

Dr Oliver Mathematics
AQA Further Maths Level 2
June 2023 Paper 2
1 hour 45 minutes

The total number of marks available is 80.

You must write down all the stages in your working.

You are permitted to use a scientific or graphical calculator in this paper.

1. Solve (3)

$$\frac{8d - 3}{3d - 7} = \frac{5}{2}.$$

2. (a) The first four terms of a linear sequence are (2)

15 18.5 22 25.5.

Work out an expression for the n th term.

- (b) A different linear sequence has n th term (2)

$$318 - 9n.$$

Work out the value of the first **negative** term in the sequence.

3. (2)

$$\begin{pmatrix} 3 & 5 \\ u & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} t \\ 6 \end{pmatrix}.$$

Work out the values of t and u .

4. A line passes through $P(1, k)$ and $Q(r, 6)$, where k and r are constants. (4)

- The midpoint of PQ has x -coordinate 5.
- The gradient of the line is 2.

Work out the value of k .

5. (3)

$$y = 0.5x^4.$$

Work out the value of x for which the rate of change of y with respect to x is 6.75.

6. The equation of a circle is

$$(x + 7)^2 + (y - 4)^2 = 36.$$

(2)

Complete these statements.

The coordinates of the centre of the circle are (.....,.....).

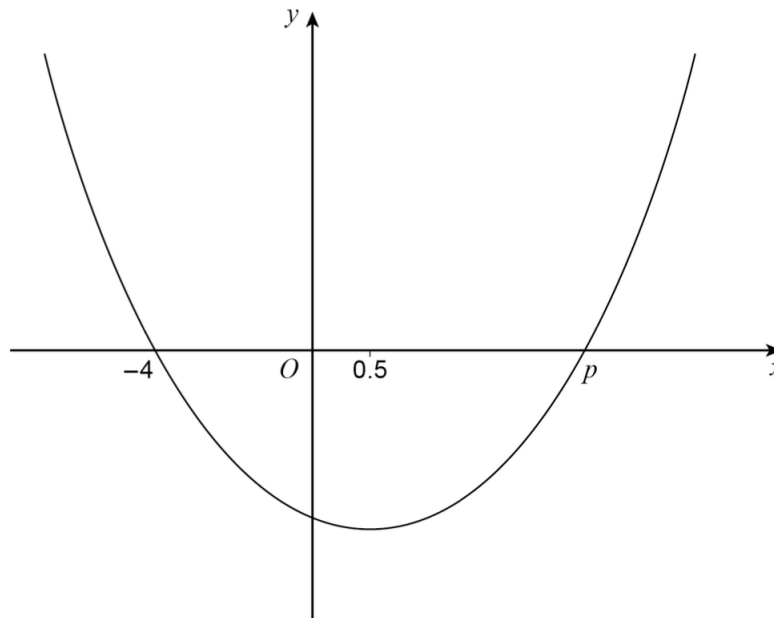
The radius of the circle is

7. Here is a sketch of the curve

$$y = ax^2 + bx + c,$$

where a , b , and c are constants.

- The curve intersects the x -axis at $(-4, 0)$ and $(p, 0)$.
- The turning point has x -coordinate 0.5.



(a) Work out the value of p .

(1)

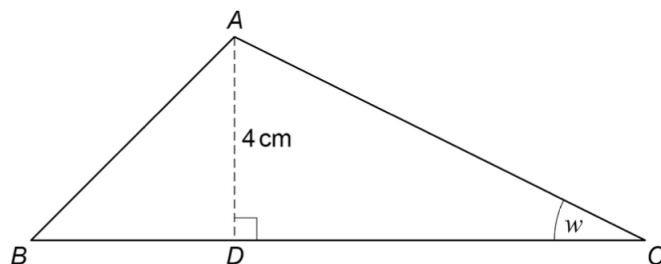
(b) Solve

(2)

$$ax^2 + bx + c > 0.$$

8. ABC is a triangle with perpendicular height AD .

(4)

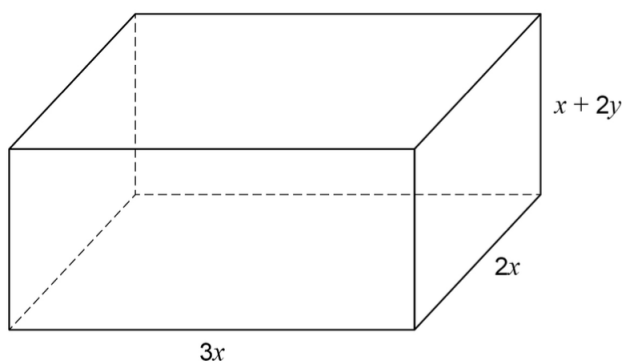


Not drawn
accurately

- Area of $ABC = 25 \text{ cm}^2$.
- $BD : DC = 2 : 3$.

