AQA A-Level Maths 2026 Paper 1

Do n0t turn over the page until instructed to do so.

This assessment is out of 100 marks and you will be given 120 minutes.

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

Name:

Total Marks: / 100

1 Write as a single logarithm

$\log_{10}(5x) + 2\log_{10}(x)$

$\log_{10}\left(5x^3\right)$ $\log_{10}\left(5x^2\right)$ $\log_{10}\left(5\right)$ $\frac{5}{2}\log_{10}(x)$

[1 mark]

2 Which of the following binomial expressions isn't valid for $x = \frac{1}{3}$.

$(1+2x)^{-1}$ $\left(1+5x\right)^{-\frac{1}{2}}$

$(2+3x)^{-\frac{1}{3}}$ $\left(3+5x\right)^{-2}$

[1 mark]

3 It is given that

$$\int_0^5 f(x)\ \mathrm{d}x = 15 \qquad \text{and} \qquad \int_0^2 f(x)\ \mathrm{d}x = -5$$

Find the value of $\int_2^5 f(x)\ \mathrm{d}x$.

10 -10 -20 20

[1 mark]

4 A curve with equation $y = f(x)$ passes through the point $(4,9)$.

Given that $f'(4) = 0$ find the equation of the tangent to the curve at $(4,9)$.

Circle your answer.

$y = 9$ $x = 4$ $y = \frac{9}{4}$ $y = 0$

[1 mark]

5 A function $f(x)$ is such that $f(4) = 6$ and $f'(x) = \dfrac{2x^3 + \sqrt{x}}{x}$.

Find an expression for $f(x)$.

[4 marks]

6 Let $p(x)$ be a polynomial such that

$$p(x) = 3x^3 + ax^2 + bx - 24$$

Where a and b are real valued constants.

Given that

- $(x - 3)$ is a factor of $p(x)$,
- and $p'(2) = 22$,

find the values of the constants a and b and fully factorise $p(x)$.

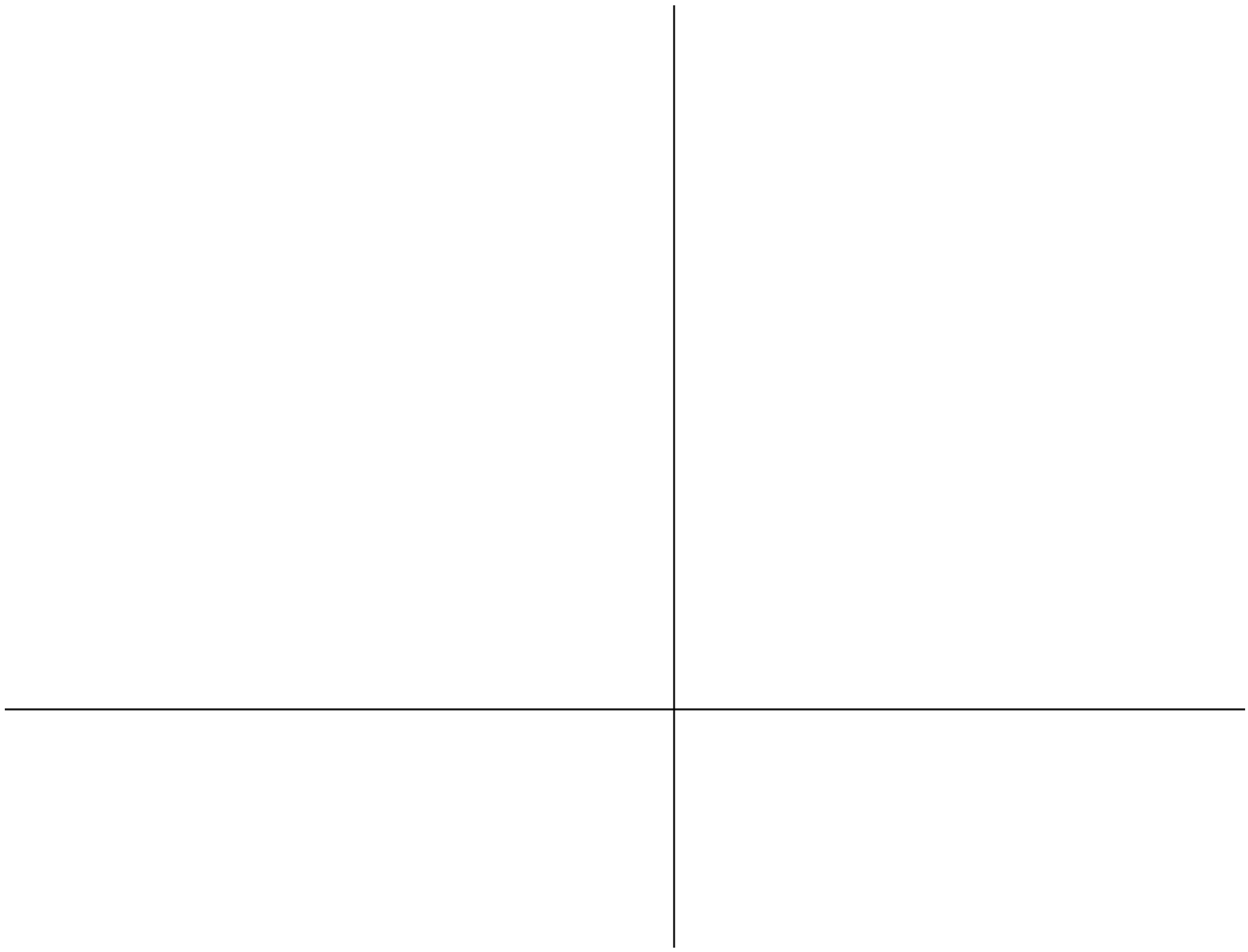
[5 marks]

