GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C1

Paper 1

Time: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You are not permitted to use a calculator in this paper.**

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- **You are reminded of the need for clear presentation in your answers.**

1. Express $\dfrac{1}{\left(\sqrt[3]{x}\right)^{\frac{6}{5}}}$ in the form x^n, stating the value of n. [2]

2. Factorise $21x^2 + 4x - 1$. [1]

Hence, or otherwise, solve the equation

$$21y^{\frac{2}{3}} + 4y^{\frac{1}{3}} - 1 = 0.$$

Give your answers as fractions. [3]

3. A circle has the equation $x^2 - 6x + y^2 + 8y + 22 = 0$.

i) Find the co-ordinates of the centre of the circle. [2]

ii) Find the radius of the circle. [1]

iii) Find the shortest distance from the origin to the circle. [2]

4. The straight line p is perpendicular to the line with equation $x + 2y = 1$ and passes through the point $A(a, 2)$. Find, in terms of the constant a, an equation for the line p. [3]

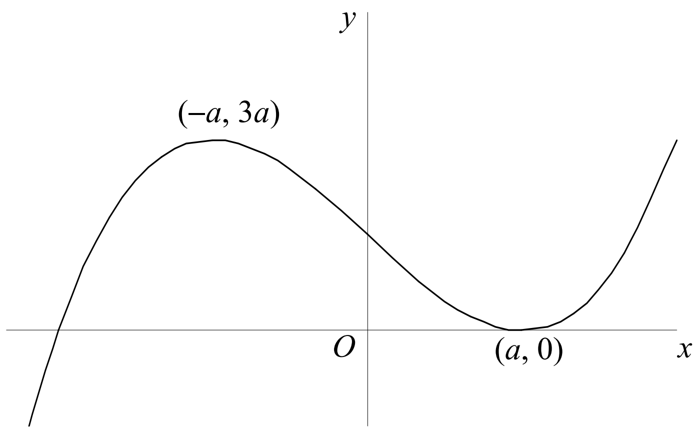
Given that the line p crosses the y-axis at the point $B(0, 3)$, find the value of a, and hence find the distance AB. [3]

5. Solve the simultaneous equations $x - 4y = 2$, $x^2 - 4xy = 8$. [5]

6. The diagram shows the curve $y = f(x)$, where a is a positive constant. The maximum and minimum points on the curve are $(-a, 3a)$ and $(a, 0)$ respectively.
Sketch the following curves, on separate diagrams, in each case stating the co–ordinates of the maximum and minimum points:

i) $y = f(x - a)$

ii) $y = -2f(x)$. [4]

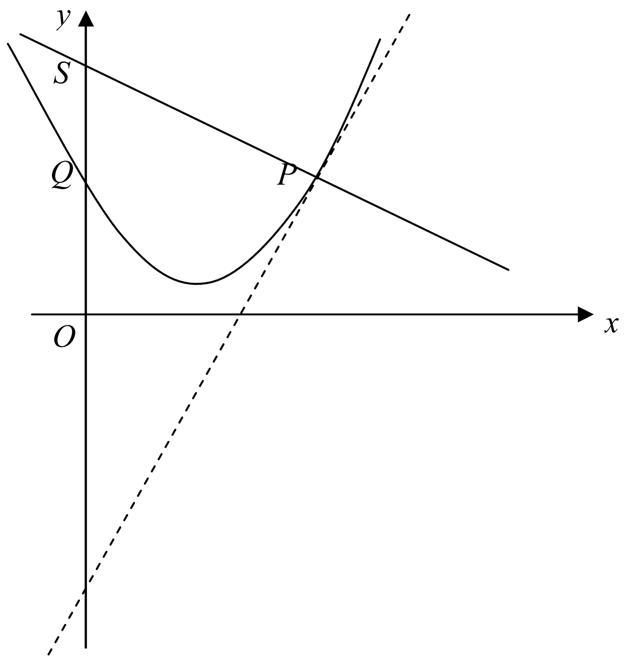


7. Find by differentiation the exact coordinates of the stationary point of the curve with equation

$$y = \frac{1}{x} + \frac{6}{x^2}.$$ [4]

Determine whether this stationary point is a maximum or a minimum, showing your working. [2]

8.



The diagram shows the curve

$$y = x^2 - bx + c,$$

where b and c are positive constants such that $b^2 - 4c < 0$. The curve crosses the y-axis at the point Q with coordinates $(0, c)$, and P is the point with coordinates (b, c). The normal to the curve at P meets the y-axis at S.

Show that the distance QS does not depend on the values of b and c. [4]

ANSWERS.

1. $x^{-\frac{2}{5}}$; $n = -\frac{2}{5}$.

2. $(7x - 1)(3x + 1)$. $y = \frac{1}{343}$ or $y = -\frac{1}{27}$.

3. i) $(3, -4)$
ii) $\sqrt{3}$
iii) $5 - \sqrt{3}$.

4. $y = 2x + 2 - 2a$. $a = -\frac{1}{2}$. $AB = \frac{\sqrt{5}}{2}$.

5. $x = 4$, $y = \frac{1}{2}$.

6. i) max $= (0, 3a)$, min $= (2a, 0)$
ii) max $= (a, 0)$, min $= (-a, -6a)$.

7. $\left(-12, -\frac{1}{24}\right)$. Min point.

8. $QS = 1$.