

Dr Oliver Mathematics
AQA Further Maths Level 2
June 2024 Paper 1
1 hour 45 minutes

The total number of marks available is 80.

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. Work out the value of

$$\sqrt{\frac{t}{20}}$$

(2)

where $t = 2.42 \times 10^3$.

2. Factorise

$$x^2 - y^2.$$

(1)

3. The n th term of a sequence is

$$\frac{3n + 4}{n}.$$

(1)

Circle the limiting value of

$$\frac{3n + 4}{n}$$

as $n \rightarrow \infty$.

1 3 4 7

4. The equations of two straight lines are

$$y - 3x = 4 \text{ and } 6y = 18x - 5.$$

(2)

Show that the lines are parallel.

- 5.

$$y = \frac{4x^3 + x^7}{x^4}.$$

(3)

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

6. Points $A(-12, 1)$ and $B(12, -1)$ lie on a circle.

(3)

AB is a diameter of the circle.

Work out the equation of the circle.

7. A point $P(x, y)$ is transformed using the transformation represented by (3)

$$\begin{pmatrix} 4 & 0 \\ -2 & 3 \end{pmatrix}.$$

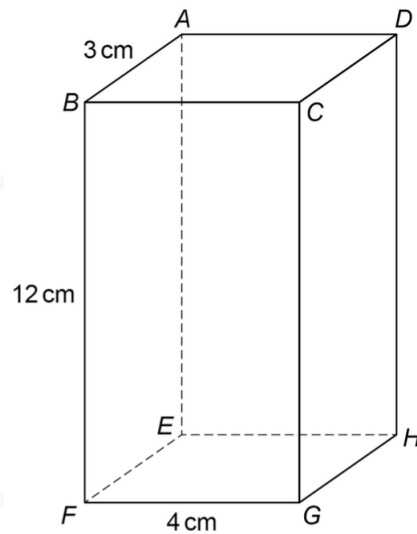
The image of P is $(-8, 7)$.

Work out the values of x and y .

8. Solve by factorising (3)

$$2x^3 - 9x^2 - 5x = 0.$$

9. $ABCDEFGH$ is a cuboid. (3)

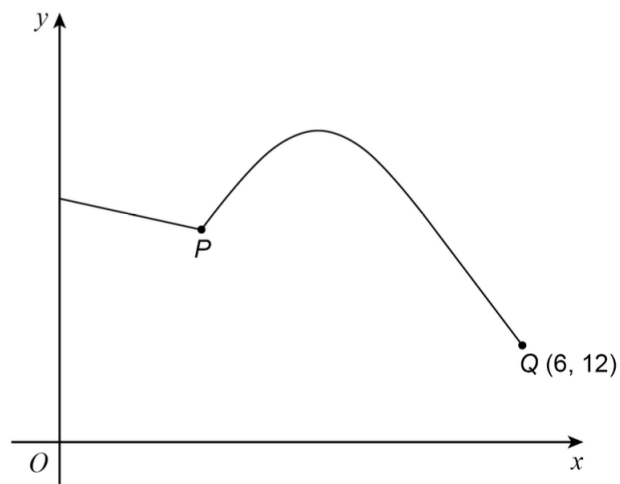


Work out the length AG .

10. A function f is given by (5)

$$f(x) = \begin{cases} -\frac{1}{2}x + 21 & \text{for } 0 \leq x \leq 2, \\ ax^2 + bx & \text{for } 2 < x \leq 6. \end{cases}$$

A sketch of $y = f(x)$ is shown.



Work out the values of a and b .

11. $(3x - 7)$ is a factor of

$$3x^3 - 4x^2 - 13x + 14.$$

- (a) Work out the other two linear factors.

(3)

- $(x - 2)$ is a factor of

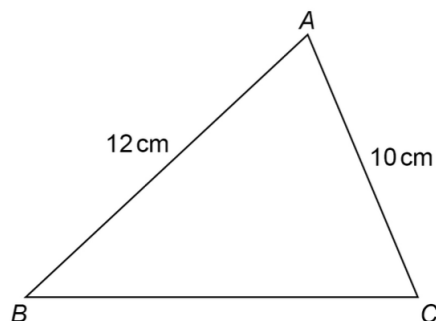
$$ax^4 - 3ax^2 + 5x - 22.$$

- (b) Work out the value of a .

(3)

12. In triangle ABC , $\cos BAC = \frac{3}{4}$.

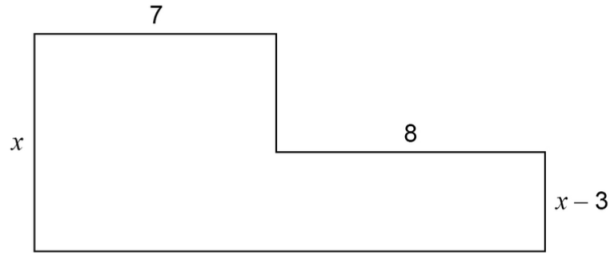
(3)



Work out the length BC .

