OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

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Candidate signature _____

I declare this is my own work.

# INTERNATIONAL AS
# MATHEMATICS

## (9660/MA01) Unit P1 Pure Mathematics

Monday 4 January 2021 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** | |

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

**1 (a) (i)** Find the constant term in the expansion of $(x+2)(2x-3)^2$

Circle your answer.

**[1 mark]**

$-18$ 18 25 36

**1 (a) (ii)** Find the coefficient of $x$ in the expansion of $(x+2)(2x-3)^2$

Circle your answer.

**[1 mark]**

$-15$ $-12$ $-10$ $-9$

**1 (a) (iii)** Find the coefficient of $x^2$ in the expansion of $(x+2)(2x-3)^2$

Circle your answer.

**[1 mark]**

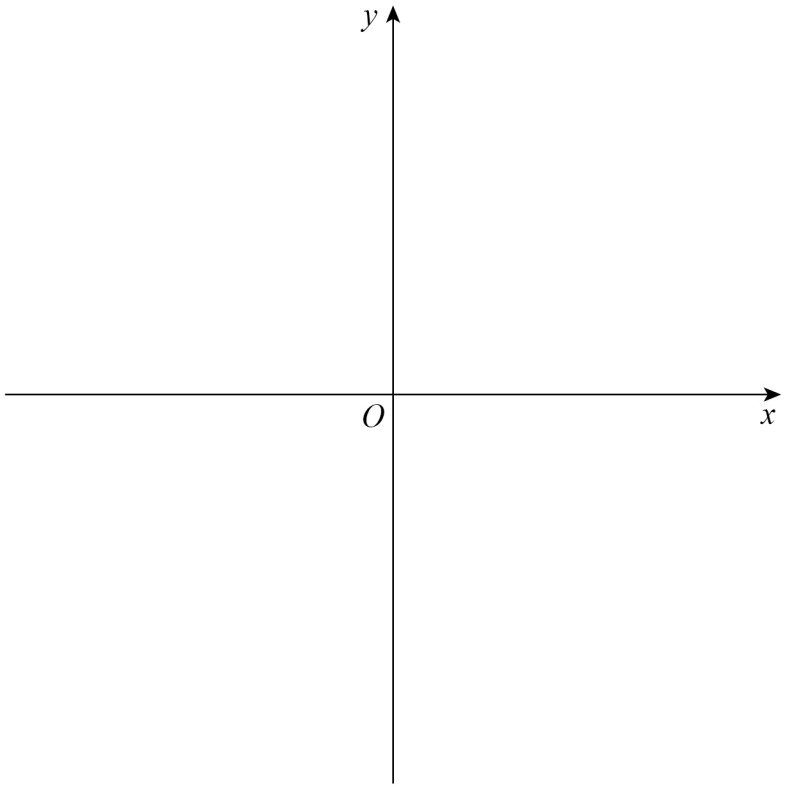
$-23$ $-19$ $-4$ 8

*Do not write outside the box*

**1 (b)** Sketch the graph of the curve $y = (x+2)(2x-3)^2$ on the axes below.

Include the coordinates of any points where the curve cuts or touches the axes.

**[3 marks]**




6

**Turn over for the next question**

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**2 (a)** Find the sum of the first 90 natural numbers.

**[2 marks]**

Answer _____

**2 (b)** Peter saves money each week over a period of 65 weeks.

He starts saving in Week 1

In Week 12 he saves 25 dollars.

In Week 28 he saves 57 dollars.

Peter's weekly savings, in dollars, form an arithmetic sequence with first term $a$ and common difference $d$

