OXFORD

INTERNATIONAL AQA EXAMINATIONS

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# 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 $n$th 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 $n$th 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]**

*Do not write outside the box*

**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]**

$a =$ _____ $c =$ _____

*Do not write outside the box*

**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**

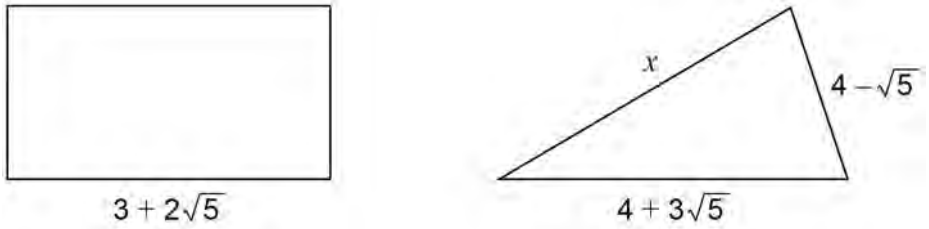
*Do not write outside the box*

**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]**

*Do not write outside the box*

$x =$ _____

7

**Turn over for the next question**

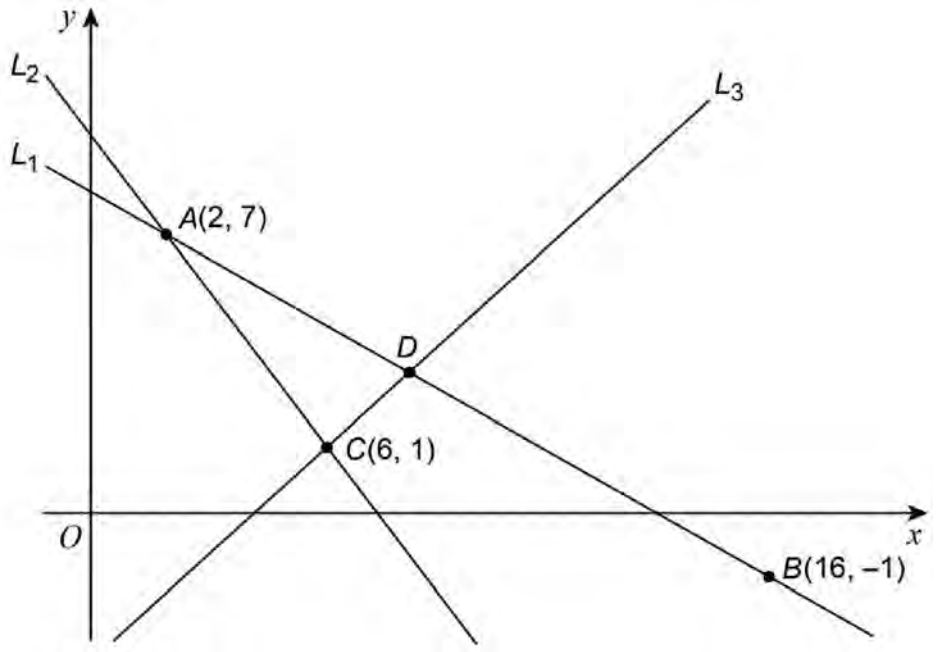
*Do not write outside the box*

**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]**

*Do not write outside the box*

**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 $ACD$.

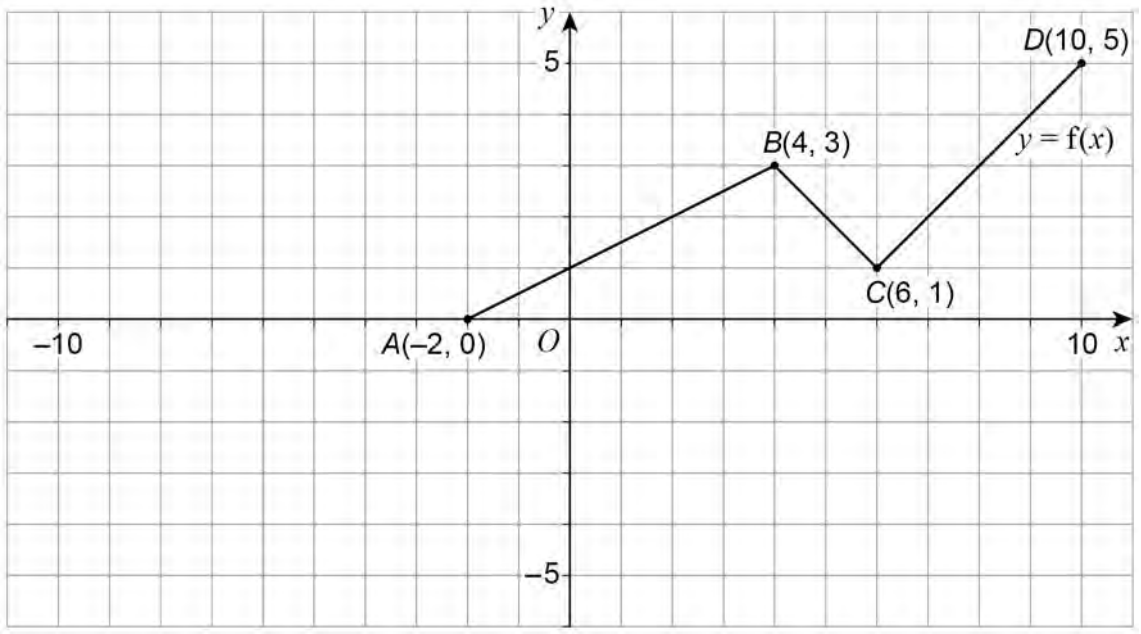