7 Let $a,\ b \in \mathbb{R}$. Prove that $\dfrac{a+b}{2} \geq \sqrt{ab}$

[4 marks]

8 **a)** Sketch on the axes below the graphs of $y = 3 - |2x - 3|$ and $y = \left|\frac{x}{2}\right| + 1$.

[3 marks]



b) Hence, solve the inequality

$$\left|\frac{x}{2}\right| + 1 \leq 3 - |2x - 3|$$

[4 marks]

9 Kia is a solving a logarithmic equation and her solution is shown below.

Line 1: $$3\log_3(x) - \log_3\left(\sqrt{x}\right) = 10$$

Line 2: $$3\log_3\left(\frac{x}{\sqrt{x}}\right) = 10$$

Line 3: $$3\log_3\left(x^{\frac{1}{2}}\right) = 10$$

Line 4: $$\frac{3}{2}\log_3(x) = 10$$

Line 5: $$\log_3(x) = \frac{20}{3}$$

Line 6: $$x = \left(\frac{20}{3}\right)^3$$

Line 7: $$x = \frac{8000}{27}$$

a) Identify the two mistakes that Kia has made.

[2 marks]

b) Correctly solve this equation.

[3 marks]

10 A sequence of triangular tiles is to be cut from a sheet of ABS plastic.

The first tile to be cut has two sides of length 4 cm 2 cm respectively with an angle of 60° between them.

Subsequent tiles are made by enlarging the previous tile by a scale factor of a $\frac{1}{2}$.