**2 (b) (i)** Find the value of $a$ and the value of $d$

**[3 marks]**

$a =$ _____ $d =$ _____

*Do not write outside the box*

**2 (b) (ii)** Find the total amount he saves over the complete 65-week period.

**[2 marks]**

Answer _____

7

**Turn over for the next question**

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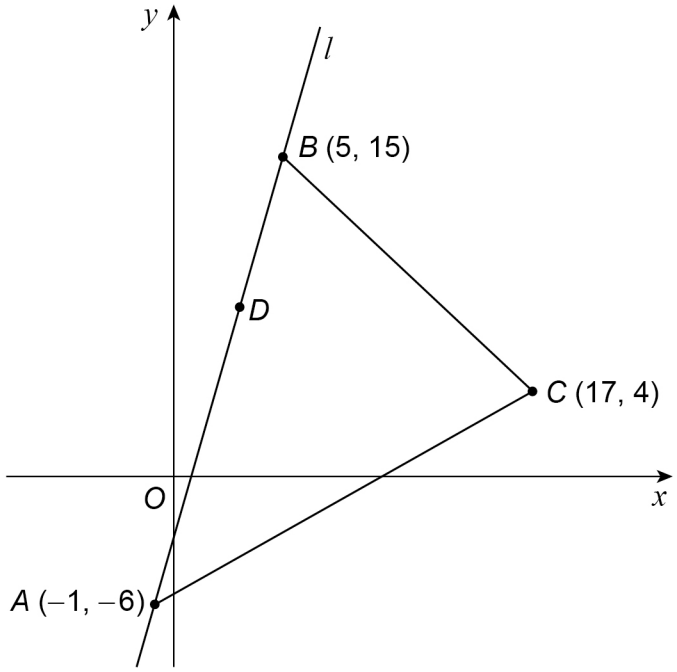
**3** The points $A(-1,-6)$, $B(5,15)$ and $C(17,4)$ are the vertices of a triangle, as shown in the diagram.

The line $l$ passes through $A$ and $B$




**3 (a)** Show that $l$ has the equation

$$7x - 2y = 5$$

**[2 marks]**

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**3 (b)** $D$ is the point on $l$ that is nearest to $C$

Find the coordinates of $D$

**[5 marks]**

Answer _____

**3 (c)** Using the fact that the line segment $AB$ has length $3\sqrt{53}$ find the area of triangle $ABC$

**[3 marks]**

Answer _____

**10**

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**4 (a)** Describe fully the single transformation which maps the graph of

$$y = x^2 + 2$$

onto the graph of

$$y = x^2 - 9x + 5$$

**[4 marks]**

**4 (b)** It is given that

$$f(x) = 4x^3 + 5x^2 + 32k^3 - 20k^2$$

where $k$ is a constant.

**4 (b) (i)** Find the remainder when $f(x)$ is divided by $(x - 3k)$

Give your answer in the form $ak^3 + bk^2$ where $a$ and $b$ are integers.

**[2 marks]**

Answer _____

*Do not write outside the box*

**4 (b) (ii)** Use the Factor Theorem to show that $(x+2k)$ is a factor of $\mathrm{f}(x)$

**[2 marks]**

**4 (c)** The graph of $y=\mathrm{f}(x)$ is mapped onto the graph of $y=\mathrm{g}(x)$ by a stretch with scale factor 3 in the $x$-direction.

**4 (c) (i)** State in terms of $k$ a root of the equation $\mathrm{g}(x)=0$

**[1 mark]**

Answer _____

**4 (c) (ii)** Find an expression for $\mathrm{g}(x)$ fully simplifying the coefficients.

**[2 marks]**

$\mathrm{g}(x)=$ _____

11

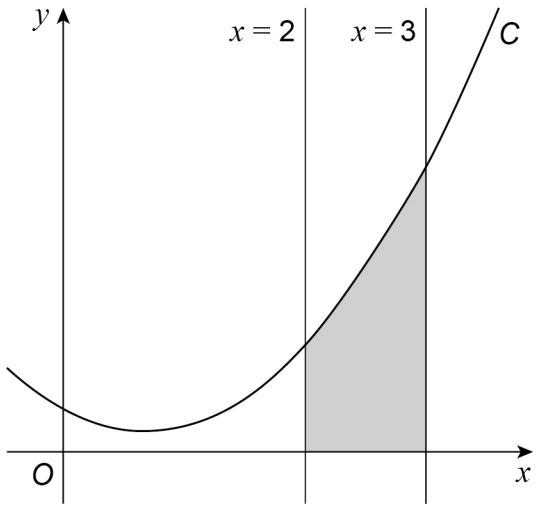
*Do not write outside the box*

**5** The equation of the curve $C$ is

$$y = ax^2 - bx + 5$$

where $a$ and $b$ are constants.

