AQA Level 2 Further Maths 2023 Paper 1

Do not turn over the page until instructed to do so.

This assessment is out of 80 marks and you will be given 90 minutes.

When you are asked to by your teacher write your **full name** below

Name:

Total Marks: / 80

1 Expand and fully simplify

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

[3 marks]

2 Circle the value of $\cos^2(30°)$.

[1 mark]

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

3 Rationalise and simplify fully $\dfrac{\sqrt{5}}{7 - \sqrt{5}}$

[3 marks]

4 Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ for $y = 3x^2 \left(x^2 + 2x + \dfrac{1}{x} \right)$

[4 marks]

5 Let $f(x)$ be defined as follows.

$$f(x) = x^2 + 4x + 4 \qquad -2 \le x < 0$$
$$= 4 + x \qquad 0 \le x < 1$$
$$= 6 - x \qquad 1 \le x < 6$$

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

[4 marks]
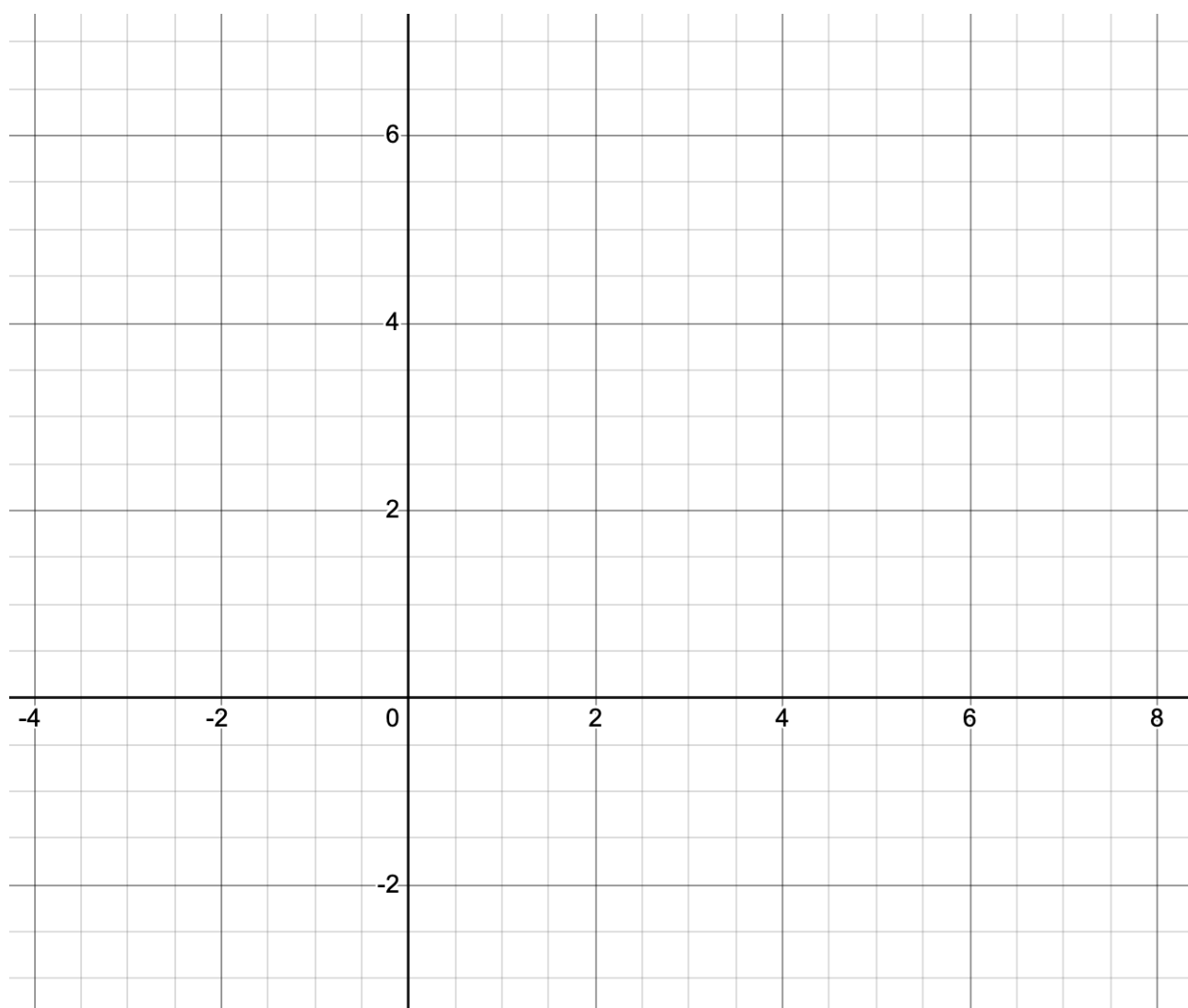
5   Circle centre $(-3,2)$ passes through the point $P(0,6)$.

a)   Find the equation of the circle.

