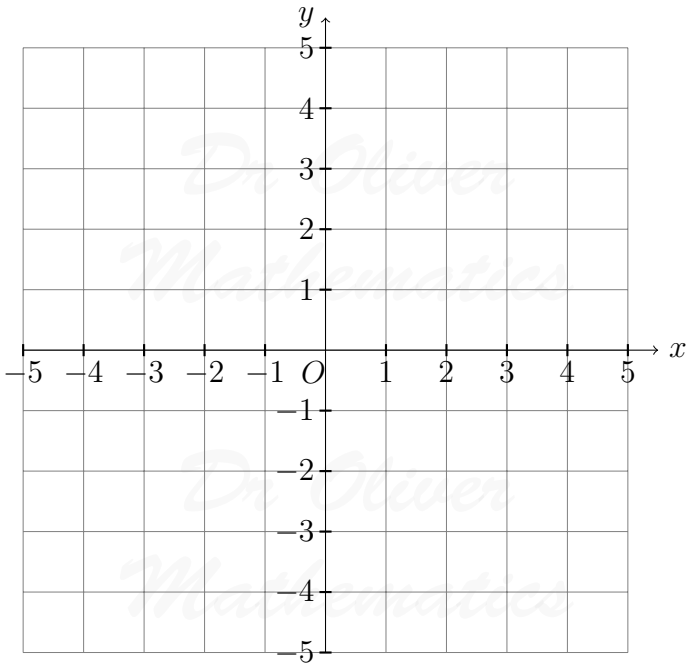
Dr Oliver Mathematics
AQA Further Maths Level 2
June 2017 Paper 1
1 hour 30 minutes

The total number of marks available is 70.
You must write down all the stages in your working.
You are **not** permitted to use a scientific or graphical calculator in this paper.

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



2. A curve has equation (3)

$$y = ax^2 + 3x,$$

where a is a constant.
When $x = -1$, the gradient of the curve is -5.

Work out the value of a.

3. (a) On the axes below, sketch the graph of (3)

$$y = x^2 + 7x - 18.$$

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

(b) Work out the equation of the line of symmetry of the graph of (1)

$$y = x^2 + 7x - 18.$$

4. A straight line passes through the points $(-4, 7)$, $(6, -5)$, and $(8, t)$. (3)

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

5. (3)

$$(x + 4)(x^2 - kx - 5)$$

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.

6. Factorise fully (3)

$$(x + 6)^4 + (x + 6)^3(3x + 4).$$

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

7. The function f is given by

$$\mathrm{f}(x) = \sqrt{2x - 5}.$$

(a) Which of these inequalities is a possible domain for $\mathrm{f}(x)$? (1)
Circle the inequality.

$$x \geqslant 0 \qquad x \geqslant \tfrac{2}{5} \qquad x \geqslant 2 \qquad x \geqslant \tfrac{5}{2}$$

(b) Work out x when $\mathrm{f}(x) = 1.2$. (2)

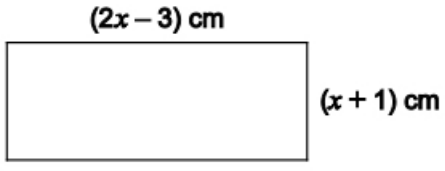
(c) Work out the value of $\mathrm{f}(2\frac{5}{8})$. (3)
Give your answer as a fraction in its simplest form.

8. The first four terms of a quadratic sequence are (4)

$$10 \qquad 33 \qquad 64 \qquad 103 \qquad \ldots$$

Work out an expression for the nth term.

9. Here is a rectangle.



Not drawn accurately

(a) Show that the area of the rectangle is (1)

$$(2x^2 - x - 3) \text{ cm}^2.$$

The area of the rectangle is greater than 7 cm^2.

(b) Work out the range of possible values of x. (4)
Give your answer as an inequality.

10. Circle C_1 has centre L and equation (4)

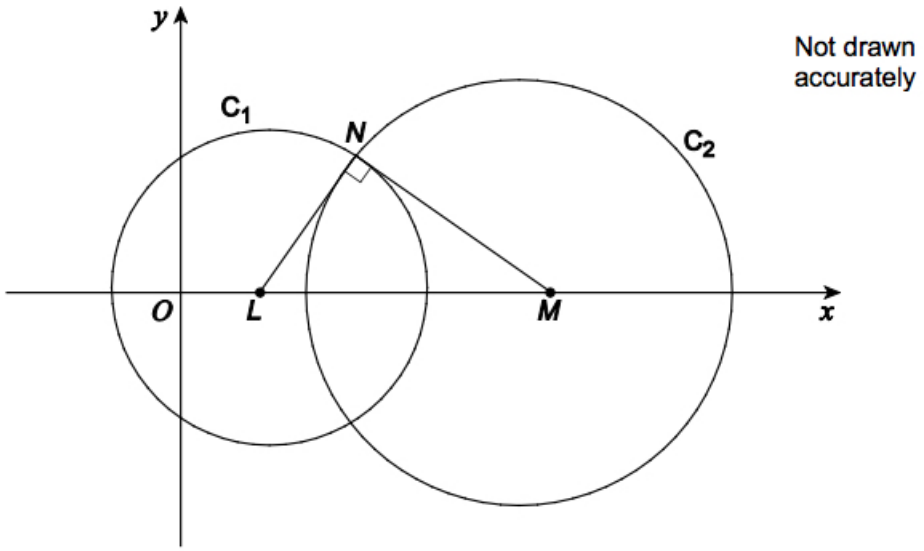
$$(x - 3)^2 + y^2 = 36.$$

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.

