OXFORD
INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

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	

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

Do not write outside the box

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]

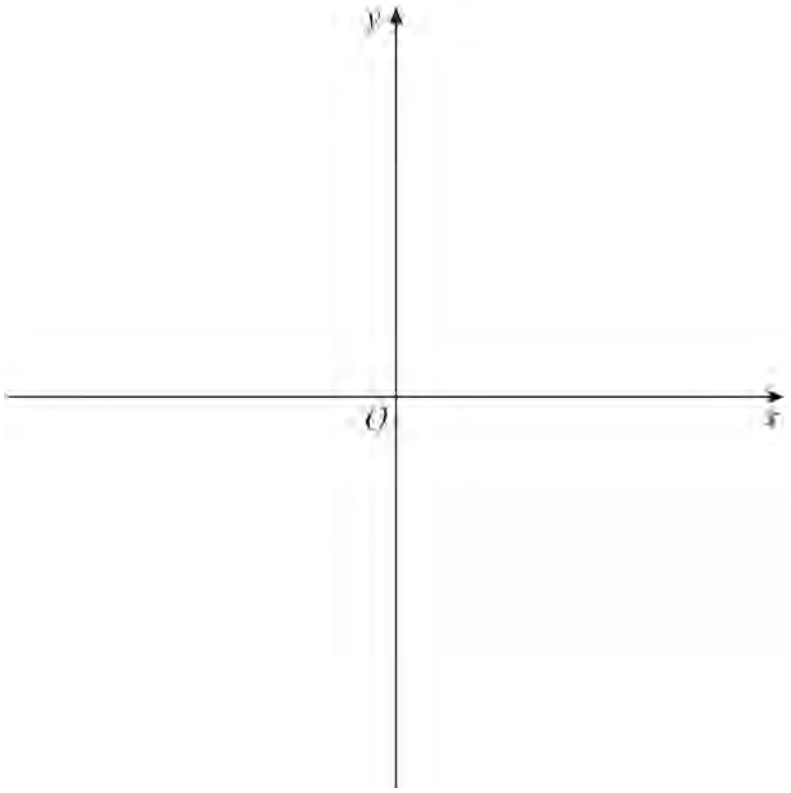
-23 -19 -4 8

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

Do not write outside the box

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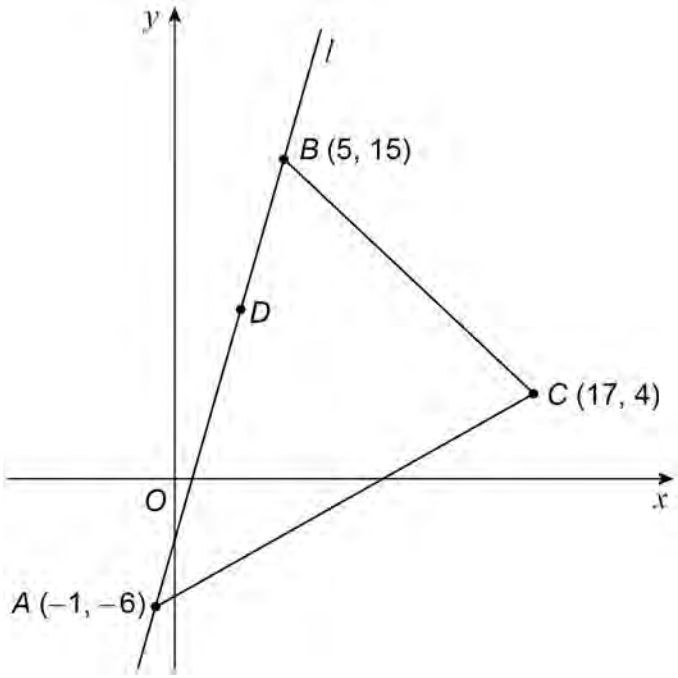
3 The points $A(-1,-6)$, $B(5,15)$ and $C(17,4)$ are the vertices of a triangle, as shown in the diagram.

The line l passes through A and B



3 (a) Show that l has the equation

$$7x - 2y = 5$$

[2 marks]

Do not write outside the box

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

Do not write outside the box

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

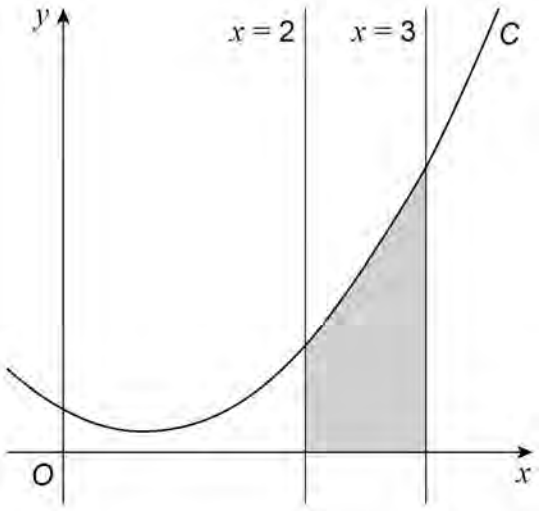
Do not write outside the box

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]

Do not write outside the box

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]

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

Do not write outside the box

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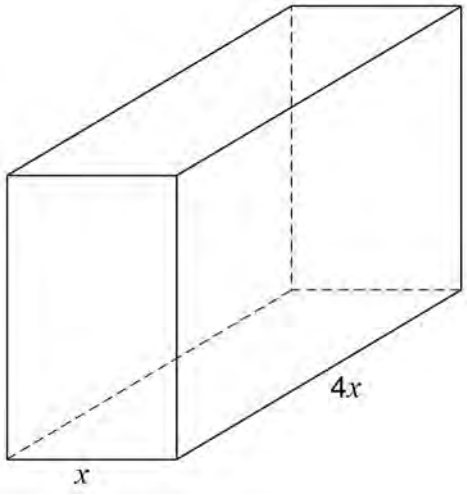
7 The diagram shows an open-topped tank in the shape of a cuboid.

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]

Do not write outside the box

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]

Do not write outside the box

8

Turn over for the next question

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9 A geometric series has first term a common ratio r and nth 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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