[2 marks]

b)   Find the equation of the tangent to the circle at P.

[4 marks]

c) The tangent crosses the $x-$axis at the point Q. Find the area of the triangle OQP, where O denotes the origin.

[4 marks]

6 Work out the distance between the points $A(-4,6)$ and $B(2,3)$.

[2 marks]

7   The first four terms of a quadratic sequence are

$$1 \qquad 10 \qquad 23 \qquad 40$$

Work out an expression for the nth term of the sequence.

[3 marks]

8 Expand $(2 + 3x)^4$.

[4 marks]

9 Under the transformation represented by the matrix $\begin{pmatrix} 4 & -1 \\ 6 & -1 \end{pmatrix}$ which of there following points is not invariant?

[1 mark]

(1,3)   (2,4)   (3,9)   (5,15)

10 Work out the value of b such that $\left(x^4\right)^b = \left(x^3\right)^5$,

[2 marks]

11 Simplify fully $\dfrac{3x^2 - 27}{x + 2} \div \dfrac{x^2 - 6x + 9}{x^2 + 5x + 6}$

[4 marks]

12 Let $f(x) = 4x + 1$ and $g(x) = x^2$. Solve $fg(x) = gf(x)$.

[4 marks]

13 The nth term of a sequence is given by $\dfrac{4n^2}{3n^2 + 3}$.

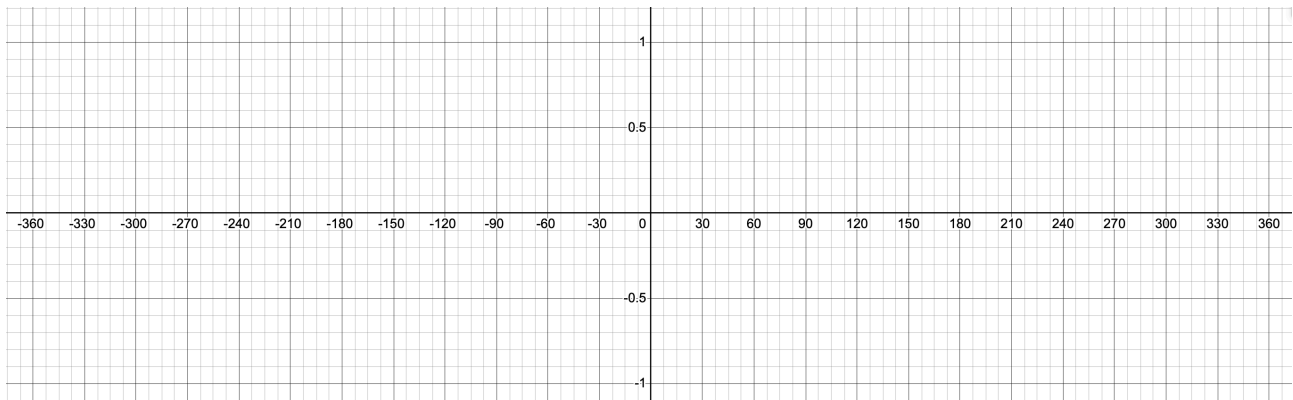**a)** One term of the sequence is $\dfrac{64}{51}$. Work out the value of n.

[2 marks]

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

[1 mark]

14   **a)**   On the axes below sketch $y = \sin(x)$ for $-360° \leq x \leq 360°$

[2 marks]

b)   Solve $\sin(x) = \dfrac{\sqrt{3}}{2}$ for $-360° \leq x \leq 360°$

[4 marks]

15   Prove that

$$\frac{1}{1 + \sin(x)} + \frac{1}{1 - \sin(x)} = \frac{2}{\cos^2(x)}$$

[4 marks]

16 Let n be a positive integer.

a) Write down the next odd number greater than $2n - 1$.

[1 mark]

b) Prove that the product of two consecutive odd numbers is always one less than a multiple of 4.

[3 marks]

17 $\begin{pmatrix} 4 & a \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 22 \\ b \end{pmatrix}$

Find the values of a and b.

[3 marks

18   **a)**   Using the factor theorem show that $(x - 2)$ is a factor of
$p(x) = x^3 + x^2 - 4x - 4$.

[2 marks]

b)   Hence, fully factorise $p(x)$.

[3 marks]

19 Solve the simultaneous equations

$$x + y = \frac{23}{5}$$
$$xy = -2$$

[5 marks]

20 A triangle has sides 6cm, 8cm and 10cm.
Given that the vertices of the triangle all lie on the circumference go a
circle, find the exact area of the circle not covered by the triangle.

[6 marks]