AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

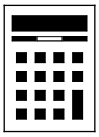
Level 2 Certificate
FURTHER MATHEMATICS

Paper 2 Calculator

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.



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	
TOTAL	

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

Do not write outside the box

1 Expand and simplify $5(2x - 1) + 4(11 - x)$

Give your answer in the form $a(bx + c)$ where a, b and c are integers greater than 1

[3 marks]

Answer _____

2 (a) $5m$ is decreased by 40%

The answer is $(m + 1)$

Work out the value of m.

[2 marks]

Answer _____

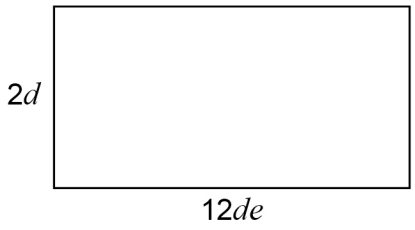
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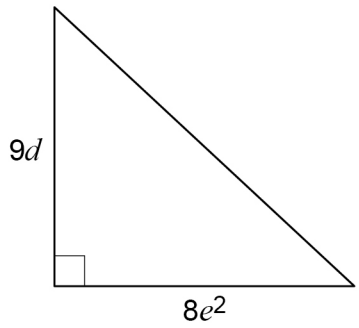
2 (b) Solve $\sqrt[3]{2w-10} = 18$

[2 marks]

$w =$ _____

3 The rectangle and triangle shown have equal areas.





Not drawn accurately

Work out the value of $\frac{d}{e}$

Give your answer in its simplest form.

[3 marks]

Answer _____

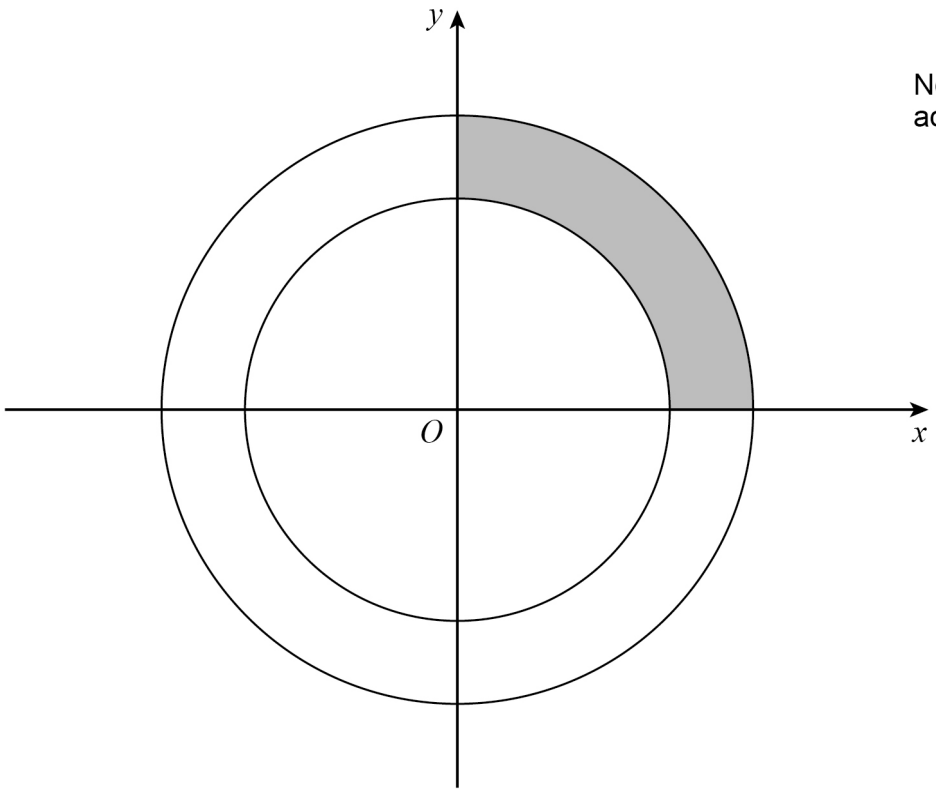
10

Turn over ►

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4 The equations of the two circles shown are

$x^2 + y^2 = 100$ and $x^2 + y^2 = 36$



Not drawn accurately

Work out the shaded area.

Give your answer as an integer multiple of π.

