

Dr Oliver Mathematics
AQA Further Maths Level 2
June 2022 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. $(x + 1)$ is increased by 20%. (3)

Its value is now the same as $(x + 6)$.

Work out the value of x .

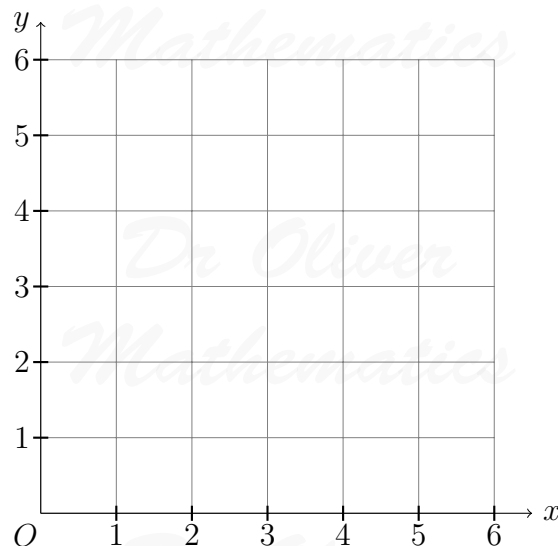
2. The point $(-6, -4)$ lies on a straight line with gradient $\frac{3}{2}$. (2)

Work out the coordinates of the point where the line crosses the y -axis.

3. (a) (4)

$$f(x) = \begin{cases} 4 - x & \text{for } 0 \leq x < 1, \\ 4x - x^2 & \text{for } 1 \leq x < 4, \\ 2x - 8 & \text{for } 4 \leq x \leq 6. \end{cases}$$

On the grid, draw the graph of $y = f(x)$.



(b) (2)

$$g(x) = 6 - 3x.$$

Work out $g^{-1}(x)$.

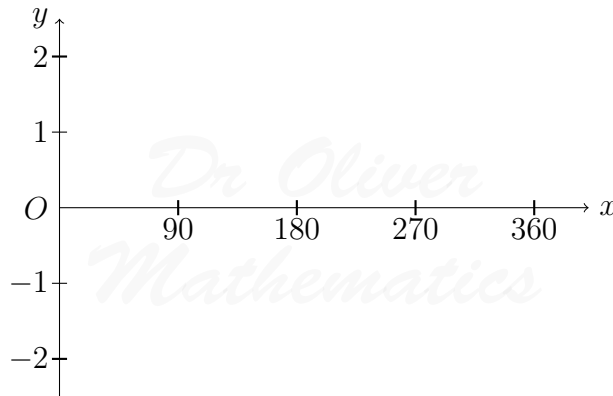
4. (a) Circle the value of (1)

$$\tan^2 30^\circ.$$

$$\frac{1}{4} \quad \frac{1}{3} \quad \frac{1}{2} \quad \frac{3}{4}$$

(b) On the axes, sketch (2)

$$y = \cos x \text{ for } 0^\circ \leq x \leq 360^\circ.$$



5. (3)

$$(3x + a)(5x - 4) \equiv 15x^2 - 2x + b.$$

Work out the values of a and b .

6. (3)

$$y = 2x^4 \left(x^3 + 2 - \frac{3}{x} \right).$$

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

7. ABC is a right-angled triangle with vertices $A(-1, 5)$, $B(-2, 5)$, and $C(-1, 5\frac{3}{4})$. (3)

Work out the length of BC .

8. Use **matrix multiplication** to show that, in the x - y plane, (3)

- a rotation, 90° anticlockwise about the origin, followed by
- a reflection in the line $y = x$

is equivalent to a reflection in the x -axis.

9. (a) A quadratic sequence starts (3)

$$-2 \quad -1 \quad 4 \quad 13.$$

Work out an expression for the n th term.

- (b) A different quadratic sequence has n th term (3)

$$n^2 + 10n.$$

Use an algebraic method to work out how many terms in the sequence are less than 2000.

Do **not** use trial and improvement.

You **must** show your working.

