



Mathematical Methods

Question and Answer Book

SAC 1a (Tech-Free)

- Reading time is **5 minutes**
- Writing time is **55 minutes**

Approved materials

- Writing equipment (students are **not** permitted to bring any technology or notes of any kind)
- The VCAA formula sheet

Materials supplied

- Question and Answer Book of 9 pages

Instructions

Students are not permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents

6 questions (30 marks)

pages

2 – 9

Instructions

Answer **all** questions in the spaces provided.

Write your responses in English.

In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.

In questions where more than one mark is available, appropriate working **must** be shown.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (3 marks)

- a. Let $y = (x^3 + 6)^3$. Find $\frac{dy}{dx}$. (1 mark)

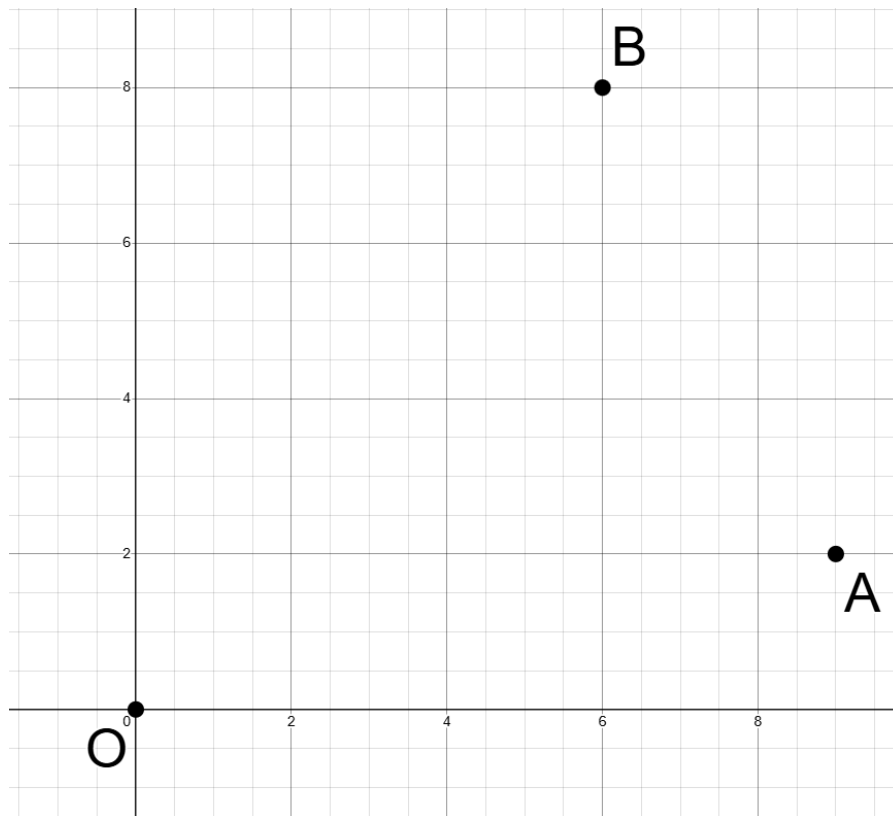
- b. Consider the function

$$f: R \rightarrow R, f(x) = \frac{1}{x^2 + 1}.$$

Find $f'(-1)$. (2 marks)

Question 2 (5 marks)

Consider the points $A = (9,2)$ and $B = (6,8)$, as depicted below.



