AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

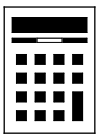
Level 2 Certificate
FURTHER MATHEMATICS

Paper 2 Calculator

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	
TOTAL	

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

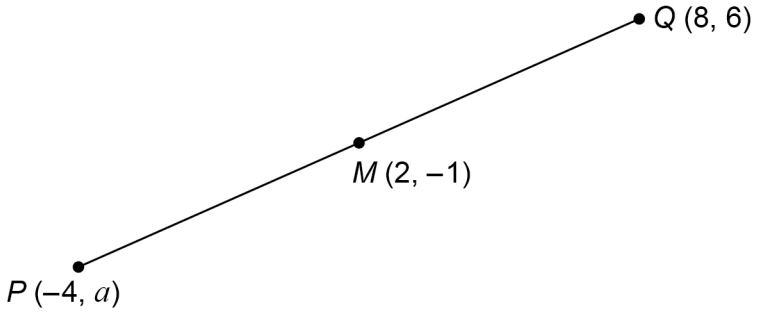
Do not write outside the box

1 Factorise fully $12w + 18w^2$

[2 marks]

Answer _____

2 *M* is the midpoint of *PQ*.



Not drawn accurately

Work out the value of a.

[2 marks]

Answer _____

Do not write outside the box

3 (a) Work out $3\begin{pmatrix} 4 & 2 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 2 & 0 \\ -1 & 5 \end{pmatrix}$

Give your answer as a single matrix.

[3 marks]

Answer _____

3 (b) $\begin{pmatrix} 7 & a^2 \\ b & -5 \end{pmatrix}\begin{pmatrix} 2 \\ a \end{pmatrix} = \begin{pmatrix} 78 \\ 12 \end{pmatrix}$

Work out the values of a and b.

[3 marks]

$a =$ _____ $b =$ _____

10

Do not write outside the box

4 Line A has equation $y + 4x = 6$

Line B is parallel to line A and passes through the point (2, 1)

The point $(d, 2d)$ lies on line B.

Work out the value of d.

[4 marks]

Answer _____

5 Work out all the **negative** integer values of x for which $3x^2 < 48$

[3 marks]

Answer _____

Do not write outside the box

6 Prove algebraically that when n is an integer

$$\frac{(2n+1)^2-(2n-1)^2}{4}$$ is always even.

[3 marks]

7 How many integers between 200 000 and 400 000 can be formed using only the digits

1 2 3 5 8 9

with no repetition of any digit?

[2 marks]

Answer _____

12

Do not write outside the box

8 A curve has equation $y = x^3 - 5x^2$

At two points on the curve, the rate of change of y with respect to x is 4

8 (a) Work out an equation, in terms of x, to represent this information.

Give your answer in the form $ax^2 + bx + c = 0$ where a, b and c are integers.

[2 marks]

Answer _____

8 (b) Hence, work out the two possible values of x.

Give your answers to 3 significant figures.

[2 marks]

Answer _____

Do not write outside the box

9 The first three terms of a linear sequence are

$30 \qquad 30 + 4k \qquad 30 + 8k$

where k is a constant.

9 (a) Work out an expression, in terms of k, for the 4th term.

Give your answer in its simplest form.

[1 mark]

Answer _____

9 (b) The 100th term of the sequence is 525

Work out the value of k.

[3 marks]

Answer _____

8

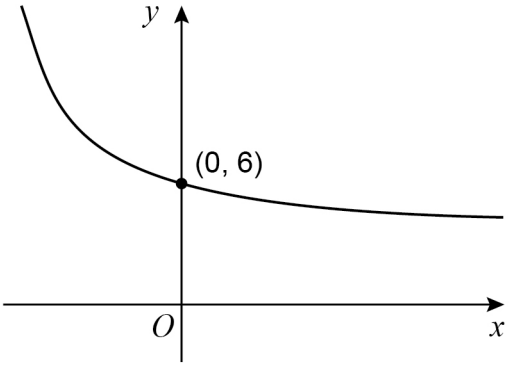
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10 Here are four sketch graphs.

