AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

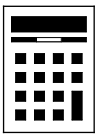
Level 2 Certificate
FURTHER MATHEMATICS

Paper 2 Calculator

Wednesday 19 June 2024 Morning Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:



- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- 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.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more graph paper and tracing paper. These must be tagged securely to this answer book.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	

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

Do not write outside the box

1 A straight line

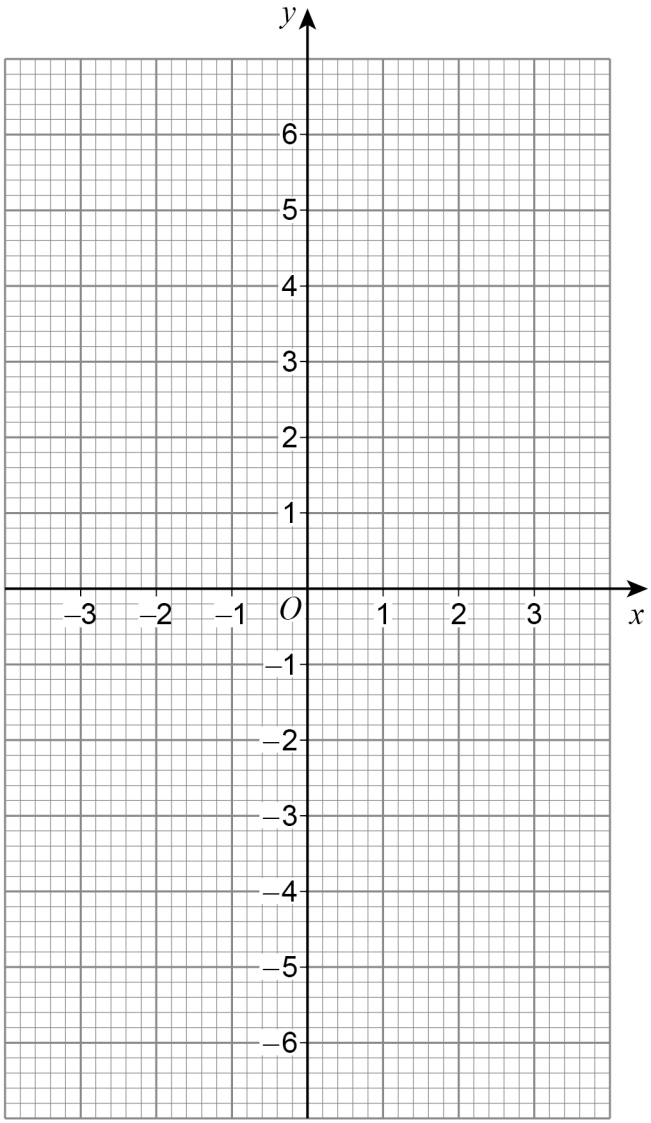
passes through the point $(-1, -1)$

and

has gradient $\frac{3}{2}$

Draw the line for values of x from -3 to 3

[3 marks]



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2 $5n^2 + 2 < 38$

Work out all the possible **integer** values of n.

[2 marks]

Answer _____

3 The equation of a curve is $y = x^4 - 3kx^2$ where k is a constant.

When $x = 2$ the rate of change of y with respect to x is 23

Work out the value of k.

[3 marks]

$k =$ _____

8

Do not write outside the box

4 Here is some information about three linear sequences, A, B and C.

nth term of C = nth term of A + nth term of B

The nth term of C is $42 - 3n$

The first four terms of B are 14 22 30 38

Work out the 20th term of A.

[4 marks]

Answer _____

Do not write outside the box

5 (a) $\begin{pmatrix} c & 1 \\ 5d & 3 \end{pmatrix}\begin{pmatrix} -2 & 0 \\ 7 & 3 \end{pmatrix} = \begin{pmatrix} -5 & 3 \\ 0 & 9 \end{pmatrix}$

Work out the values of c and d.