- a. Determine the equation of line AB . (1 mark)

- b. Determine the equation of the line through O perpendicular to line AB . (1 mark)

c. On the diagram above, mark the point P on line AB such that line OP is perpendicular to line AB , and label it with its coordinates. (1 mark)

d. What is the area of $\triangle OAB$? (2 marks)

Question 3 (6 marks)

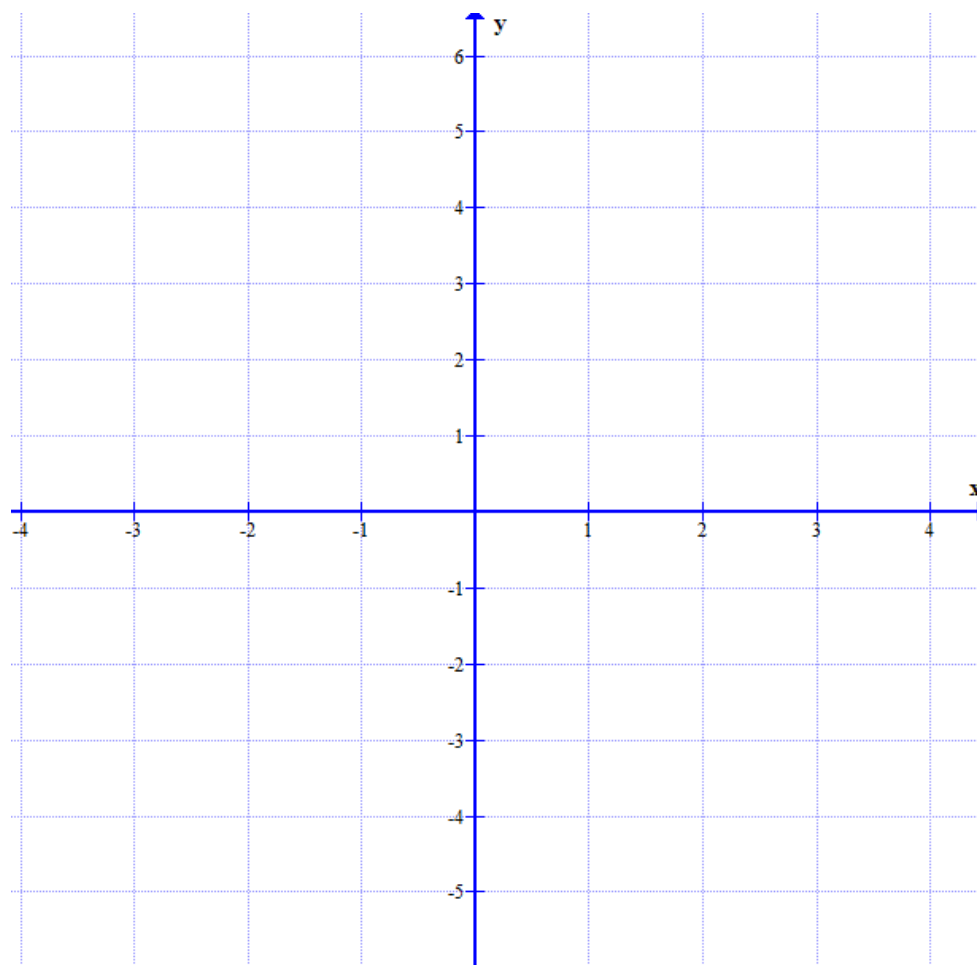
Consider the polynomial $p(x) = x^3 + 3x^2 - 4$.

- a. Verify that $x - 1$ is a factor of $p(x)$. (1 mark)

- b. Hence or otherwise, factorise $p(x)$ into linear factors. (1 mark)

- c. Find the coordinates of the stationary points of $p(x)$. (2 marks)

