

Please write clearly in block capitals.

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Level 2 Certificate FURTHER MATHEMATICS

Paper 1 Non-Calculator

Thursday 15 June 2017

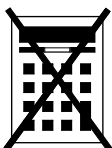
Morning

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.

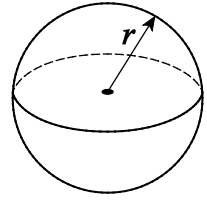
For Examiner's Use	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20	
TOTAL	



Formulae Sheet

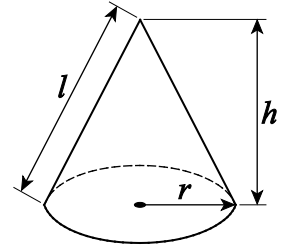
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$



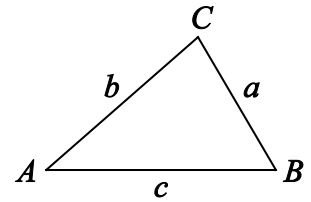
In any triangle ABC

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

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



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

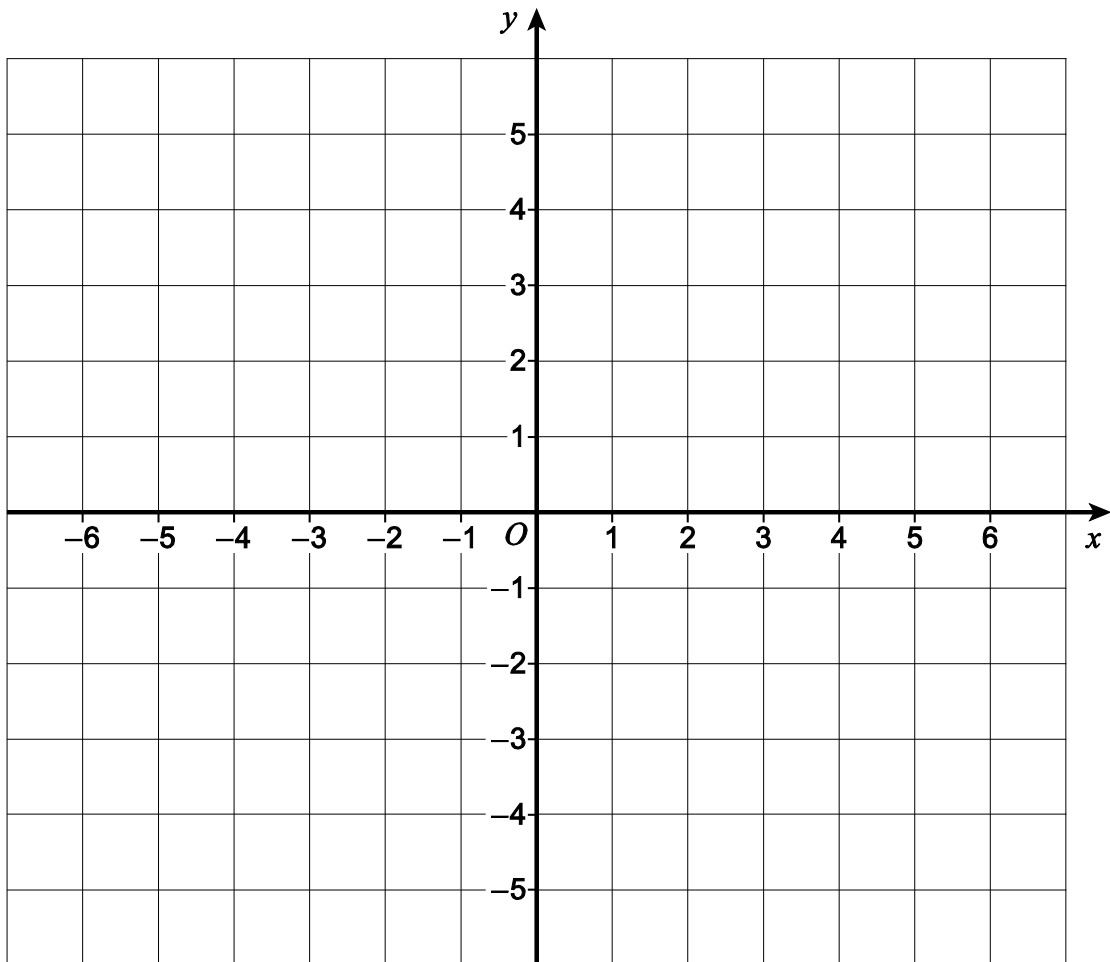
$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$



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]



Turn over ►



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]

