Dr Oliver Mathematics
AQA Further Maths Level 2
June 2025 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. (a) The function f is given by (1)

$$\mathrm{f}(x) = 5x + 3.$$

The range is

$$\mathrm{f}(x) < 23.$$

Work out the domain of the function, giving your answer as an inequality.

(b) The function g is given by (2)

$$\mathrm{g}(x) = x^3 - 4.$$

The domain is

$$-3 < x < 2.$$

Work out the range of the function, giving your answer as an inequality.

(c) The function h is given by (2)

$$\mathrm{h}(x) = \sqrt{2x + 1}.$$

Work out $\mathrm{h}^{-1}(x)$.

2. (2)

$$\begin{pmatrix} 5 & 0 \\ 1 & -6 \end{pmatrix} \begin{pmatrix} 12 \\ 7 \end{pmatrix} = 15 \begin{pmatrix} a \\ b \end{pmatrix}.$$

Work out the values of a and b.

3. A linear sequence starts (3)

$$2 \quad 5 \quad 8 \quad 11.$$

Work out the **position** of the term that is the first to have a value greater than 500.

4. AC is a straight line.

- A is the point $(-3, 2)$.
- B is the midpoint of the line AC.
- B is the point $(12, 10)$.

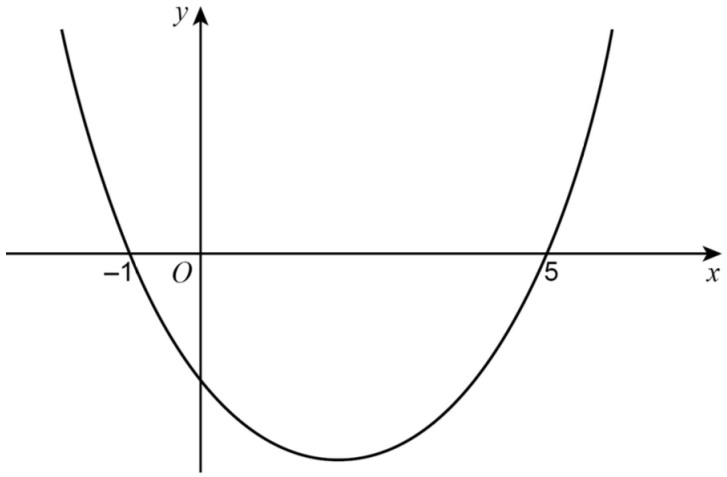
(a) Work out the coordinates of C. (2)

(b) Work out the distance AB. (2)

5. Here is a sketch of (3)

$$y = x^2 + bx + c.$$

The graph passes through $(-1, 0)$ and $(5, 0)$.



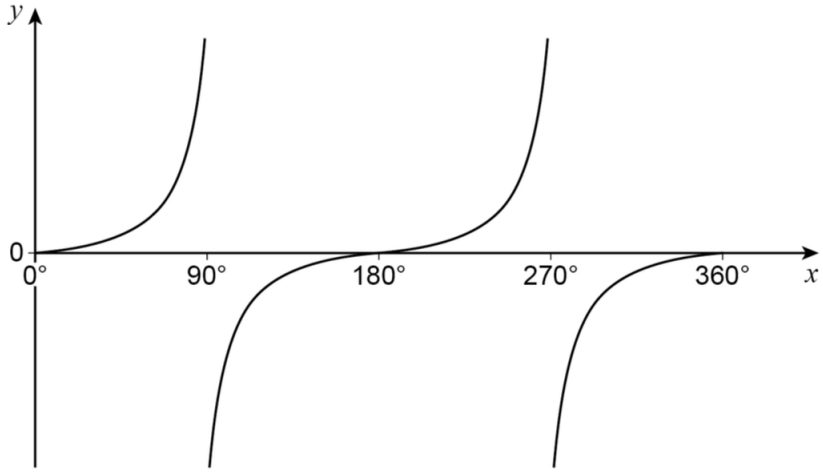
Work out the values of b and c.

6. Simplify fully (3)

$$\frac{\sqrt{75} - \sqrt{27}}{\sqrt{48}}.$$

7. Here is a sketch of (2)

$$y = \tan x, \text{ for } 0^\circ \leqslant x \leqslant 360^\circ.$$



You are given that

$$\tan 72^\circ = k.$$

Work out the two values of x between 0° and 360° for which

$$\tan x = -k.$$

8. Work out (1)

$$\left(\frac{x^{\frac{9}{2}}}{x^{\frac{1}{2}}} \right)^3$$

as a power of x.

