

Dr Oliver Mathematics
AQA Further Maths Level 2
June 2012 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.

$$f(x) = 2x^2 + 7$$

for all values of x .

(a) What is the value of $f(-1)$? (1)

(b) What is the range of $f(x)$? (1)

2.

$$\mathbf{A} = \begin{pmatrix} 2 & 0 \\ 1 & 3 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}.$$

Work out the matrix \mathbf{AB} .

3. Work out the greatest integer value of x that satisfies the inequality (2)

$$3x + 10 < 1.$$

4. (a) Factorise fully (3)

$$2x^2 - 2x - 40.$$

(b) Factorise fully (3)

$$(x + y)^2 + (x + y)(2x + 5y).$$

5. Simplify (2)

$$(2cd^4)^3.$$

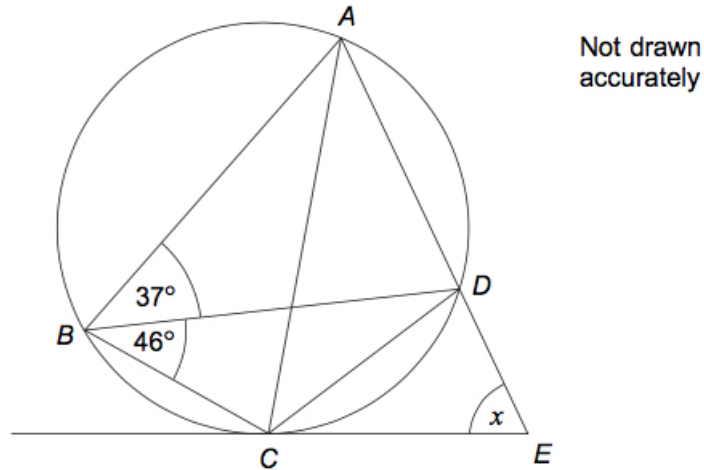
6. Solve the simultaneous equations (4)

$$2y = 3x + 4$$

$$2x = -3y - 7$$

Do **not** use trial and improvement.

7. The diagram shows a cyclic quadrilateral $ABCD$. (3)
- ADE is a straight line.
- CE is a tangent to the circle.



Work out the size of angle x .

8. A curve has equation

$$y = x^3 + 5x^2 + 1.$$

- (a) When $x = -1$, show that the value of $\frac{dy}{dx}$ is -7 . (2)

- (b) Work out the equation of the tangent to the curve (4)

$$y = x^3 + 5x^2 + 1.$$

at the point where $x = -1$.

9. Write this ratio in its simplest form: (3)

$$\sqrt{12} : \sqrt{48} : \sqrt{300}.$$

10. The n th term of the linear sequence (4)

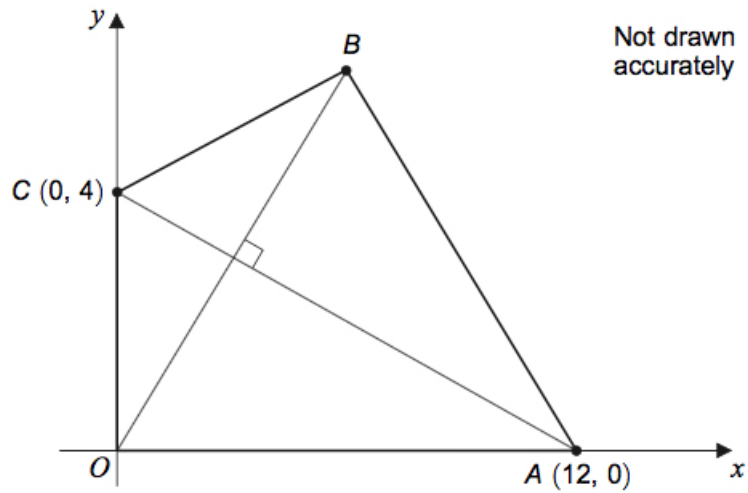
$$2 \quad 7 \quad 12 \quad 17 \quad \dots$$

is $5n - 3$.

A new sequence is formed by squaring each term of the linear sequence and adding 1.

Prove algebraically that all the terms in the new sequence are multiples of 5.

