AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

Level 2 Certificate
FURTHER MATHEMATICS

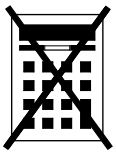
Paper 1 Non-Calculator

Thursday 15 June 2017 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.



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.
- 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.

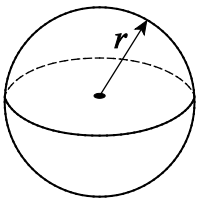
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

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

Formulae Sheet

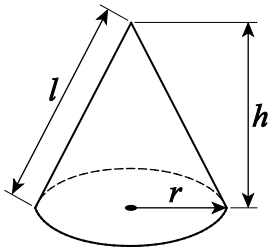
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



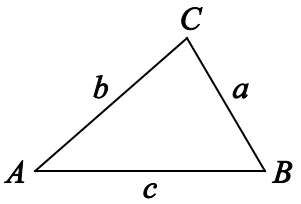
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



In any triangle ABC

Area of triangle $= \frac{1}{2}ab \sin C$



Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

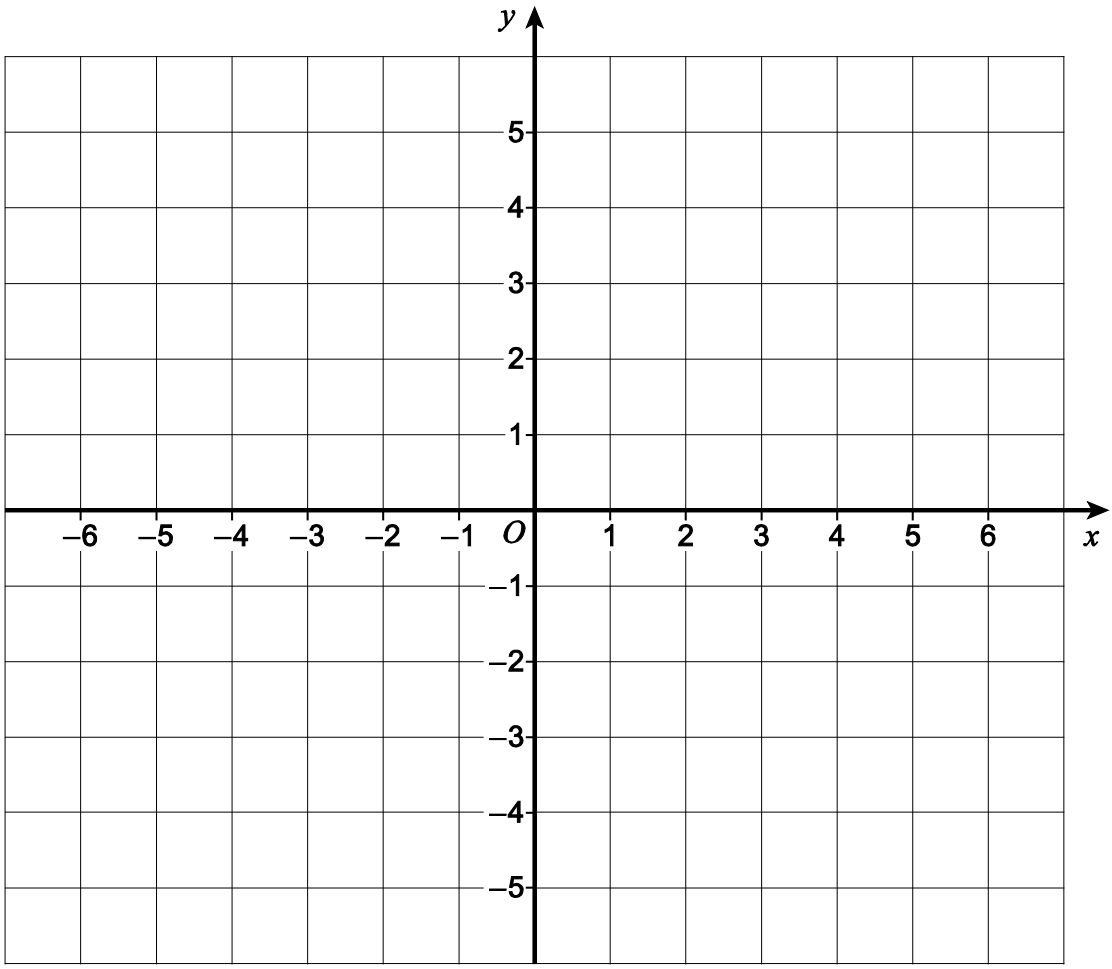
Trigonometric Identities

$\tan \theta \equiv \frac{\sin \theta}{\cos \theta}$ $\sin^2 \theta + \cos^2 \theta \equiv 1$

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

1 On the grid below, draw a straight line through (2, 1) with gradient $\frac{3}{4}$

[2 marks]



2

2 A curve has equation $y = ax^2 + 3x$ where a is a constant.

When $x = -1$, the gradient of the curve is -5

Work out the value of a.

