

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

The total number of marks available is 80.

You must write down all the stages in your working.

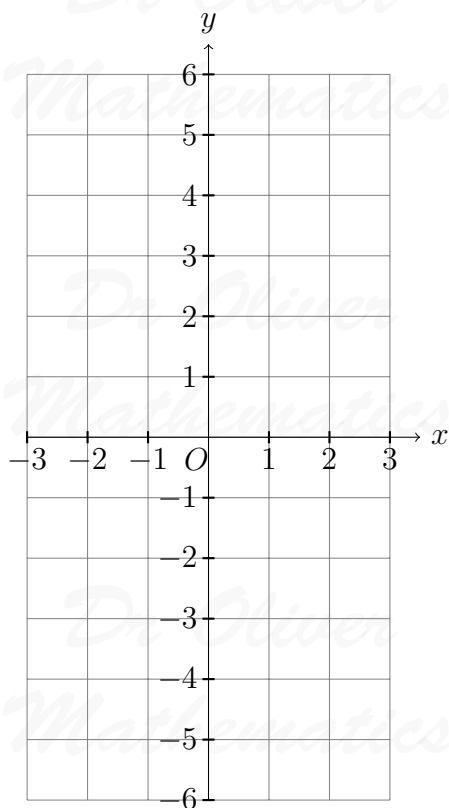
You are permitted to use a scientific or graphical calculator in this paper.

1. A straight line

(3)

- passes through the point $(-1, -1)$ and
- has gradient $\frac{3}{2}$.

Draw the line for values of x from -3 to 3 .



2.

(2)

$$5n^2 + 2 < 38.$$

Work out all the possible **integer** values of n .

3. The equation of a curve is (3)

$$y = x^4 - 3kx^2,$$

where k is a constant.

When $x = 2$, the rate of change of y with respect to x is 23.

Work out the value of k .

4. Here is some information about three linear sequences, A , B , and C . (4)

n th term of $C = n$ th term of $A + n$ th term of B .
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The n th term of C is

$$42 - 3n.$$

The first four terms of B are

$$14 \quad 22 \quad 30 \quad 38.$$

Work out the 20th term of A .

5. (a) (3)

$$\begin{pmatrix} c & 1 \\ 5d & 3 \end{pmatrix} \begin{pmatrix} -2 & 0 \\ 7 & 3 \end{pmatrix} = \begin{pmatrix} -5 & 3 \\ 0 & 9 \end{pmatrix}.$$

Work out the values of c and d .

- (b) (1)

$$\begin{pmatrix} 5 & 2 \\ 1 & 4 \end{pmatrix} \mathbf{M} = \begin{pmatrix} 5 & 2 \\ 1 & 4 \end{pmatrix}.$$

Write down matrix $\mathbf{M}$.

6. The function f is given by (2)

$$f(x) = 3x^2 + 2,$$

with domain $-1 \leq x \leq 4$.

Work out the range of the function.

7. The equation of a curve is

$$y = 4 - (x - 3)^2.$$

- (a) Circle the coordinates of the point where the curve crosses the y -axis. (1)

$$(-5, 0) \quad (0, -5) \quad (-13, 0) \quad (0, -13)$$

- (b) Write down the coordinates of the maximum point of the curve. (1)

8.

(3)

$$y = \frac{1}{2}x^2 + \frac{3}{4x^4}.$$

Work out $\frac{d^2y}{dx^2}$.

Give your answer in the form

$$a + bx^n,$$

where a , b , and n are integers.

9. A set of 4-digit integers each have

(3)

- a first digit **greater than** 6 and
- a second digit **less than** 8.

