Dr Oliver Mathematics
AQA Further Maths Level 2
June 2019 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. A straight line passes through the points $(-2, 11)$ and $(1, 2)$. (3)

   Work out the equation of the line.

   Give your answer in the form $y = mx + c$.

2. Write (2)
$$\frac{5}{6a} + \frac{a}{4}$$
   as a single fraction.

   Give your answer in its simplest form.

3. Work out the **smallest** integer value of x that satisfies the inequality (2)
$$8 - 5x < 26.$$

4. (4)
$$p(x - 1) + 2(3x + k) \equiv 4(x + 2),$$
   where p and k are integers.

   Work out the values of p and k.

5. Solve (3)
$$\sqrt[3]{(2\sqrt{x} - 10)} = 2.$$

6. The transformation matrix (5)
$$\begin{pmatrix} 2a & b \\ -b & -a \end{pmatrix}$$
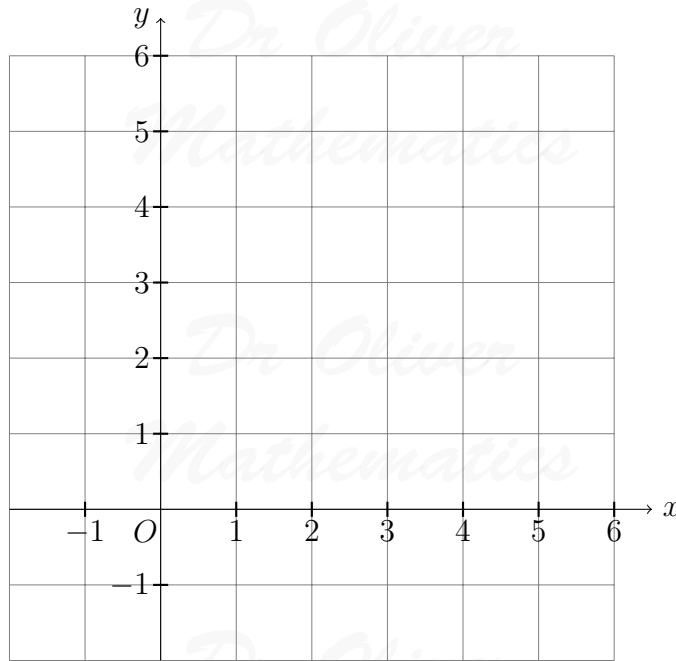   maps the point $(3, 4)$ onto the point $(8, -7)$.

   Work out the values of a and b.

7. A function is given by

$$f(x) = \begin{cases} -2x & \text{for } -1 \leqslant x < 0, \\ x(4-x) & \text{for } 0 \leqslant x < 3, \\ 2x-3 & \text{for } 3 \leqslant x \leqslant 4, \end{cases}$$
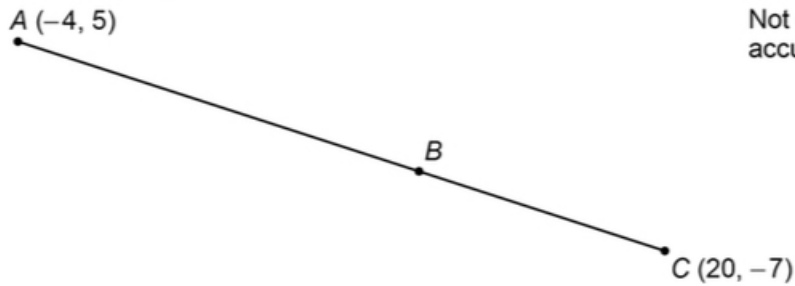
Draw the graph of $y = f(x)$ on the grid.

8. ABC is a straight line.

- A is the point $(-4, 5)$.
- C is the point $(20, -7)$.
- $AB : BC = 5 : 3$.

Work out the coordinates of B.

2

9.
$$y = 2x(x^2 - 5x)$$
Circle the expression for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$.

$$2(2x - 5) \qquad 6x^2 - 20 \qquad 3x^2 - 10x \qquad 6x^2 - 20x$$

(1)

10. Factorise fully
$$6x^2 + 26xy - 20y^2.$$

(3)

11. A cone has base radius r cm, perpendicular height h cm, and slant height l cm.

(5)

- The curved surface area is 60π cm^2.
- $l = 3r$.

Work out the value of h.

Give your answer in the form $a\sqrt{10}$, where a is an integer greater than 1.

You **must** show your working.

12. A curve has the equation
$$y = x^3 + ax^2 - 7,$$
where a is a constant.

(5)

The gradient of the curve when $x = 4$ is twice the gradient of the curve when $x = -1$.

Work out the value of a.