[3 marks]

$c =$ _____ $d =$ _____

5 (b) $\begin{pmatrix} 5 & 2 \\ 1 & 4 \end{pmatrix}\mathbf{M} = \begin{pmatrix} 5 & 2 \\ 1 & 4 \end{pmatrix}$

Write down matrix **M**

[1 mark]

$\mathbf{M} = \begin{pmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{pmatrix}$

8

Do not write outside the box

6 The function f is given by $f(x) = 3x^2 + 2$ with domain $-1 \leqslant x \leqslant 4$

Work out the range of the function.

[2 marks]

Answer _____ $\leqslant f(x) \leqslant$ _____

7 The equation of a curve is $y = 4 - (x - 3)^2$

7 (a) Circle the coordinates of the point where the curve crosses the y-axis.

[1 mark]

(–5, 0) (0, –5) (–13, 0) (0, –13)

7 (b) Write down the coordinates of the maximum point of the curve.

[1 mark]

Answer (_____ , _____)

Do not write outside the box

8 $y = \frac{1}{2}x^2 + \frac{3}{4x^4}$

Work out $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$

Give your answer in the form $a + bx^n$ where a, b and n are integers.

[3 marks]

Answer _____

9 A set of 4-digit integers each have

a first digit **greater than** 6

and

a second digit **less than** 8

What is the greatest possible number of integers in the set that are multiples of 5?

[3 marks]

Answer _____

10

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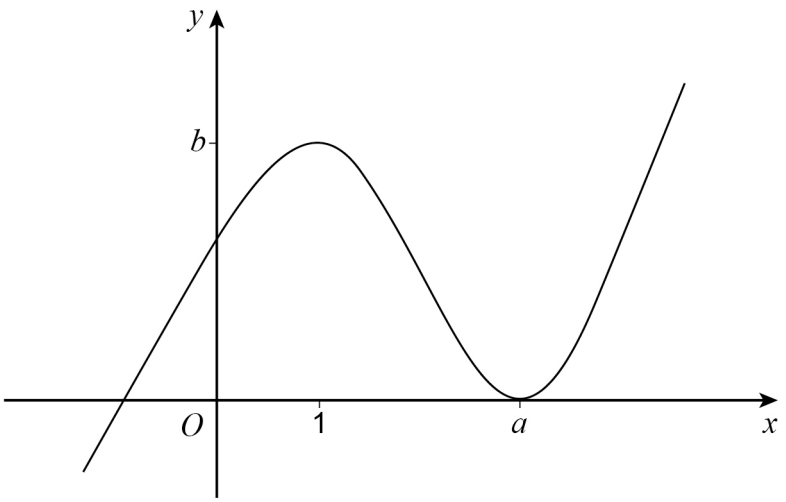
10 f is a cubic function.

The curve $y = f(x)$ has

a minimum point at $(a, 0)$

and

a maximum point at $(1, b)$



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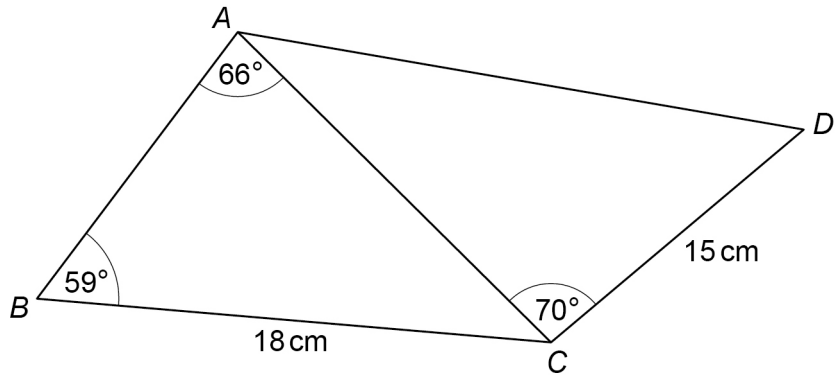
Tick one box for each statement.

[2 marks]

	True	**False**
The tangent to the curve at $(1, b)$ is parallel to the x-axis	☐	☐
There are **three different** values of x for which $y = 0$	☐	☐
The function is increasing for $0 < x < 1$	☐	☐

Do not write outside the box

11 *ABC* and *ACD* are triangles.



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Work out the area of triangle *ACD*.