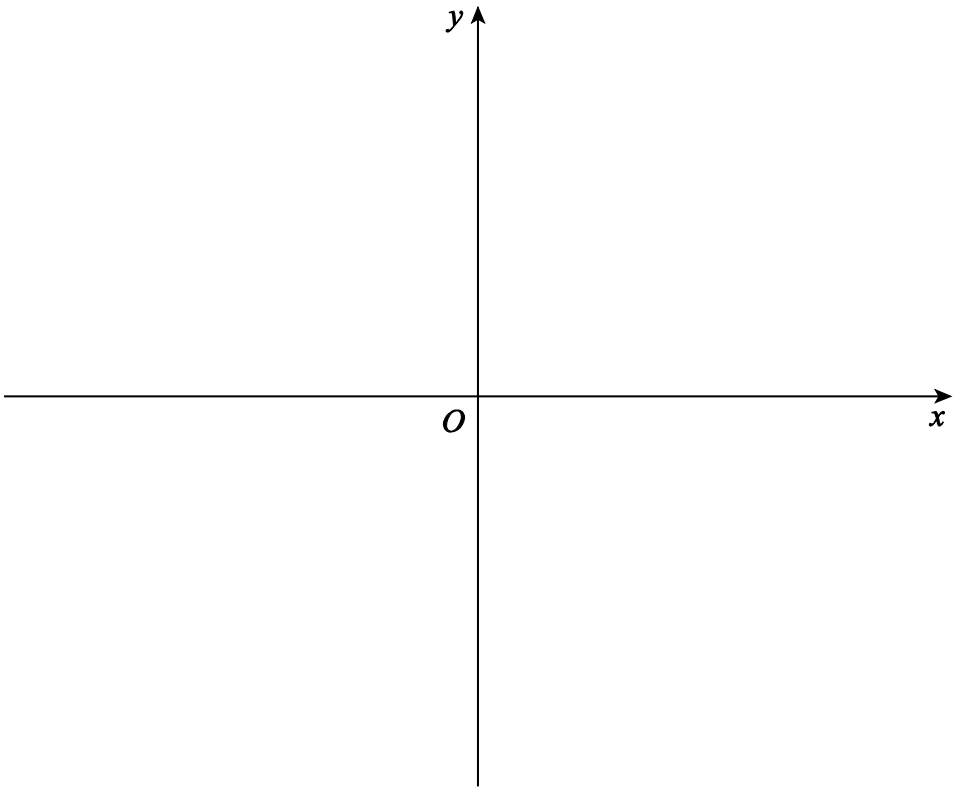
[3 marks]

$a =$ _____

3 (a) On the axes below, sketch the graph of $y = x^2 + 7x - 18$

Label all points of intersection with the axes.
You do **not** need to work out the coordinates of any stationary points.

[3 marks]



3 (b) Work out the equation of the line of symmetry of the graph of $y = x^2 + 7x - 18$

[1 mark]

Answer _____

7

4 A straight line passes through the points (–4, 7), (6, –5) and (8, t)

Use an algebraic method to work out the value of t.
You **must** show your working.

[3 marks]

$t =$ _____

5 $(x + 4)(x^2 - kx - 5)$ is expanded and simplified.

The coefficient of the x^2 term is twice the coefficient of the x term.

Work out the value of k.

[3 marks]

$k =$ _____

Turn over for the next question

6

6 Factorise fully $(x + 6)^4 + (x + 6)^3(3x + 4)$

Do **not** attempt to expand the brackets.

[3 marks]

Answer _____

7 The function f is given by $f(x) = \sqrt{2x - 5}$

7 (a) Which of these inequalities is a possible domain for $f(x)$?
Circle the inequality.

[1 mark]

$x \geqslant 0$ $x \geqslant \frac{2}{5}$ $x \geqslant 2$ $x \geqslant \frac{5}{2}$

7 (b) Work out x when $f(x) = 1.2$

[2 marks]

$x =$ _____

7 (c) Work out the value of $f(2\frac{5}{8})$

Give your answer as a fraction in its simplest form.

[3 marks]

Answer _____

9

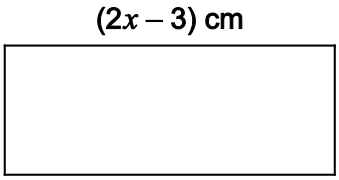
8 The first four terms of a quadratic sequence are 10 33 64 103 ...