You **must** show your working.
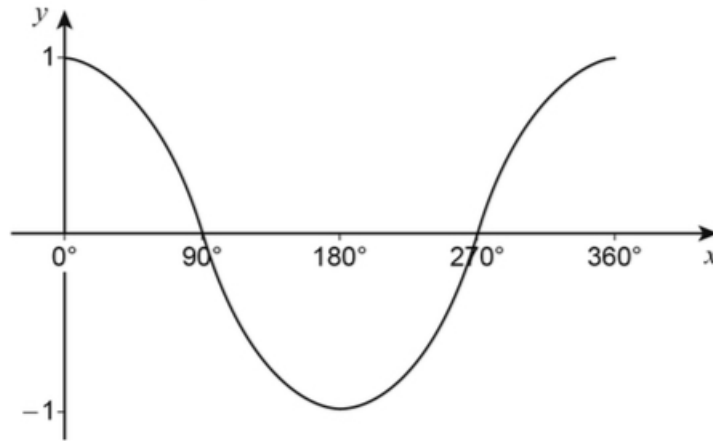
13. Prove that
$$(3x + 5)^2 - 5x(x + 10) \geqslant 0$$
for all values of x.

(4)

14. Here are two transformations.

(4)

- A Rotation $90°$ clockwise about the origin.
- B Reflection in the line $y = x$.

Use matrix multiplication to work out the single matrix which represents the combined transformation A followed by B.

15. Here is a sketch graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$. (2)

You are given that
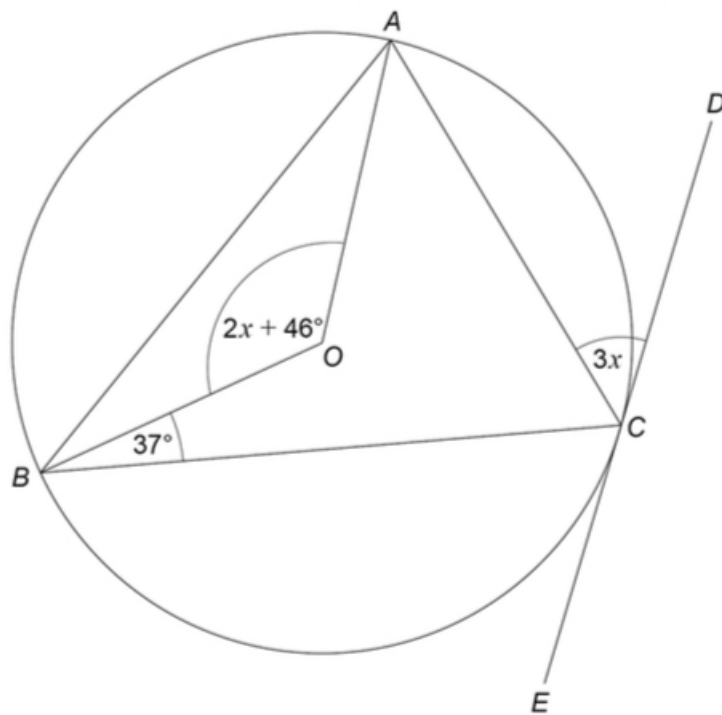$$\cos 36° = 0.809\,0.$$
Solve
$$\cos x = -0.809\,0$$
for $0° \leqslant x \leqslant 360°$.

16. Rationalise the denominator and simplify fully (4)
$$\frac{21 - 11\sqrt{5}}{3 - \sqrt{5}}.$$

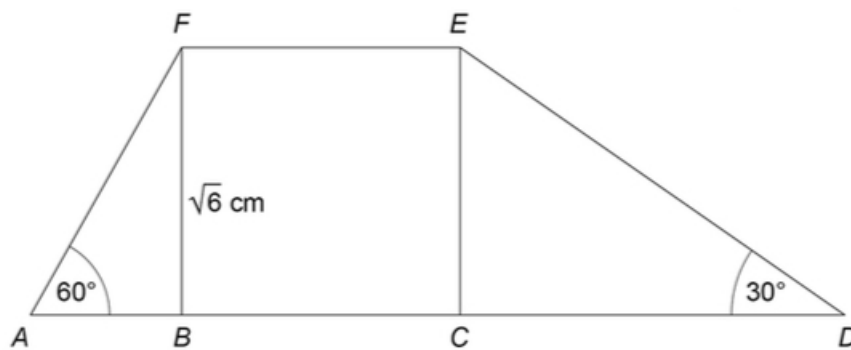17. A, B, and C are points on the circumference of a circle, centre O. (4)

- ECD is a tangent to the circle at C.
- Angle $AOB = (2x + 46)°$.
- Angle $OBC = 37°$.
- Angle $ACD = (3x)°$.

4

Not drawn accurately

Work out the value of x.

18.
- $ADEF$ is a trapezium.
- $ABCD$ is a straight line.
- $BCEF$ is a square of side $\sqrt{6}$ cm.

Not drawn accurately

(a) Show that $AB = \sqrt{2}$ cm.   (1)

(b) Show that $DE = 2\sqrt{6}$ cm.   (1)

(c) Work out the perimeter of the trapezium $ADEF$.   (3)

Give your answer in the form $t\sqrt{2} + w\sqrt{6}$, where t and w are integers.

You **must** show your working.

19.   (6)

$$f(x) = \frac{x-3}{2x}.$$

Solve

$$f(x+1) - f(2x) = 0.5.$$

You **must** show your working.