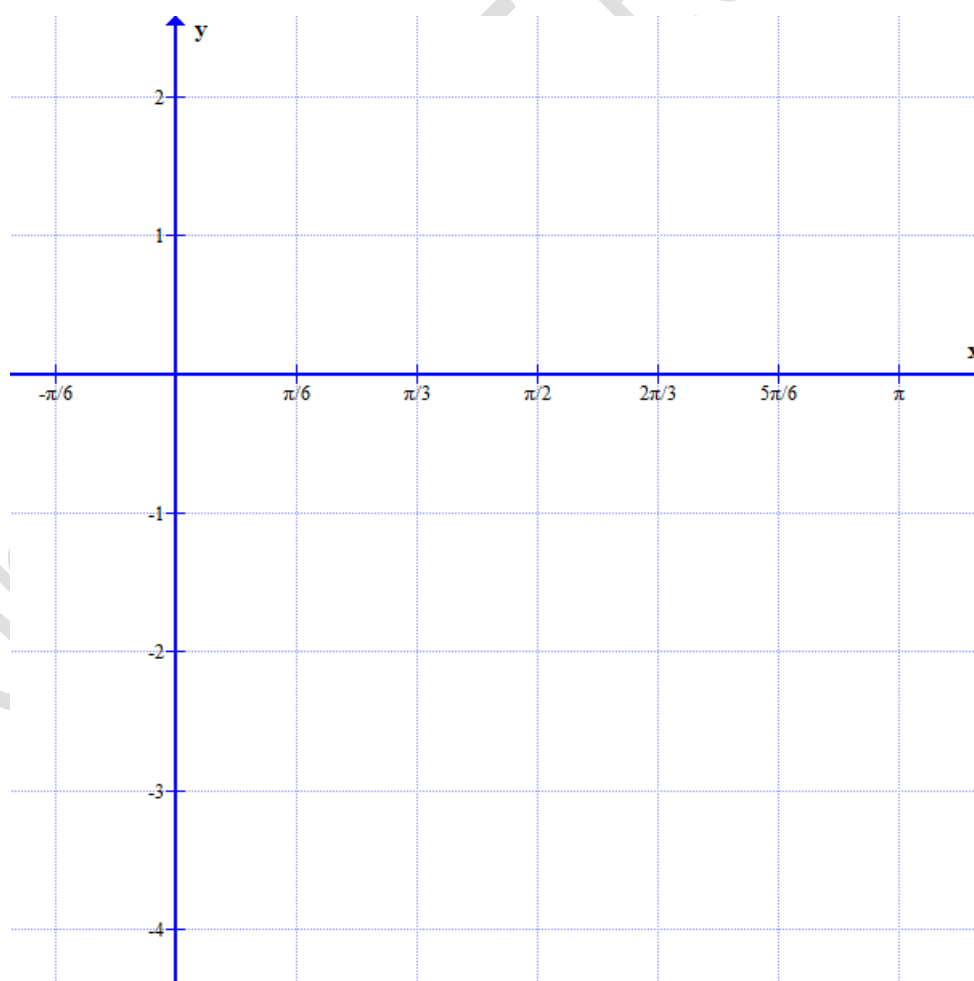
- d. Graph $y = p(x)$ on the axes below, labelling all turning points and axial intercepts with their coordinates. (2 marks)



Question 4 (5 marks)

- a. Solve $\sin\left(2x - \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$ in the range $x \in [0, \pi]$. (2 marks)

- b. Graph $y = 2 \sin\left(2x - \frac{\pi}{3}\right) - \sqrt{3}$ for $x \in [0, \pi]$ on the axes below, labelling endpoints, axial intercepts and turning points with their coordinates.



Question 5 (6 marks)

Consider the function $f: [-2, 0] \rightarrow \mathbb{R}$, $f(x) = 4^{-x} - 1$.

- a. Define the inverse function $f^{-1}(x)$. (2 marks)

- b. I want to apply a dilation to the graph of $y = f(x)$ so that it passes through the point $(-2, 3)$.

- i. State two possible choices of dilation, one from the x -axis and one from the y -axis. (2 marks)

- ii. In each case, find the rule for the resulting graph. (2 marks)

Question 6 (5 marks)

- a. Solve the equation $\log_2(4 - x) + \log_2(1 + x) = 2$. (2 marks)

- b. Find all real numbers c for which the equation $\log_2(c - x) + \log_2(1 + x) = 2$ has no real solutions in x . (3 marks)

END OF QUESTION AND ANSWER BOOK

Complete VCE Education