Work out an expression for the nth term.

[4 marks]

Answer _____

9 Here is a rectangle.



Not drawn accurately

9 (a) Show that the area of the rectangle is $2x^2 - x - 3$ cm^2

[1 mark]

9 (b) The area of the rectangle is greater than 7 cm^2

Work out the range of possible values of x.
Give your answer as an inequality.

[4 marks]

Answer _____

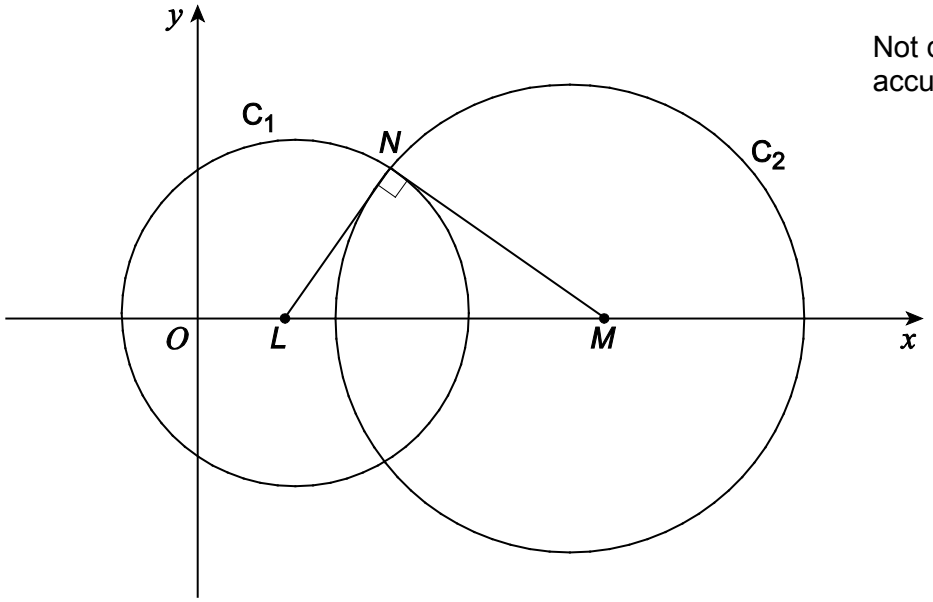
9

10 Circle C_1 has centre *L* and equation $(x - 3)^2 + y^2 = 36$

Circle C_2 has centre *M* and equation $(x - h)^2 + y^2 = 64$ where h is a constant.

The circles intersect at *N*.

LN is perpendicular to *MN*.



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Work out the value of h.

[4 marks]

$h =$ _____

11 Simplify fully $\dfrac{x}{x-3} + \dfrac{6}{(x-3)(x-5)}$

[4 marks]

Answer _____

8

Turn over ►

12 The transformation matrix **M** represents a 90° clockwise rotation about the origin.

12 (a) Write down the matrix **M**.

[1 mark]

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

12 (b) Describe fully the **single** transformation represented by $\mathbf{M}^2$.

[2 marks]

12 (c) Write down the matrix for the **single** transformation represented by $\mathbf{M}^2$.

[1 mark]

$\mathbf{M}^2 = \begin{pmatrix} & \\ & \end{pmatrix}$

13 Solve $x^{-\frac{1}{4}} = 0.2$

[3 marks]

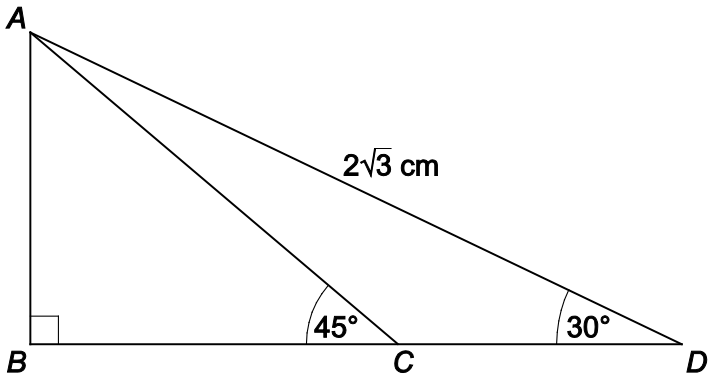
$x =$ _____

Turn over for the next question

7

14 In the diagram, *BCD* is a straight line.

$AD = 2\sqrt{3}$ cm



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Work out the exact length of *CD*.