[4 marks]

Answer _____ cm^2

6

Turn over ►

Do not write outside the box

12 The equation of a circle is $(x-2)^2+(y+3)^2=16$

The equation of a line is $y=4-x$

The circle and line intersect at two points, *A* and *B*.

12 (a) Show that the x-coordinates of *A* and *B* satisfy the equation $2x^2-18x+37=0$

[3 marks]

Do not write outside the box

12 (b) For A, the x-coordinate and y-coordinate are both **positive**.

Work out the coordinates of A.

Give each coordinate to 2 decimal places.

[3 marks]

Answer (_____ , _____)

Turn over for the next question

6

Do not write outside the box

13 Expand and simplify fully $(3x - 1)(4 - x)(2x + 5)$

[3 marks]

Answer _____

Do not write outside the box

14 *P* is the point on the graph $y = 3^{-x}$ that has x-coordinate -2

Q is a point on the graph $y = 1152 \times \left(\frac{1}{2}\right)^x$

y-coordinate of *P* = y-coordinate of *Q*

Work out the x-coordinate of *Q*.

[3 marks]

$x =$ _____

Turn over for the next question

6

Do not write outside the box

15 Simplify fully $\dfrac{2x^2 + 9x - 18}{12x^2 - 8x - 15}$

[3 marks]

Answer _____

Do not write outside the box

16 Simplify $\dfrac{\sqrt{x^3}\left(\sqrt{x^3}+x^3\right)}{\sqrt{x}}$

Give your answer in the form $x^{\frac{a}{b}}+x^c$ where a, b and c are integers.

[3 marks]

Answer _____

Turn over for the next question

6

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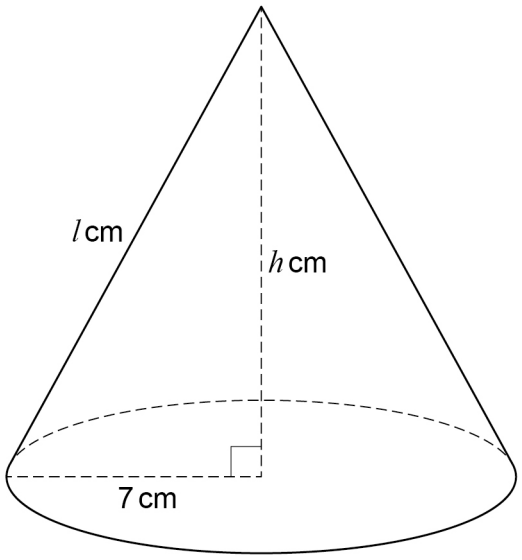
17 (a) A solid cone has base radius 7 cm, perpendicular height h cm and slant height l cm



Curved surface area of a cone $= \pi rl$

The **total** surface area of the cone is 224π cm^2

Work out the size of the angle between the slant height and the base.

[4 marks]

Answer _____ °

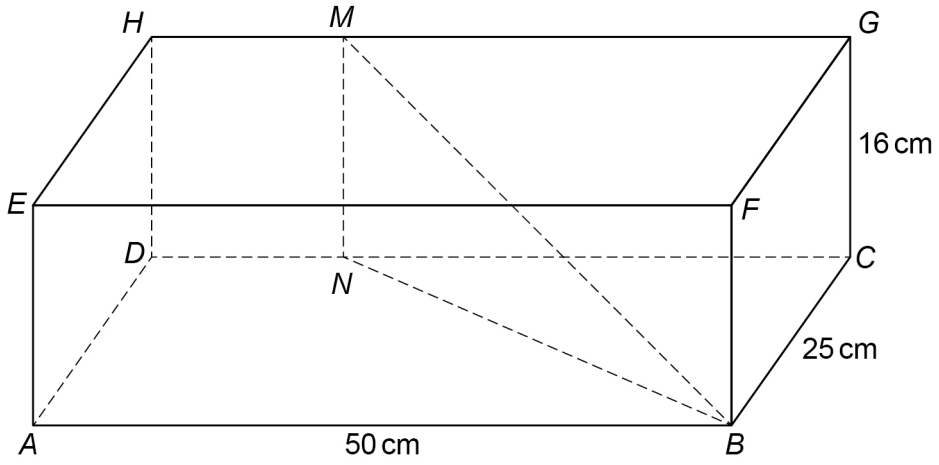
Do not write outside the box

17 (b) *ABCDEFGH* is a cuboid.

