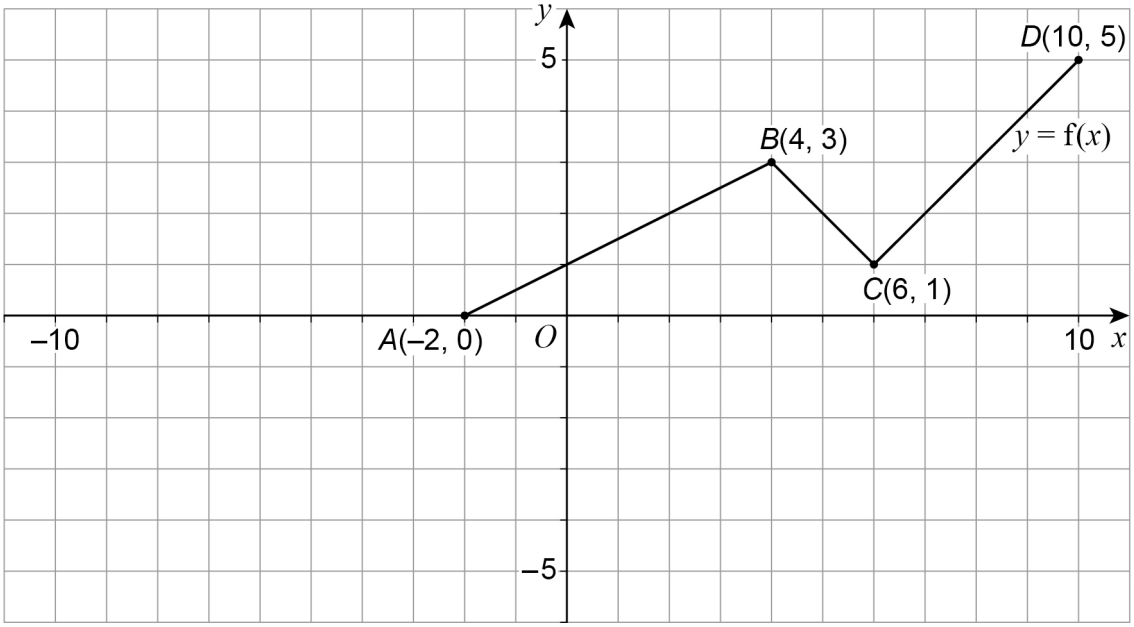
6 (c) Draw the graph of the function $y = f(-x)$ showing the coordinates of the images of *A*, *B*, *C* and *D*.

[2 marks]



Turn over for the next question

6

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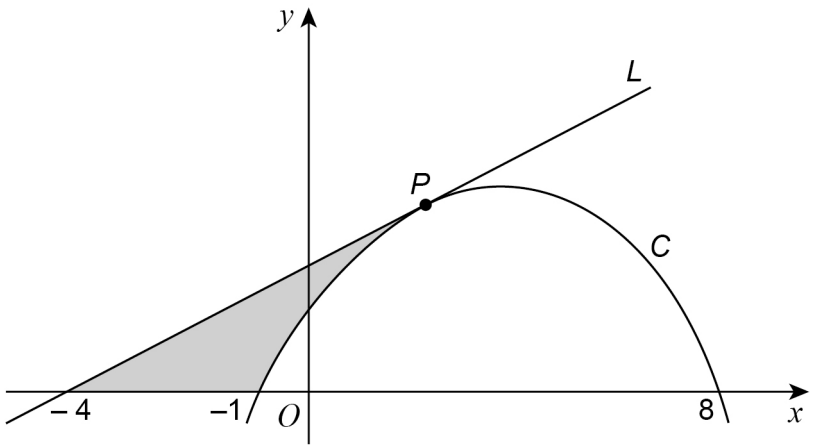
7 In the diagram below, the line L touches the curve C at the point P.

The equation of L is $3x - 2y + 12 = 0$

The equation of C is $y = 4 + \frac{7}{2}x - \frac{1}{2}x^2$



7 (a) Find the coordinates of the point P.

[5 marks]

Answer _____

Do not write outside the box

7 (b) Find $\int \left(4 + \frac{7}{2}x - \frac{1}{2}x^2\right) \mathrm{d}x$

[2 marks]

Answer _____

7 (c) The curve *C* passes through the point (–1, 0)

The line *L* passes through the point (–4, 0)

Find the area of the shaded region bounded by the curve *C*, the line *L* and the x-axis.

[4 marks]

Answer _____

11

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8 (a) Three consecutive terms in a geometric series are

k, 250 and $25k$

where $k > 0$

8 (a) (i) Find the value of the common ratio of the series.

[2 marks]

Answer _____

8 (a) (ii) Given that 250 is the fourth term in the series, find the first term.

[2 marks]

Answer _____

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8 (b) A different geometric series has nth term u_n, first term 6 and common ratio $\frac{1}{3}$, such that

$$\sum_{n=1}^{15} u_n = 3^p - 3^q$$

where p and q are integers.

Find the value of p and the value of q.

[4 marks]

$p =$ _____ $q =$ _____

8

Turn over for the next question

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9 The curve C has equation $y = 4x^{\frac{1}{3}}(x - 3) + 11$

9 (a) (i) Find $\frac{dy}{dx}$

[3 marks]

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

9 (a) (ii) The curve C has one stationary point, P.

Find the x-coordinate of P.

[3 marks]

$x =$ _____

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9 (b) Determine whether P is a maximum or minimum point.

Justify your answer.

[4 marks]

10

Turn over for the next question

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10 The first four terms of the expansion of $(1 + (k + 1)\,x)^n$ are

$$1 + 12x + ax^2 + 3ax^3 + \ldots$$

where n is a positive integer, and k and a are positive constants.

10 (a) Show that

$$(n - 2)(k + 1) = 9$$

[4 marks]

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10 (b) Find the exact value of the coefficient of x^5

[6 marks]

Answer _____

END OF QUESTIONS

10

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