**[6 marks]**

Answer _____

11

*Do not write outside the box*

**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]**

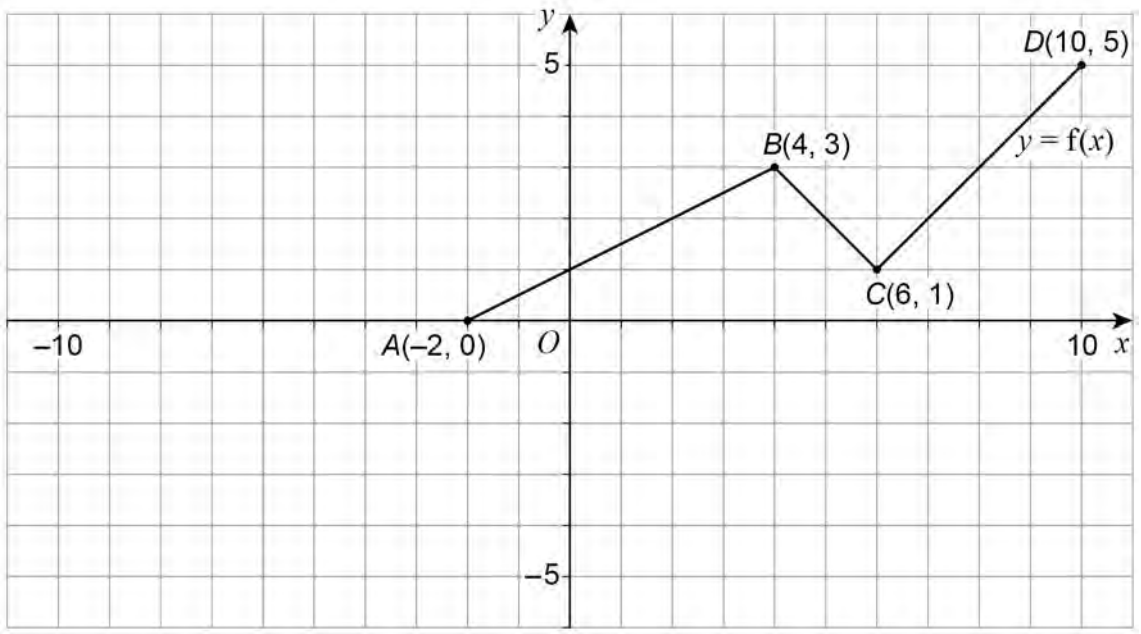
**6 (b)** Describe fully the transformation that maps the graph of $y = f(x + 2) - 5$ onto the graph of $y = f(x)$.

**[2 marks]**

*Do not write outside the box*

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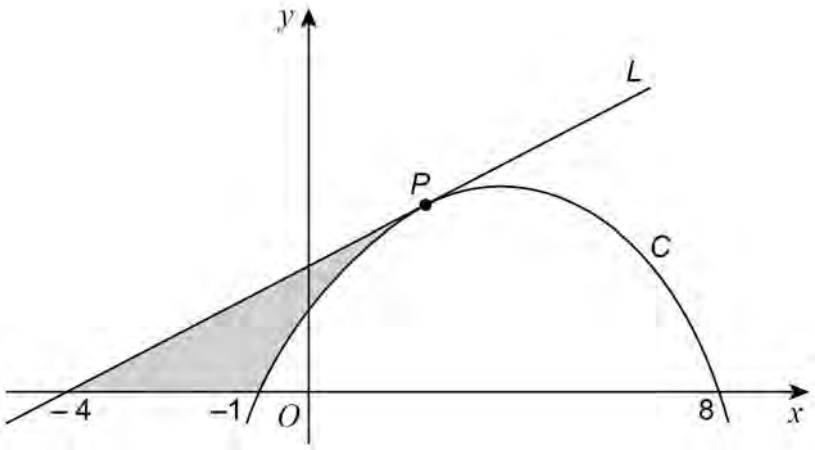
**7** In the diagram below, the line $L$ touches the curve $C$ at the point $P$.

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 _____

*Do not write outside the box*

**8 (b)** A different geometric series has $n$th 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**

*Do not write outside the box*

**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]**

$x =$ _____

*Do not write outside the box*

**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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