Circle your answer.

x^7 x^{12} x^{15} x^{27}

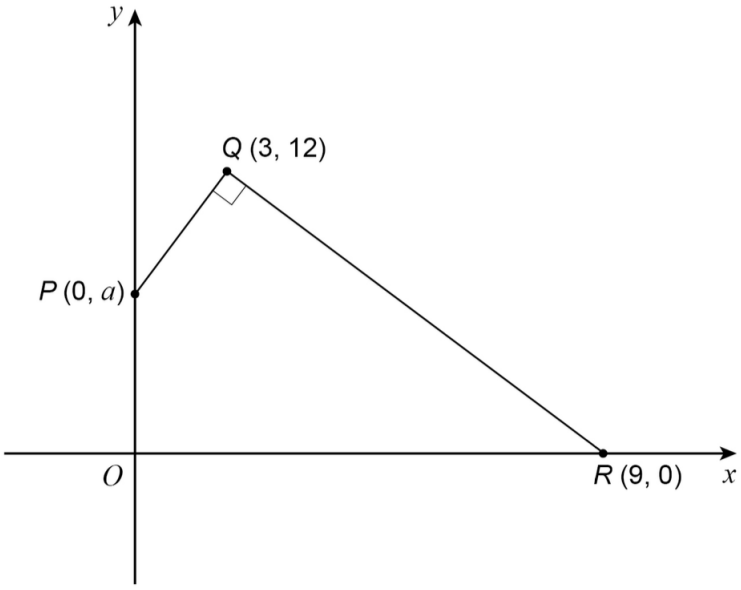
9. 3-digit integers are made using three **different** digits. (3)

The digits are chosen from

$$1, 2, 3, 4, 5, 6, 7, 8, 9.$$

How many **more** odd integers than even integers can be made?

10. PQ is perpendicular to QR. (4)



Not drawn accurately

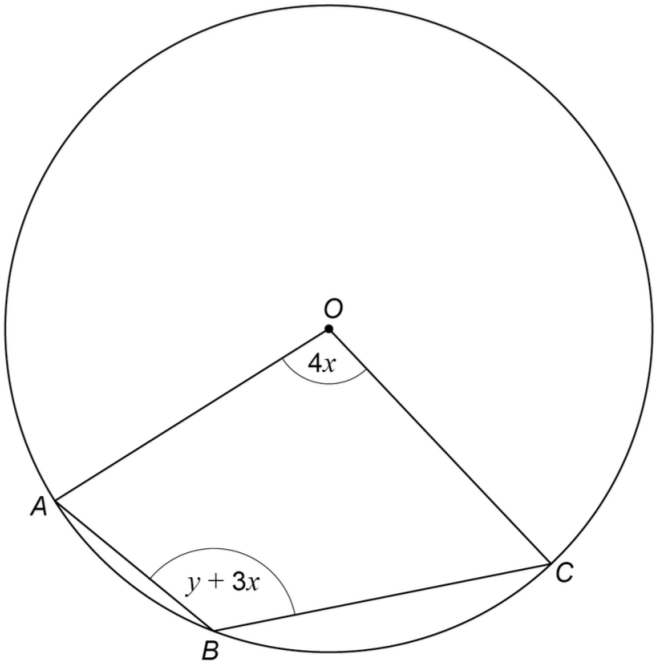
Work out the value of a.

11. Solve (4)

$$x^3 + 10x^2 + 8x = 0.$$

Where appropriate give your answers in surd form.
Simplify your answers where possible.

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



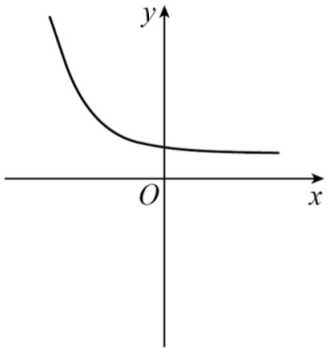
Prove that

$$y = 180 - 5x.$$

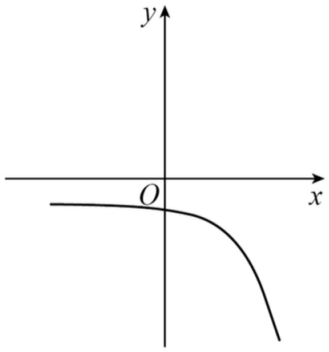
13. Here are four sketch graphs. (1)

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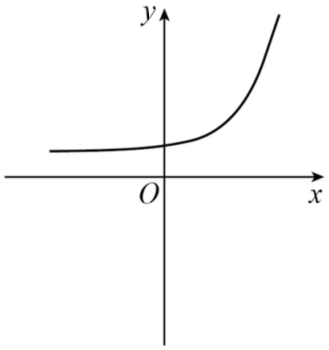
A