11. Simplify fully (4)

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

12. The transformation matrix $\mathbf{M}$ represents a 90° clockwise rotation about the origin.

    (a) Write down the matrix $\mathbf{M}$. (1)

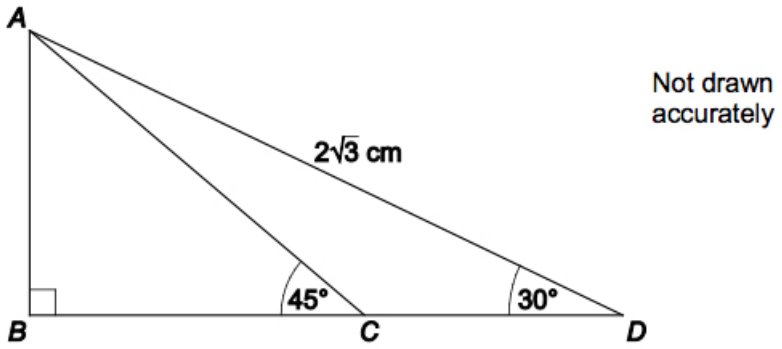
    (b) Describe fully the **single** transformation represented by $\mathbf{M}^2$. (2)

    (c) Write down the matrix for the **single** transformation represented by $\mathbf{M}^2$. (1)

13. Solve (3)

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

14. In the diagram, BCD is a straight line. (4)
    $AD = 2\sqrt{3}$ cm.

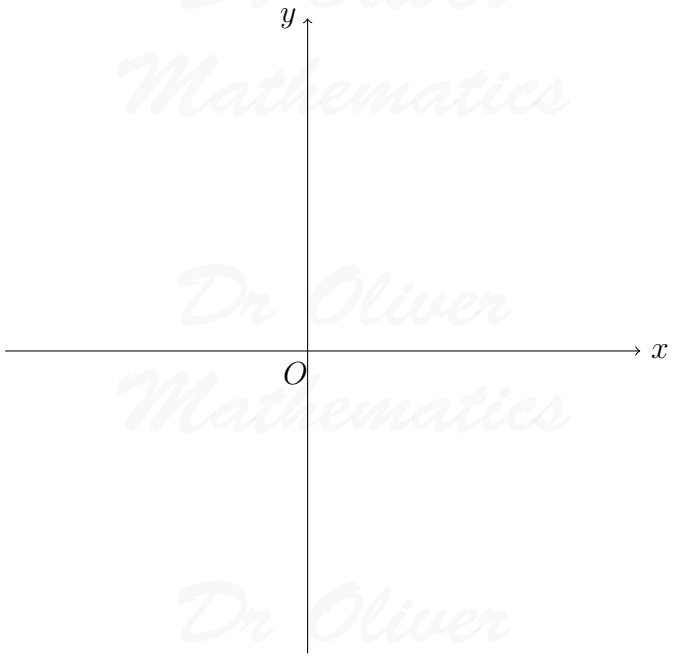


    Work out the exact length of CD.
    Give your answer in the form $a + b\sqrt{3}$, where a and b are integers.

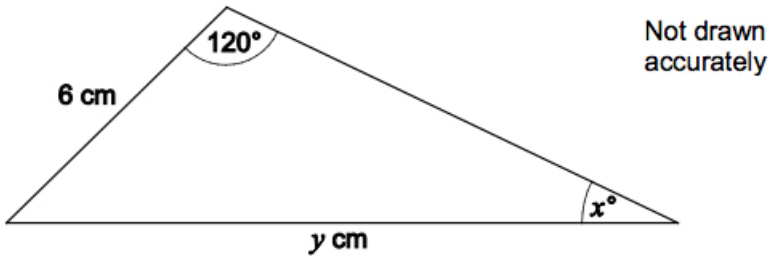
15. The continuous curve $y = \mathrm{f}(x)$ has exactly three stationary points. (4)
    The three stationary points are

    - a minimum point P at (a, b) where $a < 0$ and $b < 0$,
    - a point of inflection Q at $(0, 3)$, and
    - 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.



16. Here is a triangle. (4)



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

Work out the value of y.

17. (a) Factorise (2)

$$2x^2 + 7x + 5.$$

(b) Hence, or otherwise, work out the value of θ between 0° and 360° for which (3)

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

18. Simplify fully (5)

$$\frac{24 - \sqrt{300}}{4\sqrt{3} - 5}.$$

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