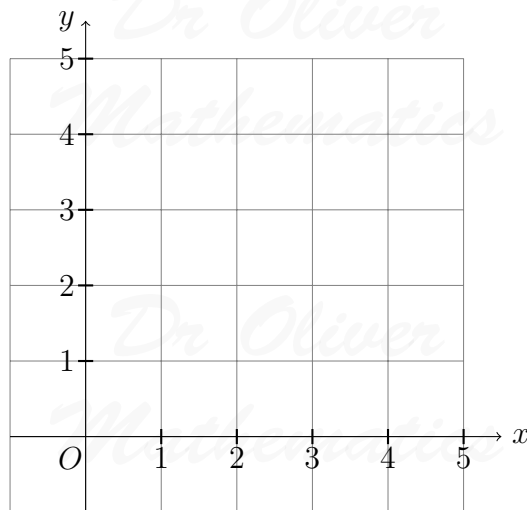
11. $OABC$ is a kite.



- (a) Work out the equation of AC . (2)
- (b) Work out the coordinates of B . (6)

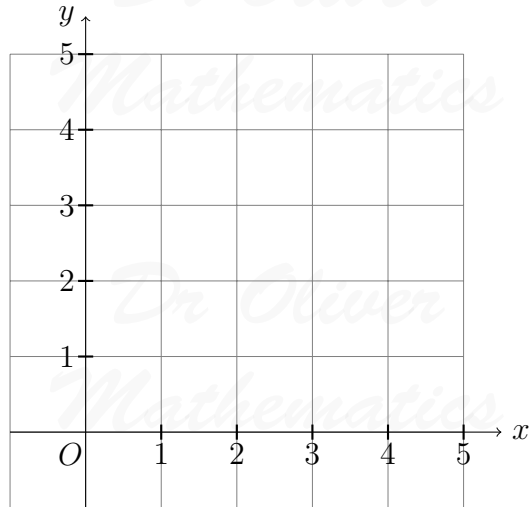
12. A graph passes through $(0, 0)$.
The rate of change of y with respect to x is always $\frac{1}{2}$.

- (a) Draw the graph of y for values of x from 0 to 4. (1)



A graph passes through $(1, 2)$.
The rate of change of y with respect to x is always 0.

- (b) Draw the graph of y for values of x from 0 to 4. (1)



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

where a is a constant.

The value of $\frac{dy}{dx}$ when $x = 2$ is twice the value of $\frac{dy}{dx}$ when $x = -1$.

(c) Work out the value of a .

(5)

13. Simplify

(5)

$$\frac{x^2 + 4x - 12}{x^2 - 25} \div \frac{x + 6}{x^2 - 5x}$$

14.

(5)

$$x^{\frac{3}{2}} = 8 \text{ where } x > 0$$

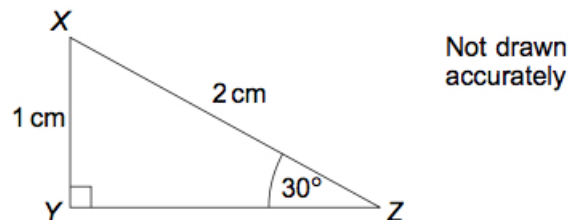
and

$$y^{-2} = \frac{25}{4} \text{ where } y > 0.$$

Work out the value of

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

15. XYZ is a right-angled triangle.

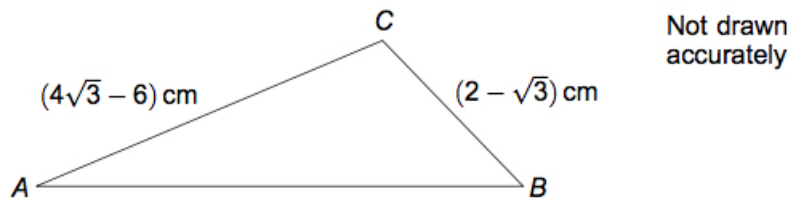


(a) Use triangle XYZ to show that

(2)

$$\sin 60^\circ = \frac{\sqrt{3}}{2}.$$

Triangle ABC has an obtuse angle at C .



(b) Given that $\sin A = \frac{1}{4}$, use triangle ABC to show that angle $B = 60^\circ$.

(6)

16. Prove that

(3)

$$\tan \theta + \frac{1}{\tan \theta} \equiv \frac{1}{\sin \theta \cos \theta}.$$