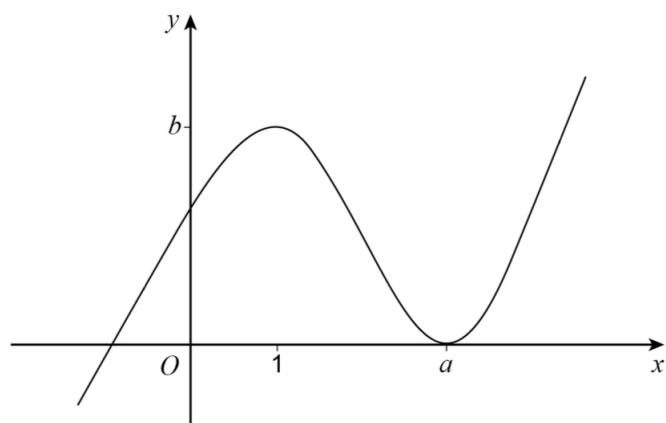
What is the greatest possible number of integers in the set that are multiples of 5?

10. f is a cubic function.

(2)

The curve $y = f(x)$ has

- a minimum point at $(a, 0)$ and
- a maximum point at $(1, b)$.

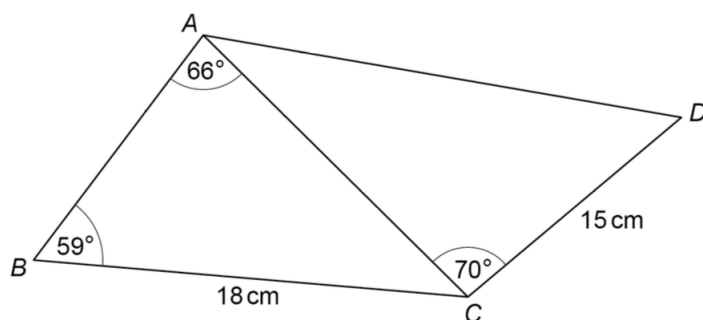


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Tick one box for each statement.

	True	False
The tangent to the curve at $(1, b)$ is parallel to the x -axis		
There are three different values of x for which $y = 0$		
The function is increasing for $0 < x < 1$		

11. ABC and ACD are triangles. (4)



Work out the area of triangle ACD .

12. The equation of a circle is

$$(x - 2)^2 + (y + 3)^2 = 16.$$

The equation of a line is

$$y = 4 - x.$$

The circle and line intersect at two points, A and B .

- (a) Show that the x -coordinates of A and B satisfy the equation (3)

$$2x^2 - 18x + 37 = 0.$$

For A , the x -coordinate and y -coordinate are both **positive**.

- (b) Work out the coordinates of A . (3)

Give each coordinate to 2 decimal places.

13. Expand and simplify fully (3)

$$(3x - 1)(4 - x)(2x + 5).$$

14. P is the point on the graph (3)

$$y = 3^{-x}$$

that has x -coordinate -2 .

Q is a point on the graph

$$y = 1\,152 \times \left(\frac{1}{2}\right)^x.$$

y -coordinate of $P = y$ -coordinate of Q

Work out the x -coordinate of Q .

15. Simplify fully (3)

$$\frac{2x^2 + 9x - 18}{12x^2 - 8x - 15}.$$

16. Simplify (3)

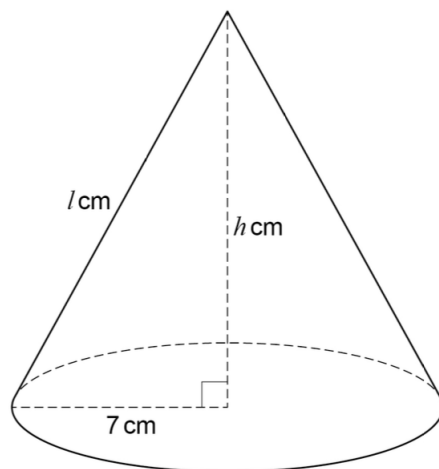
$$\frac{\sqrt{x^3}(\sqrt{x^3} + x^3)}{\sqrt{x}}.$$

Give your answer in the form

$$x^{\frac{a}{b}} + x^c,$$

where a , b , and c are integers.