The curve $C$ and the lines $x = 2$ and $x = 3$ are shown in the diagram.




**5 (a)** The gradient of $C$ at the point where $x = 2$ is 16

Show that $4a - b = 16$

**[2 marks]**

**5 (b)** The area of the shaded region is 23 units squared.

Show that $38a - 15b = 108$

**[4 marks]**

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**5 (c)** Find the value of $a$ and the value of $b$

**[1 mark]**

$a =$ _____ $b =$ _____

**5 (d)** Using your values of $a$ and $b$, find the values of $d$ for which the line $y = x + d$ does **not** intersect or touch the curve $C$

**[4 marks]**

Answer _____

11

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**6 (a)** The first five terms, in ascending powers of $x$, of the binomial expansion of $\left(2+\frac{1}{4}x\right)^8$ are

$$256 + px + qx^2 + rx^3 + \frac{35}{8}x^4$$

where $p$, $q$ and $r$ are constants.

Find the values of $p$, $q$ and $r$

**[4 marks]**

$p =$ _____ $q =$ _____ $r =$ _____

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**6 (b) (i)** Hence show that the first two non-zero terms, in ascending powers of $x$, of

$$\left(2+\frac{1}{4}x\right)^8-\left(2-\frac{1}{4}x\right)^8$$

are $512x+56x^3$

**[3 marks]**

**6 (b) (ii)** Using the result in **part (b)(i)** find an approximation to the value of $2.1^8-1.9^8$

Give your answer to two decimal places.

**[2 marks]**

Answer _____

9

**Turn over ►**

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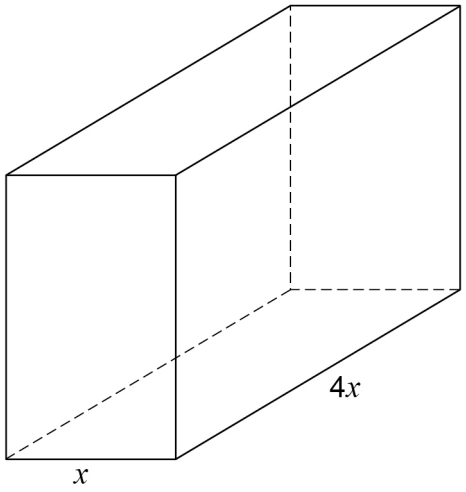
**7** The diagram shows an open-topped tank in the shape of a cuboid.

The sum of the internal surface areas of the base and the four vertical walls of the tank is 75 $m^2$

The base of the tank has width $x$ metres and length $4x$ metres.




**7 (a)** Show that the volume $V\,m^3$ of the tank is given by

$$V = 30x - \frac{8}{5}x^3$$

**[4 marks]**

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**7 (b) (i)** Find the maximum value of $V$

**[4 marks]**

Answer _____

**7 (b) (ii)** Prove, using $\frac{\mathrm{d}^2V}{\mathrm{d}x^2}$, that your value of $V$ is a maximum.

**[2 marks]**

**10**

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**8** Given that $k$ is a constant such that $k > 4$ show that

$$\int_{64}^{16k} \left( \sqrt{x} + \frac{1}{6\sqrt{x}} \right) \mathrm{d}x$$

can be written in the form

$$\sqrt{k}\left(ak + b\right) - c$$

where $a$, $b$ and $c$ are constants to be found.

**[8 marks]**

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8

**Turn over for the next question**

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**9** A geometric series has first term $a$ common ratio $r$ and $n$th term $u_n$

It is given that $u_4 = -6$ and $u_3 + u_5 = 20$

**9 (a)** Show that $3r^2 + 10r + 3 = 0$

**[3 marks]**

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**9 (b)** The sum to infinity of the series can be calculated.

Show that if $k$ is a positive integer then for all values of $k$

$$\sum_{n=k}^{\infty} u_n = \frac{(-1)^{k-1} p^{m-k}}{2}$$

where $p$ and $m$ are constants to be found.

**[5 marks]**

**8**

**END OF QUESTIONS**

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