

**Dr Oliver Mathematics**  
**AQA Further Maths Level 2**  
**June 2016 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. (3)  
$$y = x^2(x - 10).$$

Work out  $\frac{dy}{dx}$ .

2. (3)  
$$4 \begin{pmatrix} 1 - 2a \\ a \end{pmatrix} = \begin{pmatrix} b \\ 12 \end{pmatrix}.$$

Work out the values of  $a$  and  $b$ .

3. The  $n$ th term of a sequence is

$$\frac{3n}{5n + 12}.$$

(a) Work out the position of the term that has a value of  $\frac{1}{2}$ . (2)

(b) Write down the limiting value of (1)

$$\frac{3n}{5n + 12}$$

as  $n \rightarrow \infty$ .

4. The equation of a circle is

$$(x + 5)^2 + (y - 8)^2 = 10.$$

(a) What are the coordinates of the centre of the circle? (1)

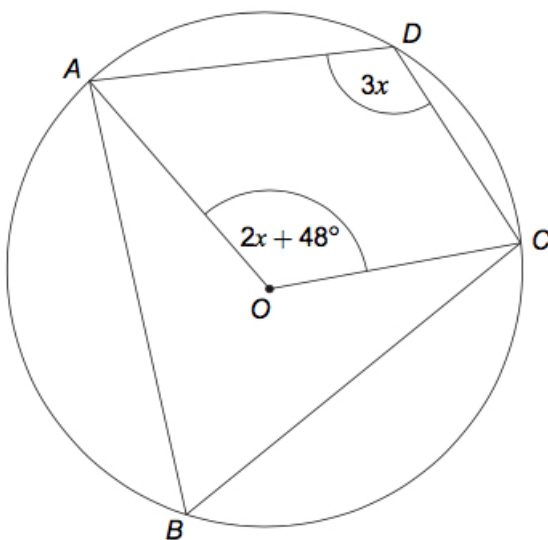
Circle your answer.

$$(-5, -8) \quad (-5, 8) \quad (5, 8) \quad (5, -8)$$

(b) Write down the radius of the circle. (1)

5.  $A$ ,  $B$ ,  $C$ , and  $D$  are points on a circle, centre  $O$ . (3)

Not drawn accurately



Work out the value of  $x$ .

6. (4)

$$mx + 4 - 2(x + p) \equiv 6(x + 1),$$

where  $m$  and  $p$  are integers.

Work out the values of  $m$  and  $p$ .

7. Work out the integer values of  $x$  for which (3)

$$x^2 - 20x + 96 < 0.$$

8. Solve (3)

$$(3 - \sqrt{x})^{\frac{1}{3}} = -2.$$

9. Expand and simplify (3)

$$(x - 5)^3.$$

10. (4)

$$\sqrt[4]{x} = 2 \text{ and } y^{-2} = 25.$$

$x > 0$  and  $y < 0$ .

Work out the value of

$$\frac{x}{y}.$$

11.  $A(1\frac{1}{5}, 3\frac{4}{5})$ ,  $B(2, 1\frac{4}{5})$ , and  $C(5, 3)$  are points on a coordinate grid. (3)

Show that the line segments  $AB$  and  $BC$  are perpendicular.

12. You are given that

$$x^2 + 6x + 2 \equiv (x + h)^2 + k.$$

- (a) Work out the values of  $h$  and  $k$ . (2)

- (b) Write down the coordinates of the minimum point on the curve (1)

$$y = x^2 + 6x + 2.$$

- (c) Solve the equation (1)

$$x^2 + 6x + 2 = 0.$$

Give your answers in the form  $a \pm \sqrt{b}$ .

13. Solve (3)

$$\sqrt{125} + \sqrt{20} = \sqrt{80} + \sqrt{x}.$$

14.  $(x - 3)$  is a factor of

$$x^3 - 8x^2 + ax + 42,$$

where  $a$  is an integer.

- (a) Show that the value of  $a$  is 1. (2)

- (b) Hence, factorise fully (3)

$$x^3 - 8x^2 + x + 42.$$

15. Rationalise the denominator and simplify fully (3)

$$\frac{6}{\sqrt{7} + 2}.$$

16. Angle  $\theta$  is obtuse and (4)

$$\sin \theta = \frac{\sqrt{11}}{6}.$$

Work out the value of  $\cos \theta$ .

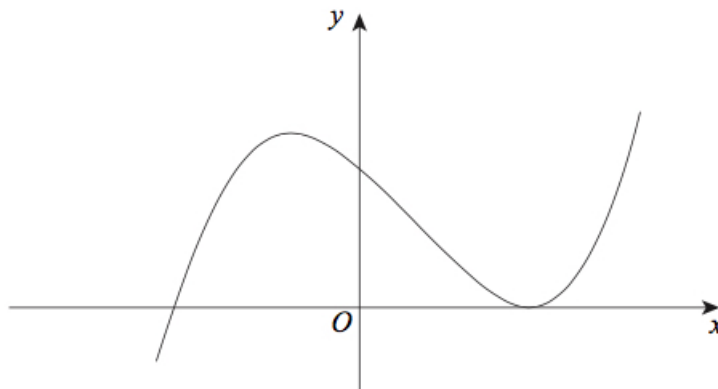
17. The diagram shows a sketch of the cubic curve (5)

$$y = \frac{1}{3}x^3 - x^2 - 3x + k,$$

where  $k$  is a constant.

The  $x$ -axis is a tangent to the curve at its minimum point.

Not drawn accurately



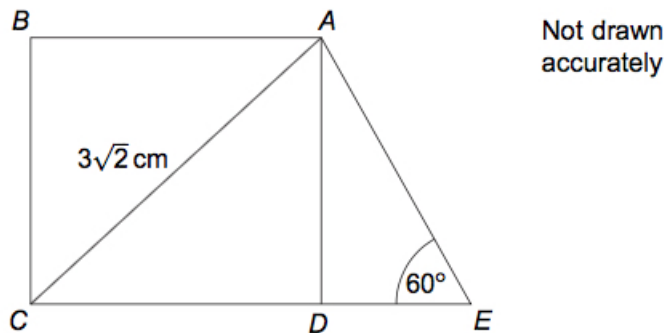
Work out the value of  $k$ .

18. Factorise fully

$$x^4 - 81.$$

(2)

19.  $ABCD$  is a square.  
 $CDE$  is a straight line.



$AC$  is  $3\sqrt{2}$  cm and angle  $DEA = 60^\circ$ .

- (a) Show that the side of the square is 3 cm.

(2)

- (b) Show that the perimeter of trapezium  $ABCE$  is

(4)

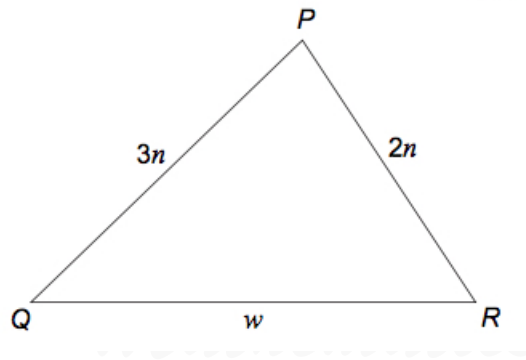
$$3(3 + \sqrt{3}) \text{ cm.}$$

20. In triangle  $PQR$ ,  $\cos P = \frac{1}{3}$ .

(4)

*Dr. Oliver*

Not drawn  
accurately



Show that triangle  $PQR$  is isosceles.

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