Give your answer in the form $a + b\sqrt{3}$ where a and b are integers.

[4 marks]

CD = _____

15 The continuous curve $y = f(x)$ has exactly three stationary points.

The three stationary points are

a minimum point *P* at (a, b) where $a < 0$ and $b < 0$

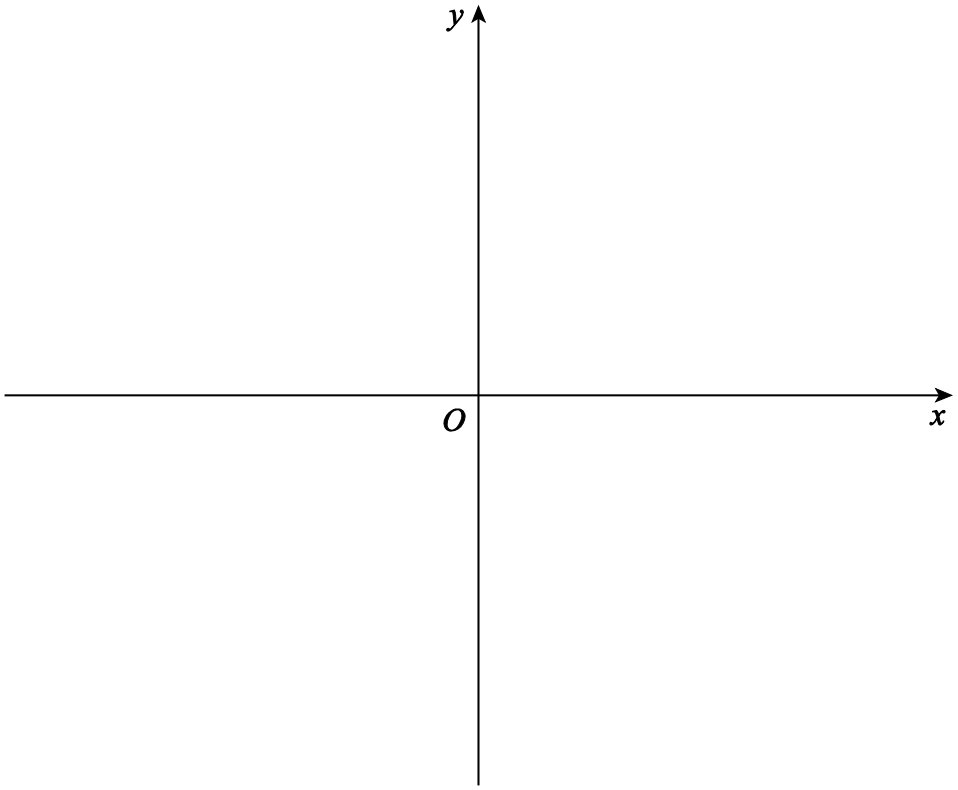
a point of inflection *Q* at (0, 3)

a maximum point *R* at (c, d) where $c > 0$ and $d > 3$

The curve cuts the x-axis at three distinct points.

On the axes below, sketch the curve.
Label the points *P*, *Q* and *R* on your sketch.

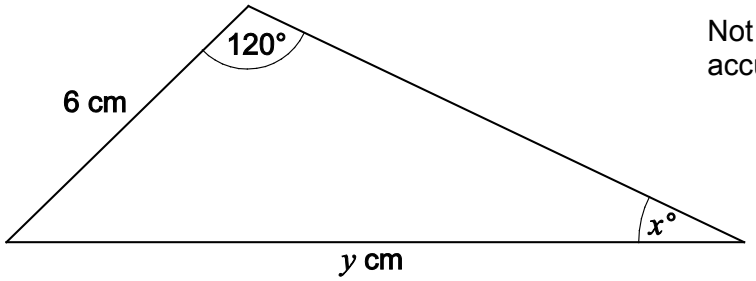
[4 marks]



Turn over for the next question

8

16 Here is a triangle.



Not drawn accurately

$\sin x° = \frac{1}{\sqrt{12}}$

Work out the value of y.

[4 marks]

$y =$ _____

17 (a) Factorise $2x^2 + 7x + 5$

[2 marks]

Answer _____

17 (b) Hence, or otherwise, work out the value of θ between 0° and 360° for which

$$2\sin^2\theta + 7\sin\theta + 5 = 0$$

[3 marks]

$\theta =$ _____

9

18 Simplify fully $\dfrac{24-\sqrt{300}}{4\sqrt{3}-5}$

Give your answer in the form $a\sqrt{b}$ where a and b are integers.

[5 marks]

Answer _____

END OF QUESTIONS

5