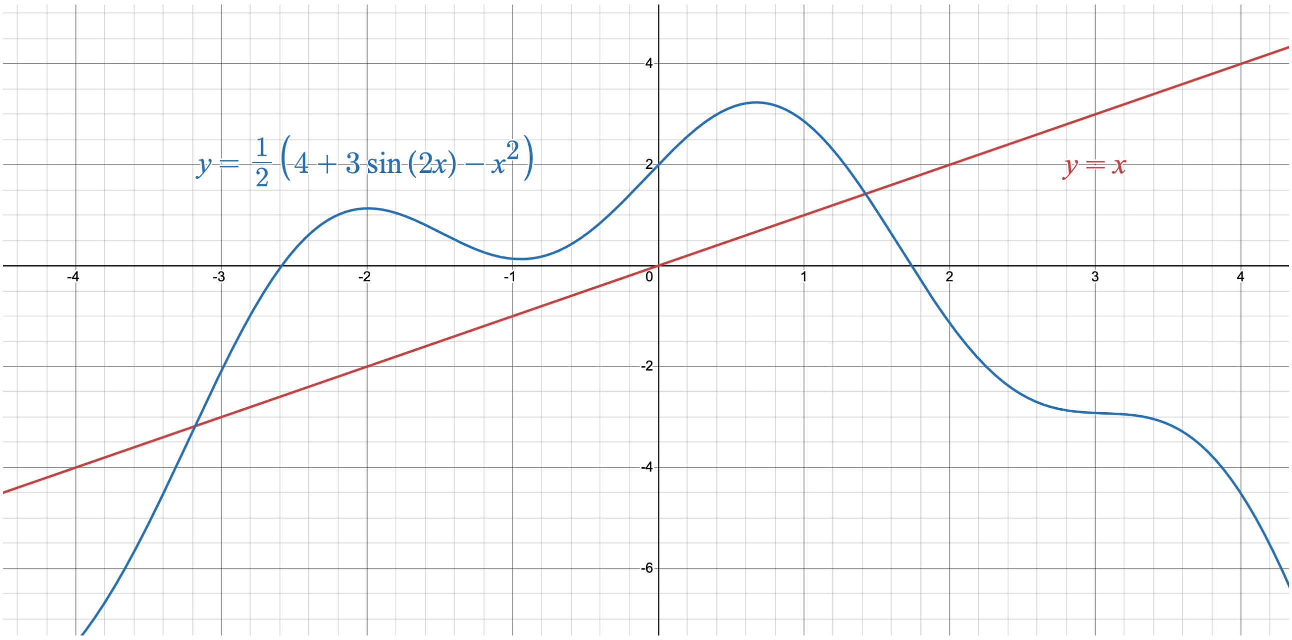
Show that all tiles to be made from this sequence can be cut from a sheet of ABS of area 5 cm^2.

[5 marks]

11 **a)** Given that $x > 0$, show that the curves of $y = x^2 + 2x - 4$ and $y = 3\sin(2x)$ intersect at a point α such that $1 < \alpha < 1.5$.

[2 marks]

b) The graph below shows the line $y = x$ and a function $y = g(x) = \frac{1}{2}\left(4 + 3\sin(2x) - x^2\right)$.



Using annotations on the graph explain why the iteration defined by

$$x_{n+1} = \frac{1}{2}\left(4 + 3\sin(2x_n) - x_n^2\right)$$

with $x_0 = 1.2$ will not converge to the point $x = \alpha$.

[2 marks]

c) Gerry uses a Newton-Raphson iteration with a starting value of $x_0 = 1.2$ to find α.

Form the iteration and perform three iterates to find x_3, a better approximation to $x = \alpha$.

[4 mark]

d) Show that to three decimal places the root is $\alpha = 1.423$

[2 marks]

e) Katie uses the same Newton-Raphson iteration but with a starting value of $x_0 = 0.52$.

Katie observes that it takes her longer to converge to the root than Tom.

Explain why this may be the case.

[2 marks]

12 The scaled concentration, Z, of a reagent in a chemical equation at time, t hours, can be modelled by the differential equation.

$$\frac{\mathrm{d}Z}{\mathrm{d}t} = \frac{\mathrm{e}^{-2Z}(4t + 11)}{t^2 + 5t + 6}$$

a) Given that at time $t = 0$ the scaled concentration is $Z = 2$ grams per litre, find a solution of the form

$$Z = \frac{1}{a} \ln \left(2 \ln \left(\frac{f(t)}{b} \right) + \mathrm{e}^{d} \right)$$

where $f(t)$ is some function of t to be found and a, b and d are i integer constants.

[8 marks]

b) What is the scaled concentration after 2 hours.

[2 marks]

13 Let $y = f(x) = \mathrm{e}^{-2x^2+12x}$ be a curve in Cartesian space.

a) Find the $x-$coordinates of the points of inflection of the curve

[5 marks]

b) Hence, identify the regions where $f(x)$ is concave and convex.

[2 marks]

14 a) Prove that $\sin(3\theta) = 3\sin(\theta) - 4\sin^3(\theta)$

[4 marks]

b) Using part (a) and the given identity $\cos(3\theta) = 4\cos^3(\theta) - 3\cos(\theta)$ show that

$$\tan(3\theta) = \frac{a\tan(\theta) - b\tan^3(\theta)}{b - a\tan^2(\theta)}$$

where $a, b \in \mathbb{Z}$ are to be found.