[3 marks]

Answer _____ units^2

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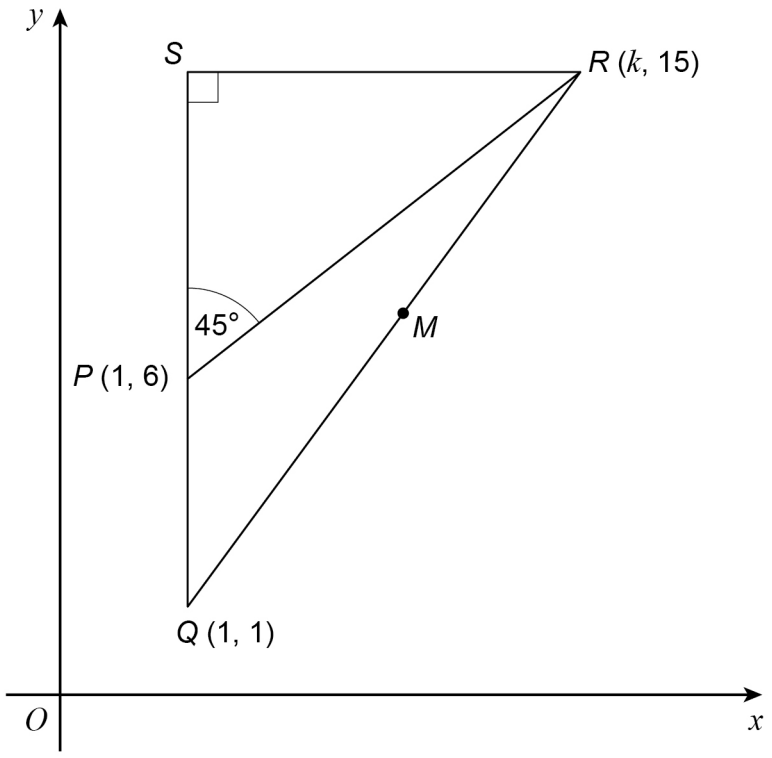
5 *SQR* is a right-angled triangle.

P is a point on *SQ*.

Angle *SPR* = 45°

M is the midpoint of *QR*.

k is a constant.



Not drawn accurately

Work out the coordinates of *M*.

[3 marks]

Answer (_____ , _____)

6

Turn over ►

Do not write outside the box

6 Rearrange $y = \sqrt{\dfrac{x + 2w}{3}}$ to make w the subject.

[3 marks]

Answer _____

7 (a) a is a value greater than 1

Work out the value of m for which $(a^m)^4 = (a^5)^{2m}$

[2 marks]

$m =$ _____

7 (b) $w^3x^2y^5 = w^{13}x^7$

Write y in terms of w and x.

Give your answer in its simplest form.

[2 marks]

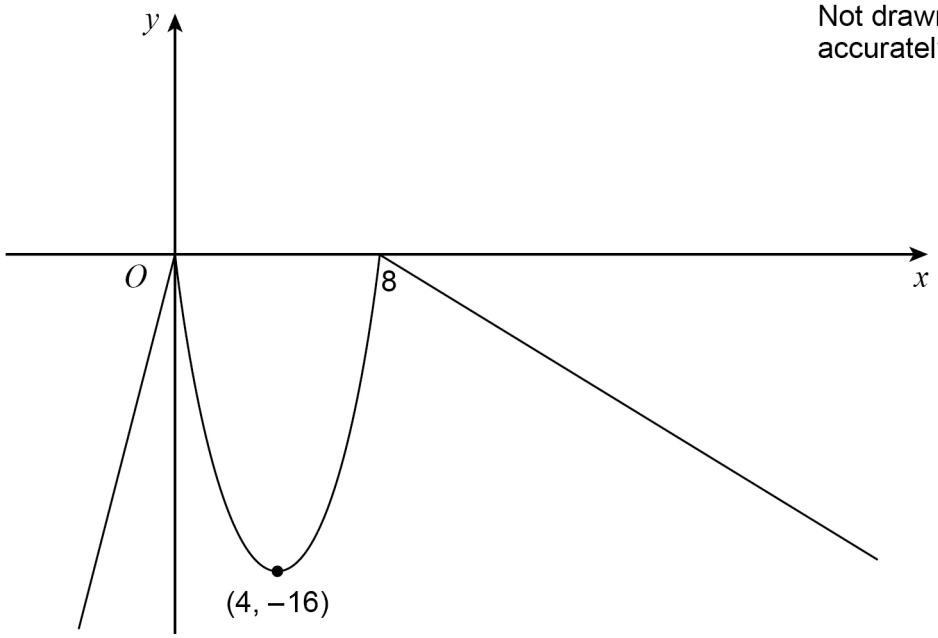
$y =$ _____

Do not write outside the box

8 A function f is given by

$$\begin{aligned} f(x) &= 4x & x &< 0 \\ &= x^2 - 8x & 0 \leqslant x &\leqslant 8 \\ &= 16 - 2x & x &> 8 \end{aligned}$$

A sketch of $y = f(x)$ is shown.