$a =$ _____

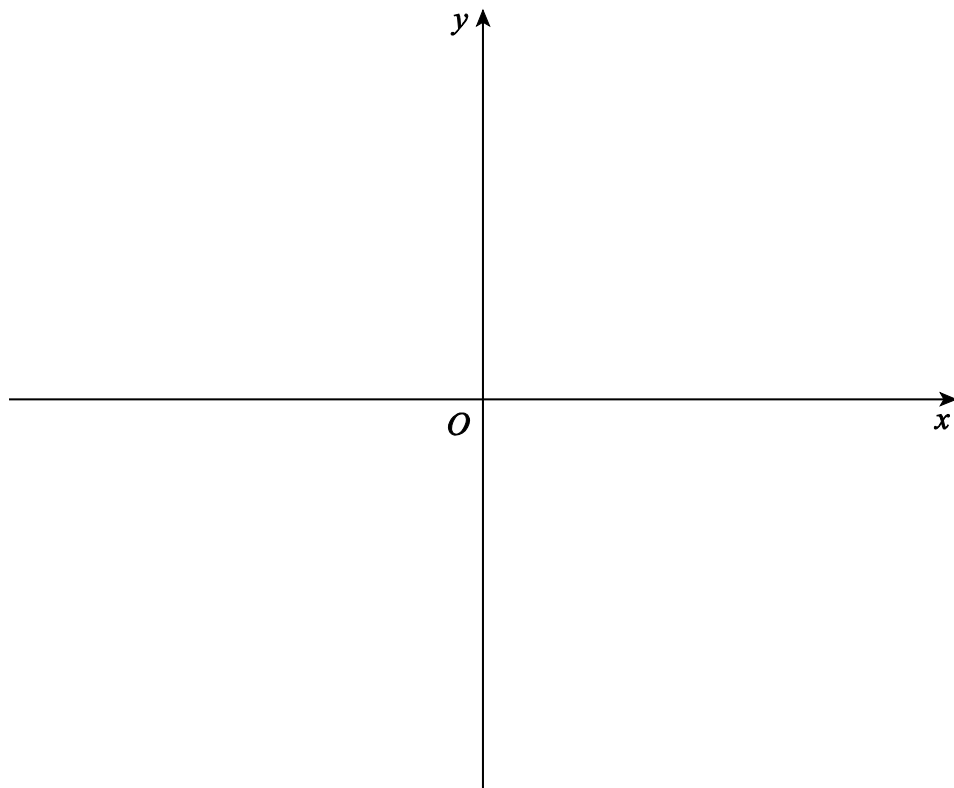


3 (a) On the axes below, sketch the graph of $y = x^2 + 7x - 18$

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

Turn over ►



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 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]

$x \geq 0$

$x \geq \frac{2}{5}$

$x \geq 2$

$x \geq \frac{5}{2}$

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

[2 marks]

$x = \underline{\hspace{10cm}}$

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

Give your answer as a fraction in its simplest form.

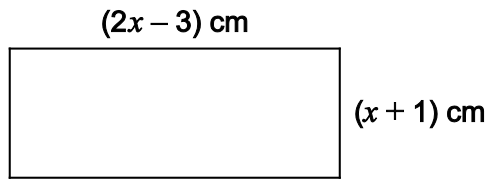
[3 marks]

Answer $\underline{\hspace{10cm}}$

Turn over ►



9 Here is a rectangle.



Not drawn
accurately

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

[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

Turn over ►



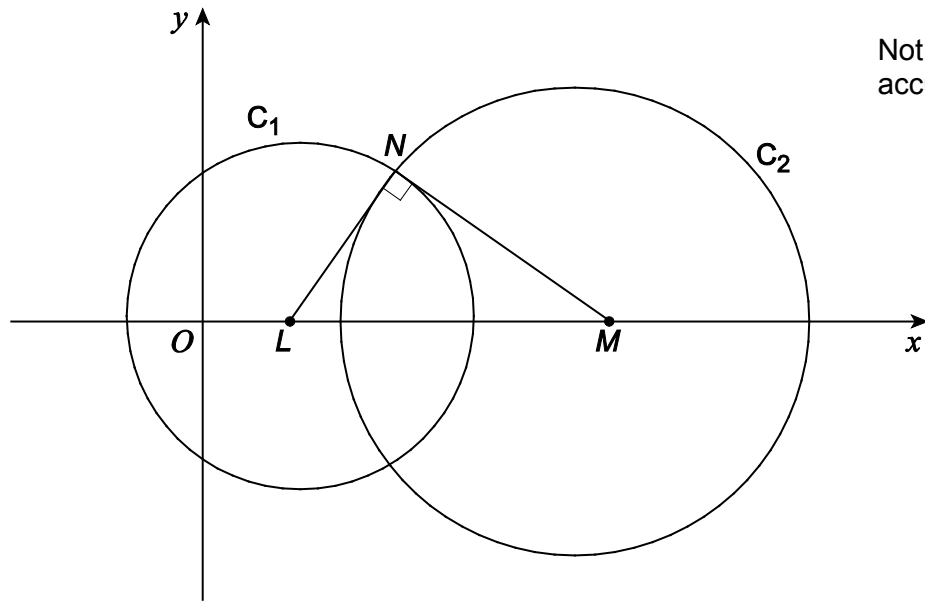
10

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 .



Work out the value of h .