13. A garden patio is made from two rectangles.
All lengths are in metres.

(4)



The area of the patio is **less than** 51 m^2 .

Work out the range of possible values of x .

Give your answer in the form $a < x < b$ where a and b are both integers.

You **must** show your working.

14. (a) Write (3)

$$2x^2 - 16x + 7$$

in the form

$$k(x + m)^2 + n,$$

where k , m , and n are integers.

- (b) Solve (1)

$$(x - 1)^2 - 5 = 0.$$

15. (a) Matrix $\mathbf{M}$ represents a reflection in the line $y = -x$. (1)

Write down matrix $\mathbf{M}$.

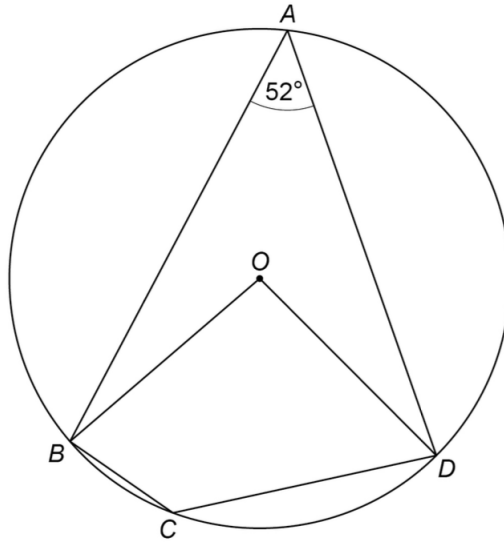
- (b) (2)

$$\mathbf{N} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}.$$

Describe geometrically the single transformation represented by $\mathbf{N}^2$.

16. A , B , C , and D are points on a circle, centre O . (4)

$$\text{Angle } OBC : \text{angle } ODC = 5 : 3.$$



Work out the size of angle OBC .
You **must** show your working.

17. Show that

$$\frac{21x}{3x^2 - 2x - 8} - \frac{7}{x - 2}$$

(3)

simplifies to

$$\frac{k}{3x^2 - 2x - 8},$$

where k is an integer.

18. Rationalise the denominator and simplify fully

(4)

$$\frac{3\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}.$$

19. The equation of a curve is

(5)

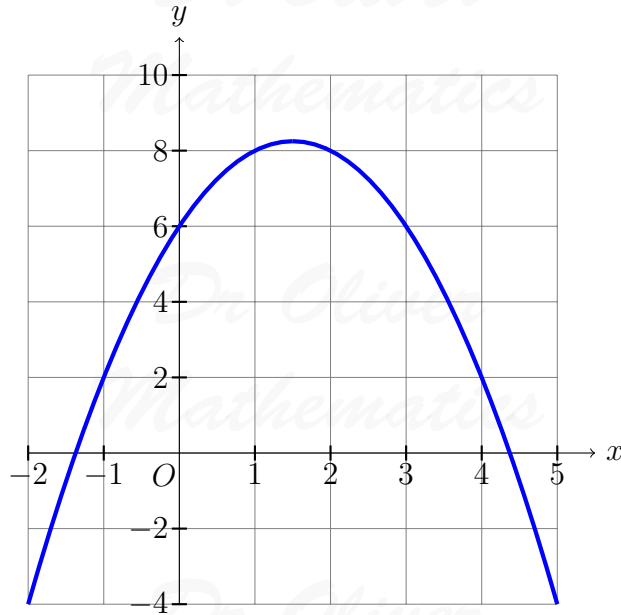
$$y = x^3 - 3x^2 + 5.$$

Work out the stationary points of the curve and determine their nature.
You **must** show your working.

20. Here is the graph of

(4)

$$y = -x^2 + 3x + 6, \text{ for } -2 \leq x \leq 5.$$



By drawing a suitable **straight line**, work out approximate solutions to

$$x^2 - \frac{7}{2}x - 3 = 0.$$

21.

$$(2^{x+3})^{4x+1} = 8^{x-1}.$$

(5)

Work out the possible values of x .

22.

$$f(x) = \frac{3 \sin x \cos x + \sin^2 x}{12 \cos^2 x + 4 \sin x \cos x}.$$

(4)

Simplify $f(x)$ and hence solve

$$f(x) = -\frac{\sqrt{3}}{4}, \text{ for } 90^\circ < x < 180^\circ.$$

You **must** show your working.

23. The n th term of a quadratic sequence is

$$an^2 - 5n + c,$$

(5)

where a and c are integers.

The first four terms of the sequence are

$$2 \quad x \quad 16 \quad y.$$

Work out the values of x and y .