17. (a) A solid cone has base radius 7 cm, perpendicular height h cm and slant height l cm. (4)



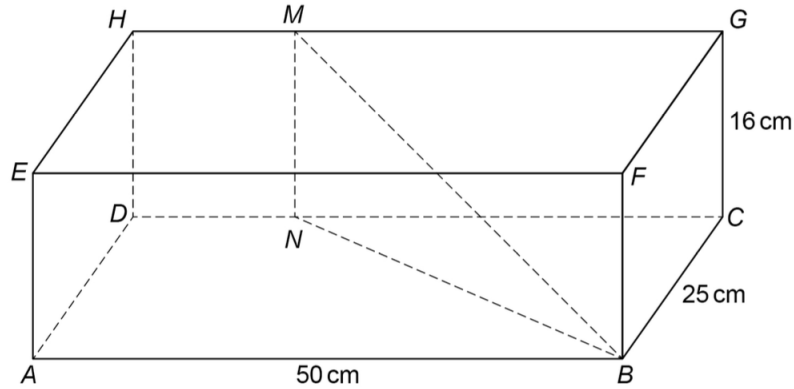
Curved surface area of a cone = $\pi r l$

The total surface area of the cone is $224\pi \text{ cm}^2$.

Work out the size of the angle between the slant height and the base.

- (b) $ABCDEFGH$ is a cuboid. (2)

- $ABCD$ is horizontal.
- MN is vertical.
- The acute angle between the planes MNB and $HDCG$ is 36° .



Work out the length CN .

18. Rearrange

$$m = \frac{2k^3 - 7}{5m - 3k^3}$$

to make k the subject.

19. In the expansion of

$$(3 + ax)^5,$$

where a is a non-zero constant,

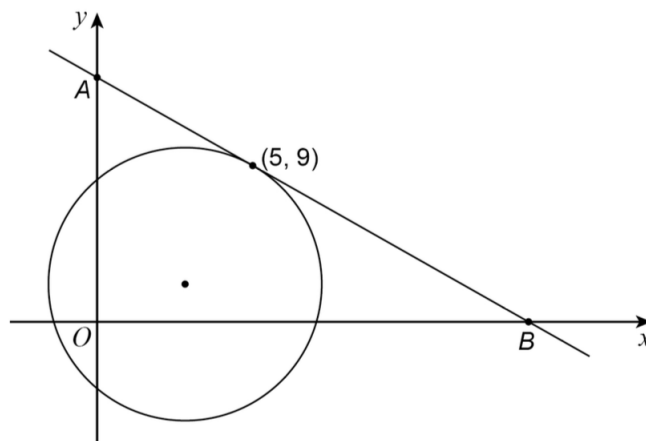
$$8 \times \text{coefficient of } x^2 = \text{coefficient of } x^4.$$

Work out the possible values of a .

20. AB is the tangent to the circle

$$(x - 3)^2 + (y - 4)^2 = 29$$

at the point $(5, 9)$.



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Work out the area of triangle AOB .

21.

(6)

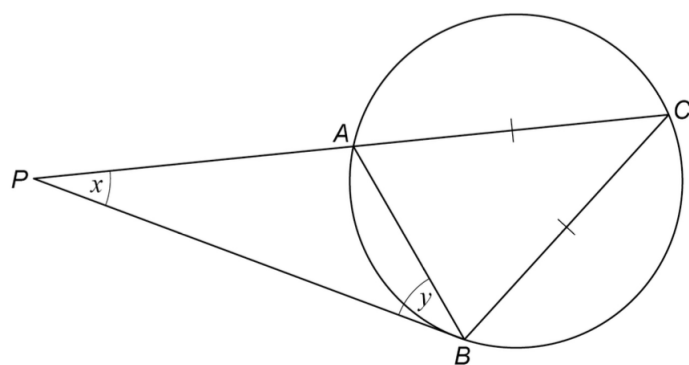
$$f(x) = \frac{2-x}{3}$$
$$g(x) = 18x^2 + 15x.$$

$f^{-1}(x) + g f(x)$ simplifies to $ax^2 + bx + c$.
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Work out the values of a , b , and c .

22. A , B , and C are points on a circle.

(5)



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- PAC is a straight line.
- PB is a tangent to the circle.
- $AC = BC$.

Prove that

$$x = 90 - \frac{3}{2}y.$$