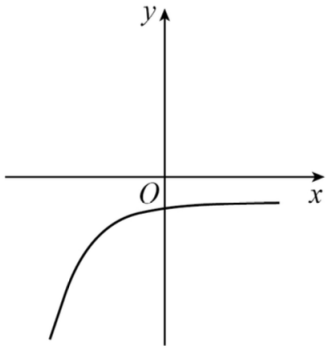
B



C



D



Circle the letter of the sketch graph that represents

$$y = 5^x.$$

14. Simplify fully (4)

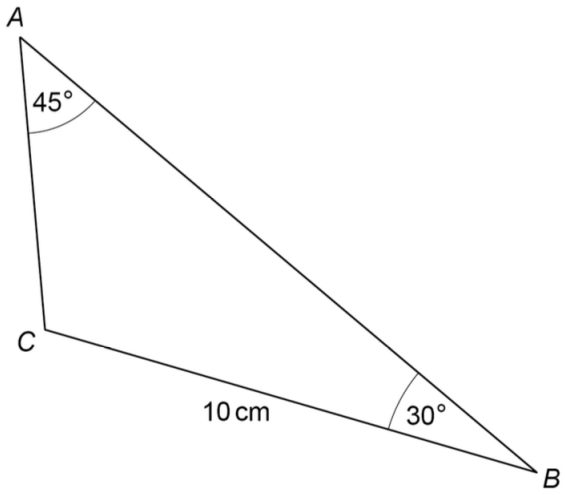
$$\frac{2x^2 - 4x - 6}{x^2 - 3x} \div \frac{4x + 4}{7x^2}.$$

15. (3)

$$(x - 3)(x + 4)(x + p) \equiv x^3 + qx^2 + rx + 24.$$

Work out the values of p, q, and r.

16. Work out the length AC. (3)



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Give your answer in the form $a\sqrt{2}$, where a is an integer.

17. The expansions of (3)

$$(4a + x)^4$$

and

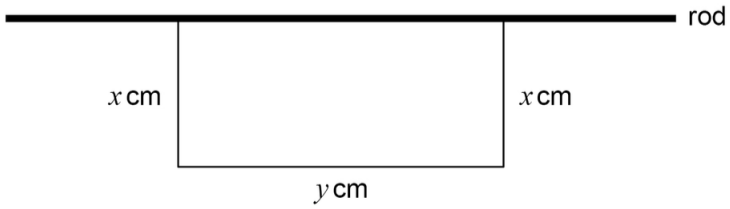
$$(5 - 2x)^3$$

have the same coefficient of x^3.

Work out the value of a.

18. A 60 cm piece of wire is bent to form three sides of a rectangle.
It is then attached to a fixed rod as shown in the diagram.

Not drawn accurately



(a) The area of the rectangle is A cm^2. (2)

Show that

$$A = x(60 - 2x).$$

(b) Work out the maximum value of A as x varies. (4)

19. (a) $(x - 1)$ is a factor of (3)

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

Factorise fully

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

(b) (2)

$$\mathrm{f}(x) = (x - 2)(5x + 4)(3x + 2).$$

c is a positive integer.

The value of $\mathrm{f}(c)$ can be written as the product of two prime factors.

Deduce the value of $\mathrm{f}(c)$.

20. (4)

$$y = \tfrac{1}{3}x^3 - 5x^2 + 28x + 11.$$

Show that y is an increasing function for all values of x.

21. Show that (2)

$$\frac{20\sin^2 x}{3 + \cos^2 x - 3\sin^2 x}$$

can be simplified to

$$k\tan^2 x,$$

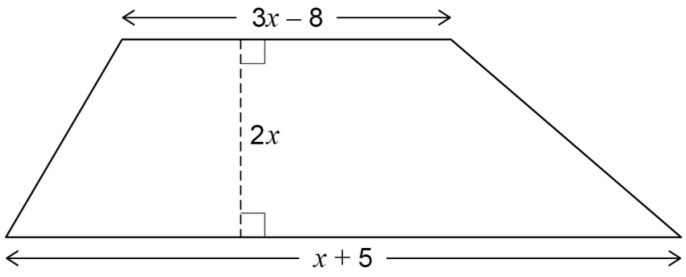
where k is an integer.

22. A circle has centre $(2, 3)$ and radius 5. (6)

A straight line passes through $(3, 7)$ and has a gradient of 2.

Work out the coordinates of the **two** points where the circle and the straight line intersect.

23. The diagram shows a trapezium. (5)
All lengths are in centimetres.



Not drawn accurately

The area of the trapezium is less than 22 cm^2.

Work out the greatest possible range of values of x. Give your answer in the form

$$m < x < n,$$

where m and n are both positive numbers.

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