

**Dr Oliver Mathematics**  
**AQA Further Maths Level 2**  
**June 2014 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 has gradient  $-2$  and passes through the point  $(-3, 10)$ . (2)  
Work out the equation of the line.  
Give your answer in the form  $y = mx + c$ .

2. (2)

$$y = 4x^3 - 7x.$$

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

3. A transformation is given by the matrix  $\mathbf{M}$ , where (3)

$$\mathbf{M} = \begin{pmatrix} 1 & a \\ 0 & 2 \end{pmatrix}.$$

The image of the point  $(b, 5)$  under  $\mathbf{M}$  is  $(5, b)$ .

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

4. Solve (3)

$$20 + w < 3(w + 2).$$

- 5.

$$f(x) = 10 - x^2, \text{ for all values of } x.$$

$$g(x) = (x + 2a)(x + 3) \text{ for all values of } x.$$

- (a) Circle the correct value of  $f(-4)$ . (1)

26      -6      36      16      196

- (b) Write down the range of  $f(x)$ . (1)

$$g(0) = 24.$$

- (c) Show that  $a = 4$ . (1)

(d) Hence solve

$$f(x) = g(x).$$

(4)

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

$$\frac{2n^2 + 7}{3n^2 - 2}.$$

(a) Work out the 7th term.

Give your answer as a fraction in its simplest form.

(2)

(b) Show that the limiting value of

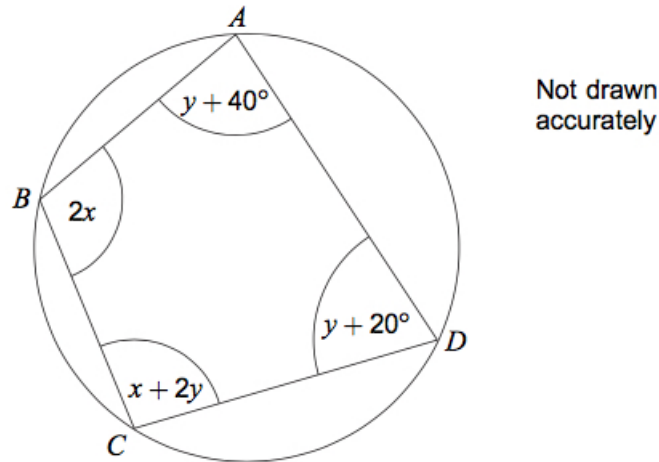
$$\frac{2n^2 + 7}{3n^2 - 2}$$

(2)

as  $n \rightarrow \infty$  is  $\frac{2}{3}$ .

7.  $ABCD$  is a cyclic quadrilateral.

(5)



Work out the values of  $x$  and  $y$ .

8. (a) Factorise fully

$$3x^2 - 12.$$

(2)

(b) Factorise

$$5x^2 + 4xy - 12y^2.$$

(3)

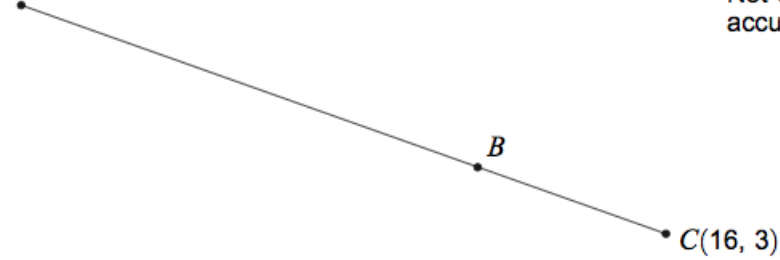
9.  $ABC$  is a straight line.

$BC$  is 20% of  $AC$ .

(4)

*Dr. Oliver*  
*Mathematics*  
 $A(-9, 18)$

Not drawn  
accurately



Work out the coordinates of  $B$ .

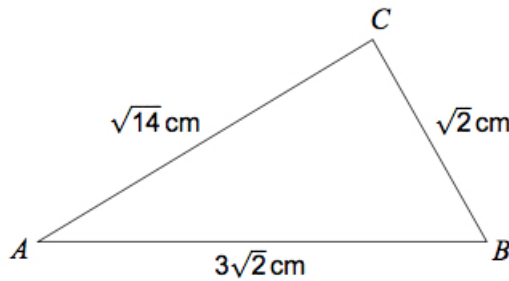
10. Rationalise the denominator of

$$\frac{8}{3 - \sqrt{5}}$$

(3)

Give your answer in the form  $a + b\sqrt{5}$ , where  $a$  and  $b$  are integers.

11. Here is triangle  $ABC$ .



Not drawn  
accurately

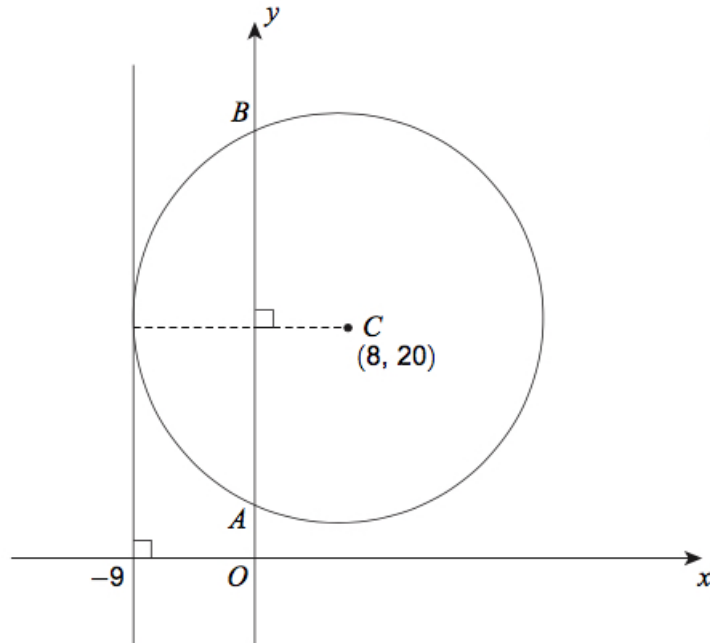
- (a) Show that angle  $B = 60^\circ$ .

(3)

- (b) Hence work out the area of triangle  $ABC$ .

(3)

12. The line  $x = -9$  is a tangent to the circle, centre  $C(8, 20)$ .



Not drawn accurately

- (a) Show that the radius of the circle is 17. (1)

The circle intersects the  $y$ -axis at  $A$  and  $B$ .

- (b) Show that the length  $AB$  is 30. (3)

13. A curve has equation

$$y = x^3 - 3x^2 + 5.$$

- (a) Show that the curve has a minimum point when  $x = 2$ . (4)

- (b) Show that the tangent at the minimum point meets the curve again when  $x = -1$ . (3)

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

$$x^3 + 2ax^2 - a^2x - 16.$$

- (a) Show that  $a = 2$ . (2)

- (b) Solve (4)

$$x^3 + 4x^2 - 4x - 16.$$

15. Prove that

$$\frac{\sin \theta - \sin^3 \theta}{\cos^3 \theta} \equiv \tan \theta. \quad (3)$$

16. (6)

$$2x^2 - 2bx + 7a \equiv 2(x - a)^2 + 3.$$

Work out the **two** possible pairs of values of  $a$  and  $b$ .