Not drawn accurately

Work out **all** the values of x for which $f(x) = -12$

[4 marks]

Answer _____

11

Do not write outside the box

9 (a) Circle the expression that is equivalent to $\frac{1}{a}+\frac{1}{b}$

[1 mark]

$\frac{2}{a+b}$ $\frac{ab}{b+a}$ $\frac{2}{ab}$ $\frac{b+a}{ab}$

9 (b) Simplify fully $\frac{6c^4-c^3}{36c^2-1}$

[3 marks]

Answer _____

Do not write outside the box

10 The radius of a sphere, in cm, is $\frac{3k}{2}$

The volume of the sphere, in cm^3, is 972π

Volume of a sphere $= \frac{4}{3}\pi r^3$ where r is the radius

Work out the value of k.

[3 marks]

Answer _____

11 Expand and simplify fully $(5x + 3y^2)(4x - y^2)$

[3 marks]

Answer _____

10

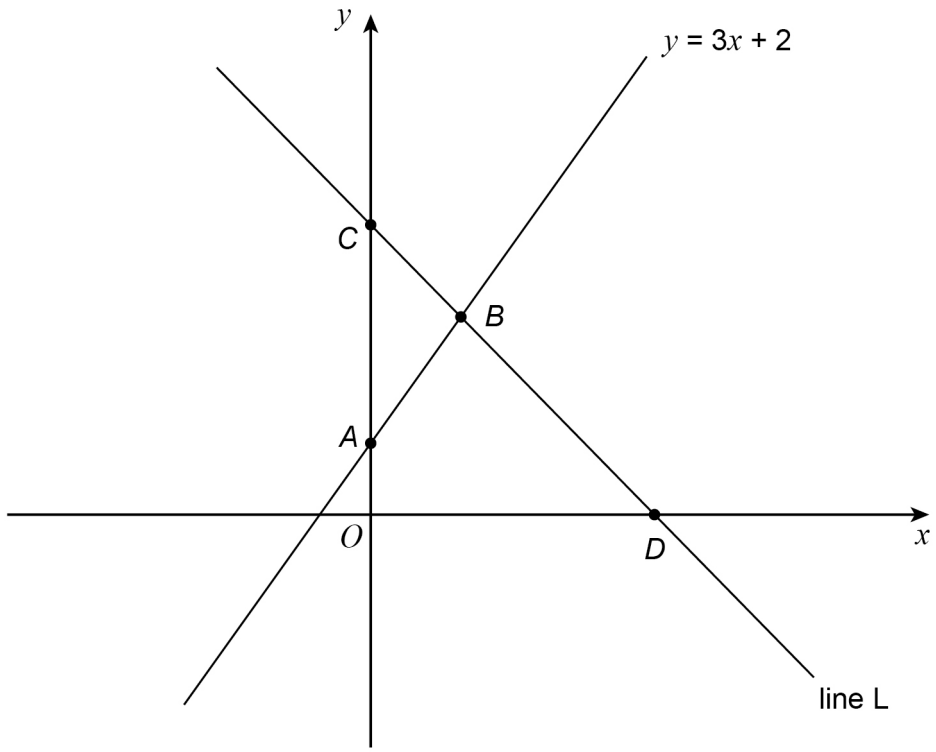
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Do not write outside the box

12 *A* and *B* are points on the line $y = 3x + 2$

B, *C* and *D* (5, 0) are points on the line L.

$OA : AC = 1 : 4$



Not drawn accurately

Work out the x-coordinate of *B*.

[5 marks]

Answer _____

Do not write outside the box

13 *P* is the point on the curve $y = ax^3 + 10x^2$ where $x = 2$

The gradient of the **normal** to the curve at *P* is $-\frac{1}{4}$

Work out the value of a.

[4 marks]

Answer _____

Turn over for the next question

9

Do not write outside the box

14 (a) $\mathbf{A} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

Describe geometrically the single transformation represented by **A**.