10. Rationalise and simplify fully (3)

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

11. Expand and simplify fully (4)

$$(3 + 2x)^5.$$

12. The n th term of a sequence is

$$\frac{3n^2}{n^2 + 2}.$$

- (a) One term in the sequence is (2)

$$\frac{32}{11}.$$

Work out the value of n .

- (b) Write down the limiting value of the sequence as $n \rightarrow \infty$. (1)

13. Simplify fully (3)

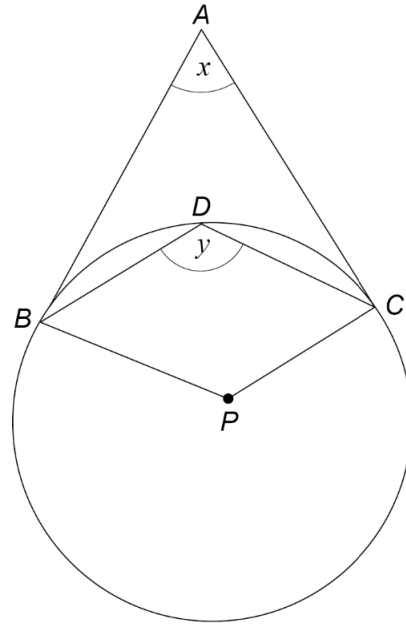
$$(6x^3y^{-2} + 9x^5y) \div 3x^2y^{-3}.$$

14. Rearrange (3)

$$ef = \frac{5e + 4}{3}$$

to make e the subject.

15. B , C , and D are points on a circle, centre P . (5)
 AB and AC are tangents to the circle.



Not drawn accurately

Prove that

$$y = 90 + \frac{1}{2}x.$$

16. Solve the simultaneous equations

(6)

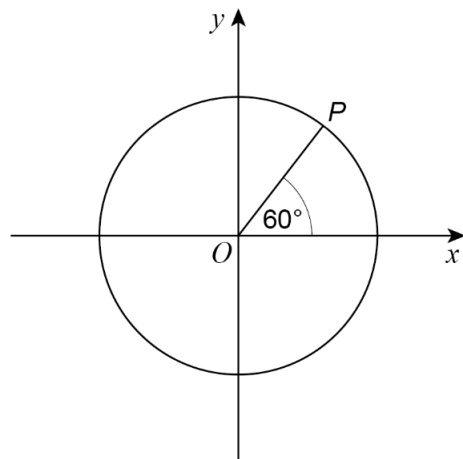
$$\begin{aligned} x - y &= \frac{19}{4} \\ xy &= -3. \end{aligned}$$

Do **not** use trial and improvement.
You **must** show your working.

17. The point P lies on the circle

$$x^2 + y^2 = 16.$$

The line OP is at an angle of 60° to the positive x -axis.



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(a) Show that the coordinates of point P are $(2, 2\sqrt{3})$. (2)

(b) Work out the equation of the tangent to the circle at P . (4)

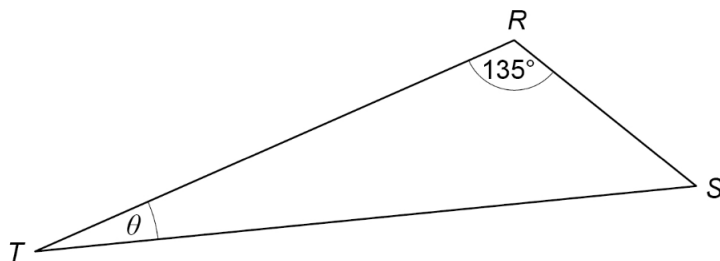
Write your answer in the form

$$x + ay = b,$$

where a and b are constants.

18. In triangle RST , (3)

$$RS : ST = 1 : 4.$$



Not drawn accurately

Work out the exact value of $\sin \theta$.

19. Write (3)

$$6x^2 - 24x + 17$$

in the form

$$a(x + b)^2 + c,$$

where a , b , and c are integers.

20. The curve

$$y = x^4 - 18x^2$$

(6)

has three stationary points.

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

21. Show that

$$\frac{4 \cos^2 x + 3 \sin^2 x - 4}{\cos^2 x} \equiv -\tan^2 x.$$

(3)