Work out the size of angle w .

9. The dimensions of the cuboid are given in centimetres.



The total length of all 12 edges is 300 cm.

- (a) Show that

$$y = \frac{75 - 6x}{2}.$$

(2)

The volume of the cuboid is $V \text{ cm}^3$.

- (b) Show that

$$V = 450x^2 - 30x^3.$$

(2)

- (c) Use calculus to work out the maximum value of V as x varies.

(3)

10. Line K has equation

$$4x - 5y = 17.$$

(3)

Line L passes through the points $(3, 6)$ and $(-5, 16)$.

Tick (✓) the correct statement about lines K and L .

The lines are parallel.

☐

The lines are perpendicular.

☐

The lines are neither parallel nor perpendicular.

☐

Show working to support your answer.

11. Expand and simplify fully

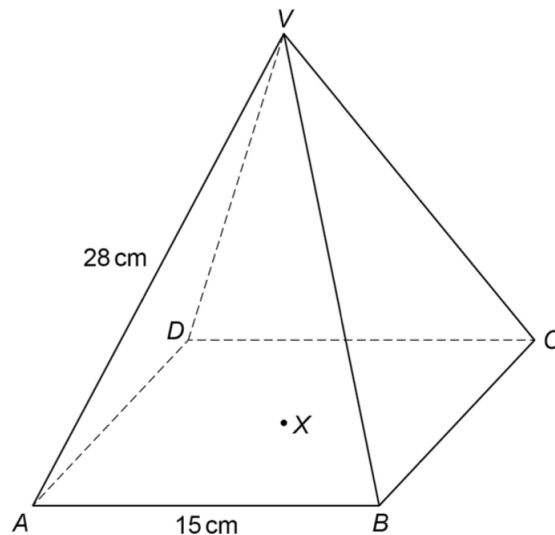
(4)

$$(2x^3 - 9)(3x^2 + 4) + x(x - 4)^2.$$

12. $VABCD$ is a pyramid.

(3)

- The square horizontal base, $ABCD$, has side length 15 cm.
- V is directly above the centre, X , of the base.
- $VA = 28$ cm.



Work out the size of the angle that VA makes with $ABCD$.

13. (a) Circle the expression equivalent to $3x^{-7}$.

(1)

$$-\frac{3}{x^7} \quad -\frac{1}{3x^7} \quad \frac{1}{3x^7} \quad \frac{3}{x^7}$$

(b) Simplify fully (2)

$$\frac{12w^8}{(4w^3)^2}.$$

(c) (3)

$$\sqrt{y} \times \sqrt[3]{y} = \sqrt[c]{y^d},$$

where c and d are positive integers.

Work out the least possible values of c and d .

14. Simplify fully (4)

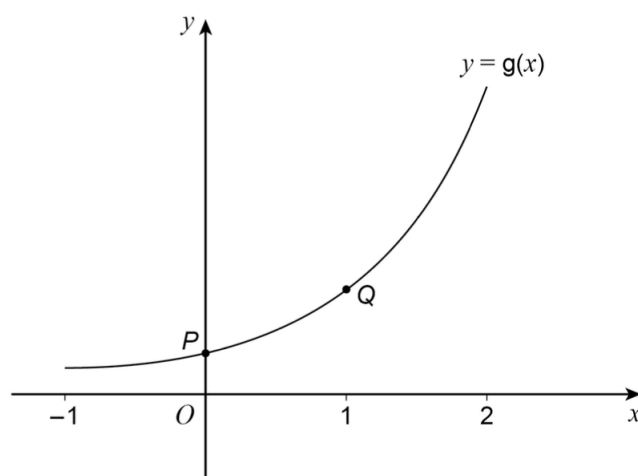
$$\frac{15a^2}{a^2 + 6a - 16} \times \frac{8 - 4a}{3a}.$$

15. The function g is given by (4)

$$g(x) = a \times b^x,$$

where a and b are constants.