[5 marks]

c) Hence, for, $0 \leq x \leq 2\pi$, solve

$$\frac{9\tan(x) - 3\tan^3(x)}{1 - 3\tan^2(x)} = \sqrt{3}$$

[3 marks]

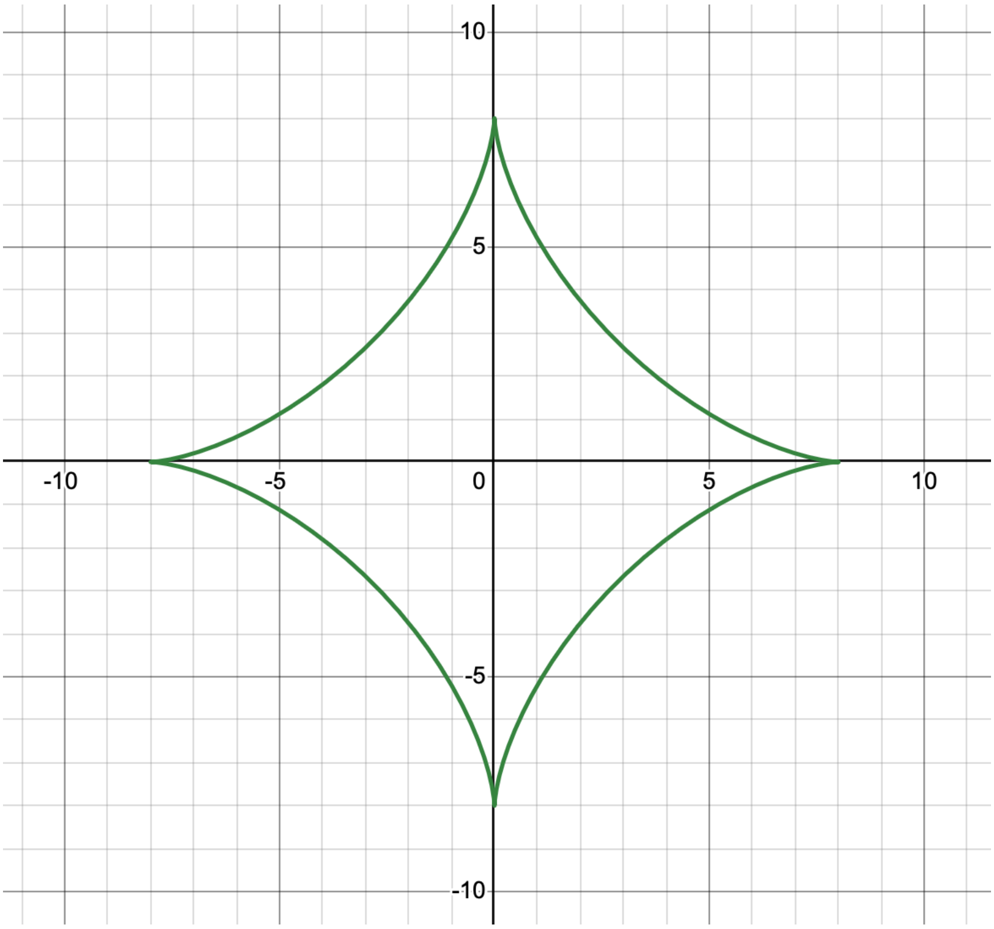
15 The centre of a circle, C, lies on the line $y = \frac{1}{3}x + \frac{11}{3}$.

Given that $A(6,9)$ and $B(-8, -5)$ are two points on the circumference of C, determine the values of k for which the line $4x - 3y = k$ is a tangent to the circle C.

[11 marks]

17 The curve shown in the picture below is known as an Astroid and has Cartesian equation

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



a) Find thee stationary points of the curve.

[5 marks]

b) Given that the parametric form of the astroid shown is $x = 8\cos^3(t)$, $y = 8\sin^3(t)$ for $0 \le t \le 2\pi$ find the area enclosed by the curve.

You may use, without proof, that $\displaystyle\int_0^{\frac{\pi}{2}} \sin^6(x)\ \mathrm{d}x = \frac{5\pi}{32}$.

Fully justify your answer.

[9 marks]