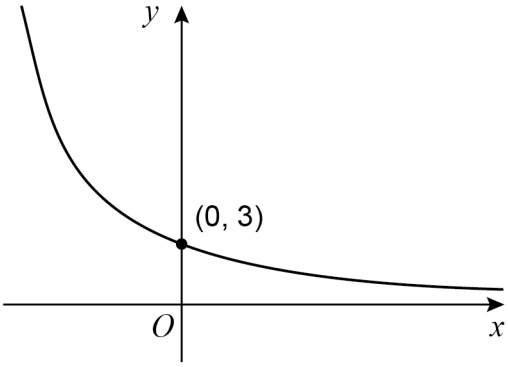
Circle the letter of the sketch graph that represents $y = 3 \times 2^x$

[1 mark]

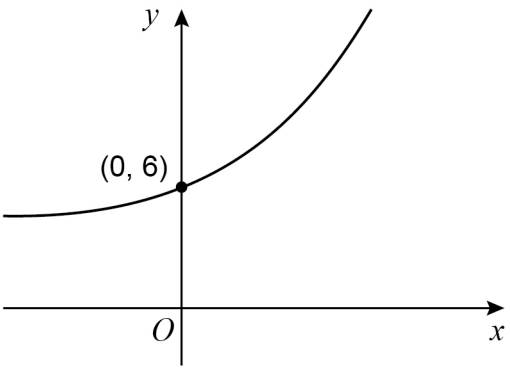
A



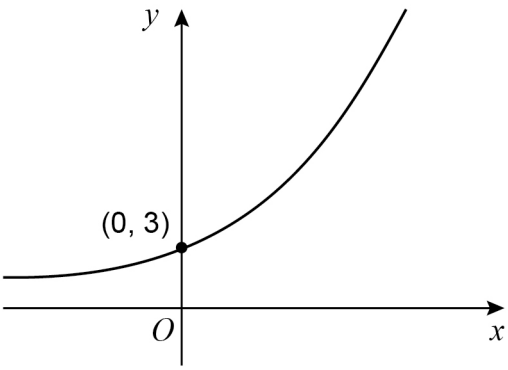
B



C

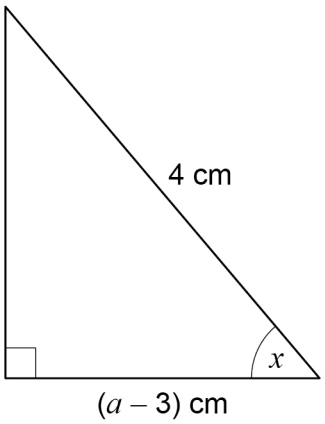


D



Do not write outside the box

11 Here is a right-angled triangle.



Not drawn accurately

You are given that $a > 5$

Use trigonometry to work out the range of values of x.

[2 marks]

Answer _____

Turn over for the next question

3

Do not write outside the box

12 Work out the gradient of the curve $y = \dfrac{12x^3 - 8x + 3}{4x^2}$

at the point where $x = -1$

You **must** show your working.

[5 marks]

Answer _____

Do not write outside the box

13 *A* (–2, 5) and *B* (4, 13) are points on a circle.

AB is a diameter.

Work out the equation of the circle.

Give your answer in the form $(x - a)^2 + (y - b)^2 = c$ where a, b and c are integers.

[3 marks]

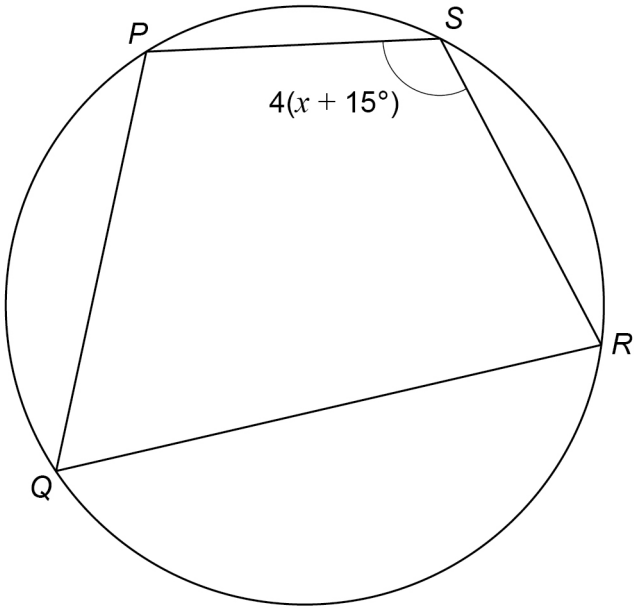
Answer _____

Turn over for the next question

8

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14 *PQRS* is a cyclic quadrilateral.



Not drawn accurately

Angle *PSR* = $4(x + 15°)$

Angle *PQR* is 40° smaller than angle *PSR*.

Work out the value of x.

