



VCE Mathematical Methods

Written examination 1 – End of year

Sample questions

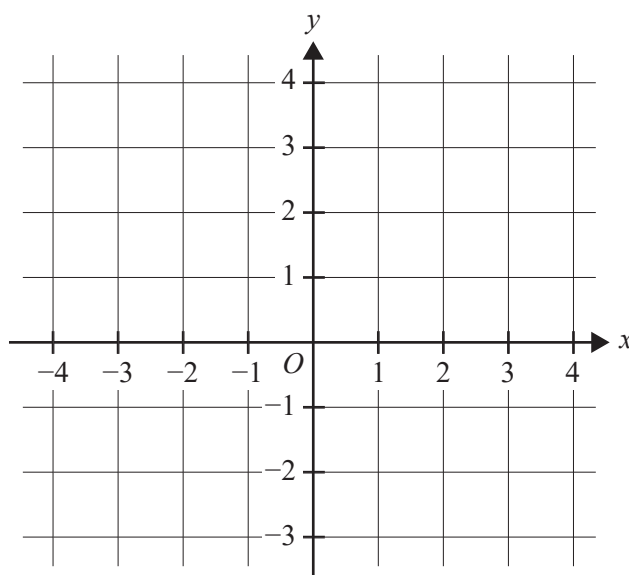
These sample questions are intended to demonstrate how new aspects of Units 3 and 4 of VCE Mathematical Methods may be examined in written examination 1. They do **not** constitute a full examination paper.

Question 1 (5 marks)

Let $f : [-3, -2) \cup (-2, \infty) \rightarrow \mathbb{R}$, $f(x) = 1 + \frac{1}{x+2}$.

- a. On the axes below, sketch the graph of f . Label any asymptotes with their equations, and endpoints and axial intercepts with their coordinates.

3 marks



- b. Find the values of x for which $f(x) \leq 2$.

2 marks

Question 2 (5 marks)

Consider the functions f and g , where

$$f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = x^2 - 9$$

$$g : [0, \infty) \rightarrow \mathbb{R}, g(x) = \sqrt{x}$$

- a. State the range of f . 1 mark

- b. Determine the rule for the equation and state the domain of the function $f \circ g$. 2 marks

- c. Let h be the function $h : D \rightarrow \mathbb{R}, h(x) = x^2 - 9$.
Determine the maximal domain, D , such that $g \circ h$ exists. 2 marks

Question 3 (3 marks)

Find the general solution for $2\sin(x) = \tan(x)$ for $x \in \mathbb{R}$.

Question 4 (4 marks)

Consider the simultaneous equations below, where a and b are real constants.

$$(a + 3)x + 9y = 3b$$

$$2x + ay = 5$$

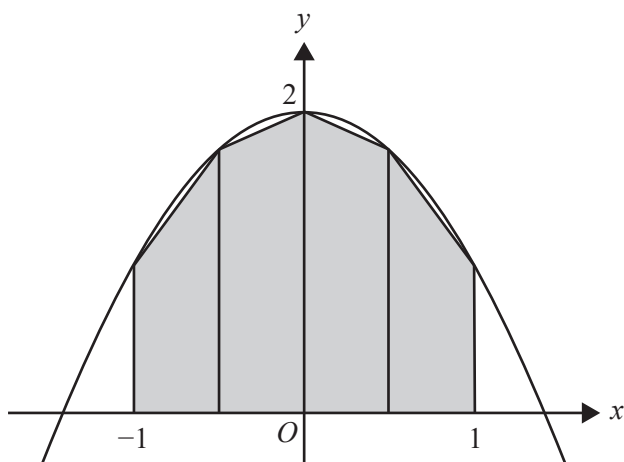
Find the values of a and b for which the simultaneous equations have no solutions.

Question 5 (6 marks)Let $f: R \rightarrow R$, where $f(x) = 2 - x^2$.

- a. Calculate the average rate of change of f between $x = -1$ and $x = 1$. 1 mark

- b. Calculate the average value of f between $x = -1$ and $x = 1$. 2 marks

- c. Four trapeziums of equal width are used to approximate the area between the functions $f(x) = 2 - x^2$ and the x -axis from $x = -1$ to $x = 1$.
The heights of the left and right edges of each trapezium are the values of $y = f(x)$, as shown in the graph below.



- Find the total area of the four trapeziums. 3 marks

Question 6 (3 marks)

Newton's method is used to estimate the x -intercept of the function $f(x) = \frac{1}{3}x^3 + 2x + 4$.

- a. Verify that $f(-1) > 0$ and $f(-2) < 0$.

1 mark

- b. Using an initial estimate of $x_0 = -1$, find the value of x_1 .

2 marks

Question 7 (3 marks)

The duration of telemarketing calls to mobile phone users is a continuous random variable T minutes, with probability density function

$$f(t) = \begin{cases} \frac{2}{5}e^{-\frac{2}{5}t} & t \geq 0 \\ 0 & \text{elsewhere} \end{cases}$$

Find the value of k such that 90% of telemarketing calls last less than k minutes. Express your answer in the form $\frac{a}{b} \log_e(c)$, where a , b and c are positive integers.