[1 mark]

Answer _____

_____

14 (b) $\mathbf{B} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

Describe geometrically the single transformation represented by $\mathbf{B}^2$

[2 marks]

Answer _____

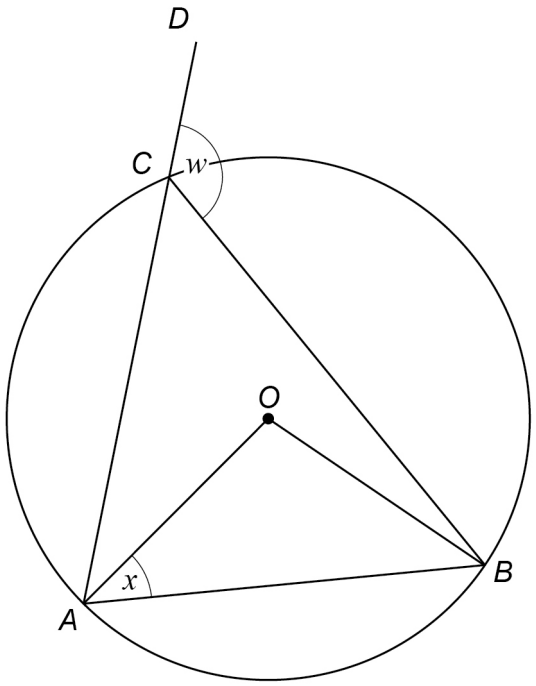
_____

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15 *A*, *B* and *C* are points on a circle, centre *O*.

ACD is a straight line.

Angle *BCD* = w



Not drawn accurately

Prove that $w = x + 90°$

[5 marks]

8

Turn over ►

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16 The coefficient of x^4 in the expansion of $(a + 2x)^6$ is 1500

Work out the **two** possible values of a.

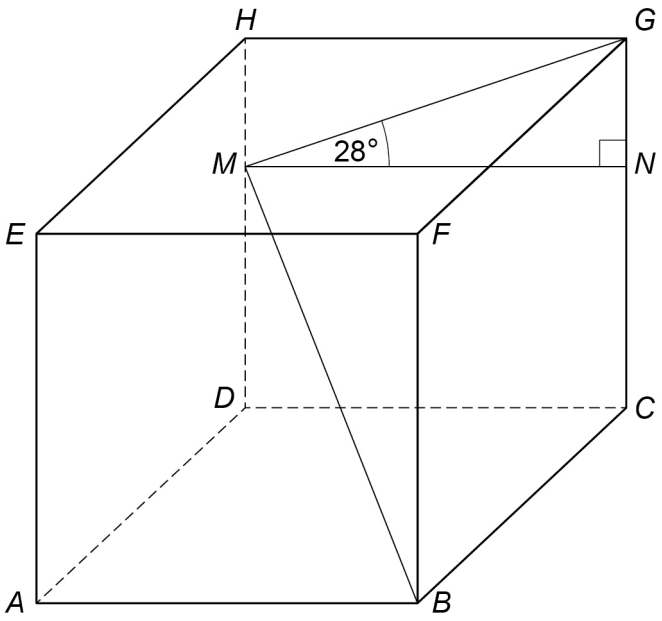
[3 marks]

Answer _____ and _____

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17 *ABCDEFGH* is a cube with side length 32 cm

M and *N* are points on *DH* and *CG* respectively.



Work out the size of the angle that the line *BM* makes with the plane *ABCD*.

[5 marks]

Answer _____ degrees

8

Turn over ►

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18 $y = 12x + \frac{3}{x}$

Show that y has a minimum value when $x = 0.5$

[5 marks]

Do not write outside the box

19 (a) $f(x) = (x + 2)^3$

g is a function such that $gf(x) = (x + 2)^{12}$

Work out an expression for $g(x)$

[1 mark]

Answer _____

19 (b) $h(x) = x^2 + 5$

k is a function such that $hk(x) = 4x^2 + 5$

Work out an expression for $kh(x)$

[2 marks]

Answer _____

Turn over for the next question

8

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20 Show that $\dfrac{2\sin x + \cos x}{\tan x} - \dfrac{1}{\sin x}$ can be written in the form $a\cos x + b\sin x$

where a and b are integers.

[4 marks]

Do not write outside the box

21 $3x^2 + 2bx + 8a$ can be written in the form $3(x + a)^2 + b + 2$

Work out the **two** possible pairs of values of a and b.

[6 marks]

$a =$ _____ $b =$ _____

$a =$ _____ $b =$ _____

END OF QUESTIONS

10

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