[3 marks]

Answer _____ degrees

Do not write outside the box

15 Simplify fully $\left(\frac{x}{2}+\frac{3x}{5}\right) \div \sqrt{\frac{x^6}{4}}$

[5 marks]

Answer _____

Turn over for the next question

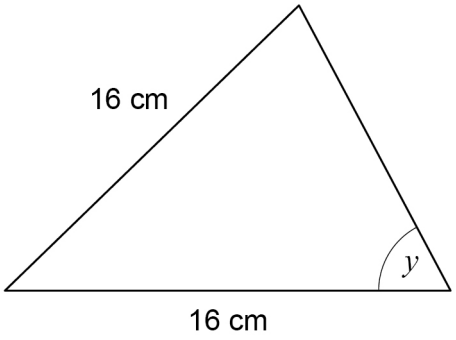
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Do not write outside the box

16 Here is an isosceles triangle.

All the angles are acute.

Not drawn accurately



The area of the triangle is 120 cm^2

Work out the size of angle y.

[4 marks]

Answer _____ degrees

Do not write outside the box

17 Solve the simultaneous equations

$$a + 3b - 2c = 4$$
$$4a - 3b + 5c = -5$$
$$2a + b + 3c = 9$$

Do **not** use trial and improvement.

You **must** show your working.

[5 marks]

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

9

Turn over ►

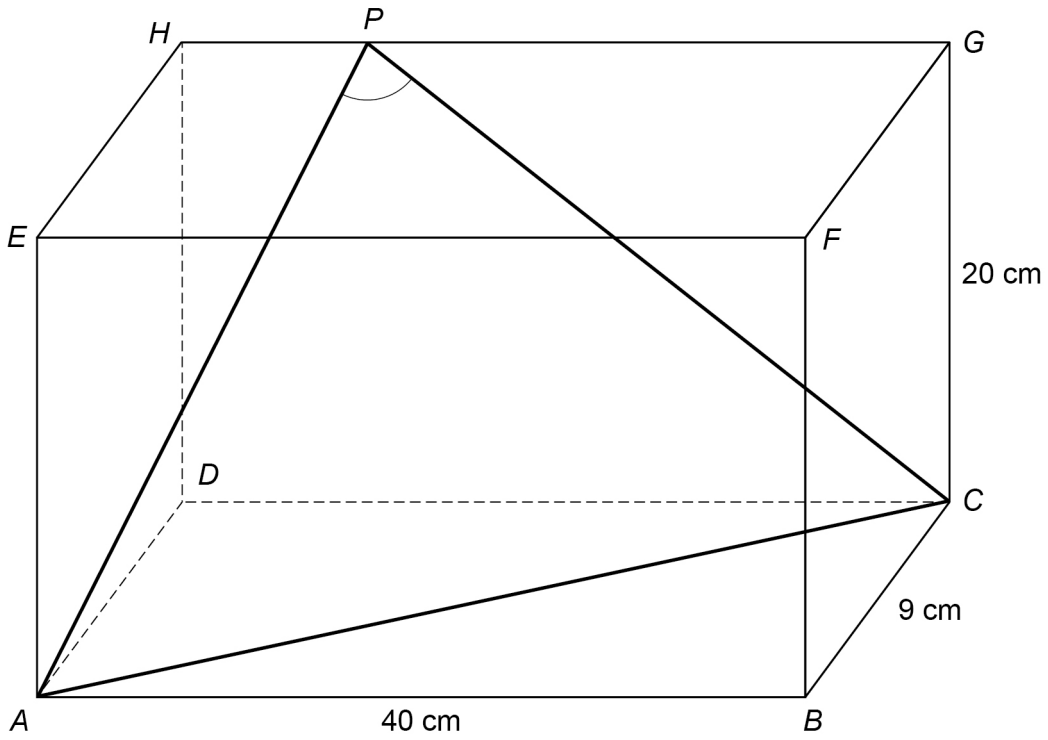
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18 *ABCDEFGH* is a cuboid.

$AB = 40$ cm $BC = 9$ cm $CG = 20$ cm

P is a point on HG such that $HP : PG = 3 : 7$

$AP = 25$ cm



Work out the size of angle *APC*.

[5 marks]

Do not write outside the box

Answer _____ degrees

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

[3 marks]

Answer _____

8

Do not write outside the box

20 $f(x) = 2x^3 + 11x^2 + 12x - 9$

20 (a) Use the factor theorem to show that $(2x - 1)$ is a factor of $f(x)$.

[2 marks]

20 (b) Show that $f(x) = 0$ has **exactly two** solutions.

[4 marks]

Do not write outside the box

21 Work out the values of x between 0° and 360° for which

$$2\tan^2 x = 3$$

Give your answers to 1 decimal place.

You **must** show your working.

[4 marks]

Answer _____

Turn over for the next question

10

Do not write outside the box

22 Using powers of 2 or otherwise, work out the non-zero value of x for which

$$\left(16^x\right)^x = \frac{1}{2^{3x}}$$

You **must** show your working.

[4 marks]

Answer _____

END OF QUESTIONS

4

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ANSWER IN THE SPACES PROVIDED

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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