- The domain of the function is $-1 \leq x \leq 2$,
- $P(0, \frac{1}{2})$ and $Q(1, \frac{3}{2})$ are points on the graph $y = g(x)$.



Not drawn
accurately

Work out the range of the function.

16. $(2x - 3)$ is a factor of (4)

$$6x^3 - 25x^2 + 28x - 6.$$

Solve

$$6x^3 - 25x^2 + 28x - 6 = 0.$$

Give all solutions as **exact** values.

17. The function h is given by

$$h(x) = ax(3x^2 - 2) + 5x,$$

where a is a positive constant.

h is an **increasing** function for all values of x .

Work out the possible values of a .

Give your answer as an inequality.

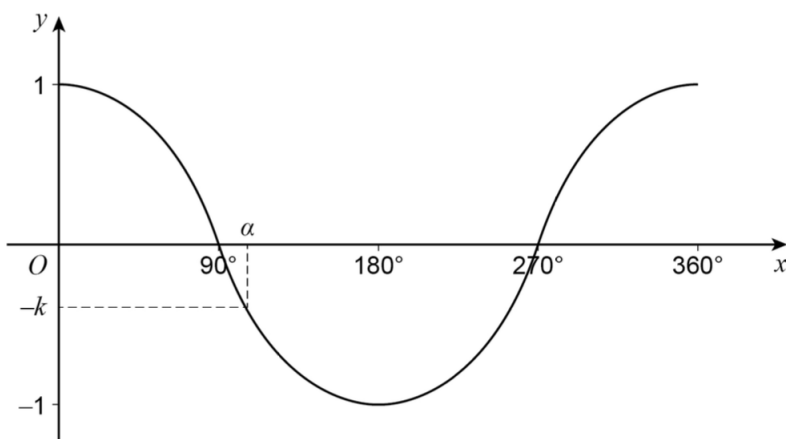
18. Here is a sketch of

$$y = \cos x$$

for values of x from 0° to 360° .

α is an obtuse angle measured in degrees.

$\cos \alpha = -k$, where k is a positive constant.



(a) Tick (✓) **two** boxes that show expressions for x where $\cos x = -k$.

☐

$$180^\circ - \alpha$$

☐

$$180^\circ + \alpha$$

☐

$$270^\circ - \alpha$$

☐

$$270^\circ + \alpha$$

☐

$$360^\circ - \alpha$$

☐

$$360^\circ + \alpha$$

- (b) Circle the expression for x where $\sin x = -k$. (1)

$$\alpha \quad 90^\circ + \alpha \quad 180^\circ - \alpha \quad 180^\circ + \alpha$$

19. In these simultaneous equations, k is a positive constant. (3)

$$3x + 4y = k$$

$$y = 2kx.$$

Solve the simultaneous equations.

Give the answers in their simplest form in terms of k .

20. Show that (3)

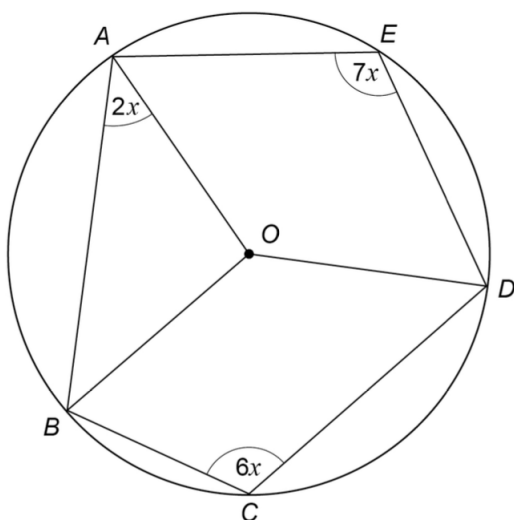
$$2 \sin^3 x + 2 \sin x \cos^2 x + 5 \tan x \cos x$$

simplifies to

$$p \sin x,$$

where p is a constant.

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



Not drawn
accurately

Work out the value of x .

22. Five-digit integers are made using (3)

$$1 \quad 2 \quad 7 \quad 8 \quad 9.$$

For each integer, all the digits are used exactly once.

The integers are greater than 40 000 **and** odd.

How many different integers can be made?

You **must** show your working.