[4 marks]

$h =$ _____



11

Simplify fully

$$\frac{x}{x-3} + \frac{6}{(x-3)(x-5)}$$

[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]

$x =$ _____

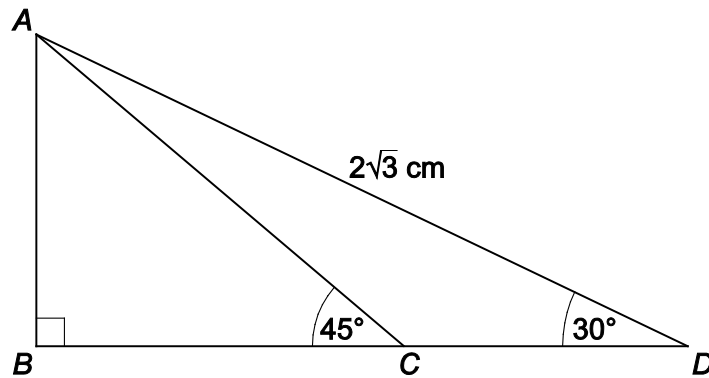
Turn over for the next question

7

Turn over ►

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

$$AD = 2\sqrt{3} \text{ cm}$$



Not drawn
accurately

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]

$$CD = \underline{\hspace{10em}}$$



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 $(0, 3)$

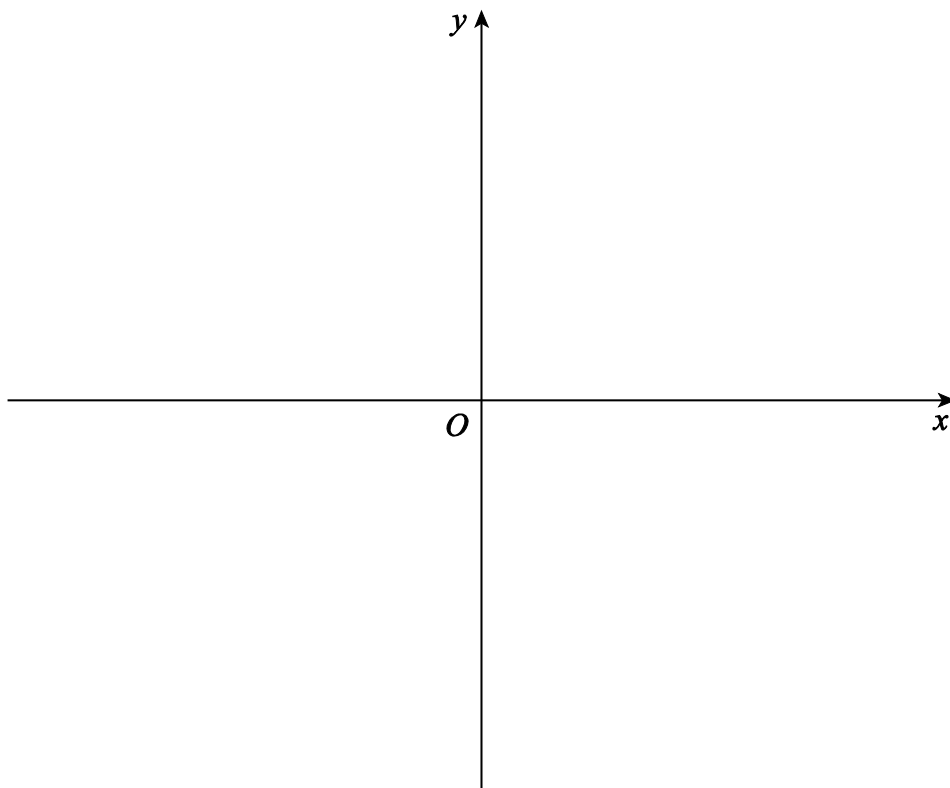
a maximum point R at (c, d) where $c > 0$ and $d > 3$

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]

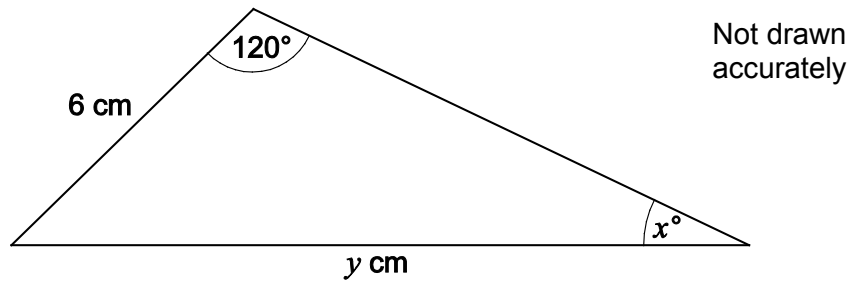


Turn over for the next question

Turn over ►



16 Here is a triangle.



$$\sin x^\circ = \frac{1}{\sqrt{12}}$$

Work out the value of y .

[4 marks]

$$y = \underline{\hspace{10em}}$$



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]

$\theta =$ _____

Turn over ►



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

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

[5 marks]

Answer _____

END OF QUESTIONS

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