ABCD is horizontal.

MN is vertical.

The acute angle between the planes *MNB* and *HDCG* is 36°



Work out the length *CN*.

[2 marks]

Answer _____ cm

6

Turn over ►

Do not write outside the box

18 Rearrange $m = \dfrac{2k^3 - 7}{5m - 3k^3}$ to make k the subject.

[4 marks]

Answer _____

Do not write outside the box

19 In the expansion of $(3 + ax)^5$ where a is a non-zero constant

8 × coefficient of x^2 = coefficient of x^4

Work out the possible values of a.

[4 marks]

Answer _____

Turn over for the next question

8

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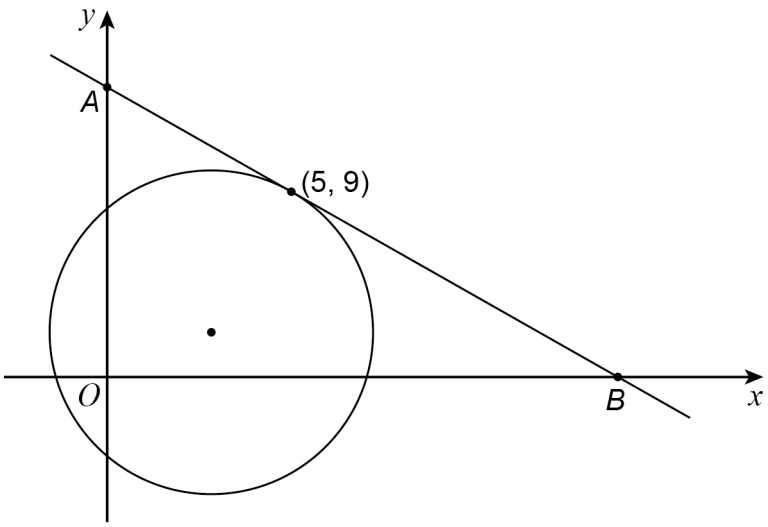
20 *AB* is the tangent to the circle $(x-3)^2+(y-4)^2=29$ at the point (5, 9)



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Work out the area of triangle *AOB*.

[5 marks]

Answer _____ square units

Do not write outside the box

21 $f(x) = \dfrac{2-x}{3}$

$g(x) = 18x^2 + 15x$

$f^{-1}(x) + gf(x)$ simplifies to $ax^2 + bx + c$

Work out the values of a, b and c.

[6 marks]

$a =$ _____ $b =$ _____ $c =$ _____

11

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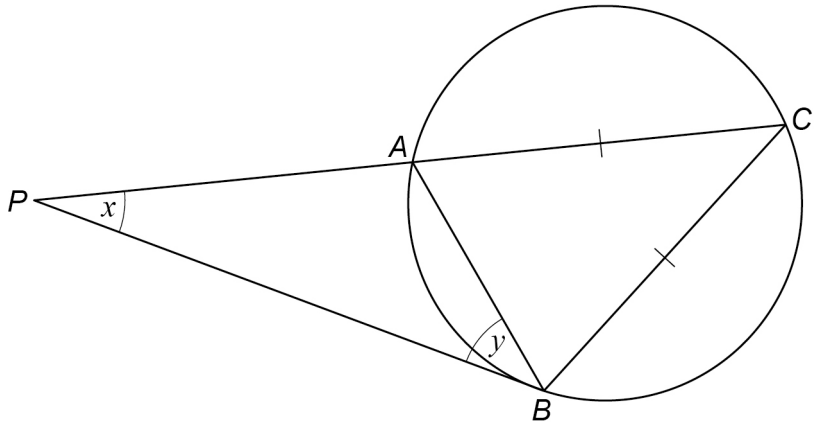
22 *A*, *B* and *C* are points on a circle.

PAC is a straight line.

PB is a tangent to the circle.

$AC = BC$

Not drawn accurately



Prove that $x = 90 - \frac{3}{2}y$

[5 marks]

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END OF QUESTIONS

5

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