

Trial Examination 2013

VCE Specialist Mathematics Units 3 & 4

Written Examination 1

Question and Answer Booklet

Reading time: 15 minutes

Writing time: 1 hour

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Number of questions	Number of questions to be answered	Number of marks
10	10	40

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers.

Students are not permitted to bring into the examination room: notes of any kind, a calculator of any type, blank sheets of paper and/or white out liquid/tape.

Materials supplied

Question and answer booklet of 11 pages. Formula sheet of miscellaneous formulas.

Working space is provided throughout the booklet.

Instructions

Write **your name** and your **teacher's name** in the space provided above on this page.

All written responses must be in English.

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

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2013 VCE Specialist Mathematics Units 3 & 4 Written Examination 1.

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Instructions

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

A decimal approximation will not be accepted if an **exact** answer is required to a question.

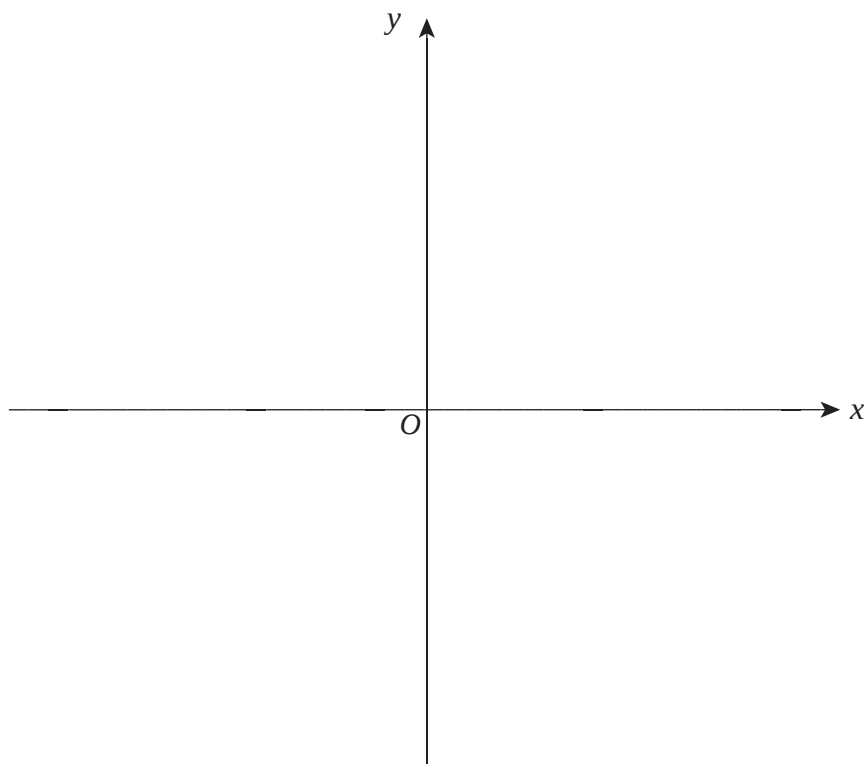
In questions where more than one mark is available, appropriate working **must** be shown.

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

Take the **acceleration due to gravity** to have magnitude $g \text{ m/s}^2$, where $g = 9.8$.

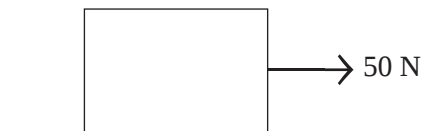
Question 1 (2 marks)

Sketch the curve with equation $y = \frac{1}{4x^2 + 1}$. State the coordinates of the points where the curve intersects the coordinate axes and the equations of any asymptotes.



Question 2 (4 marks)

A block of mass 4 kg is made to move in a straight line on a rough horizontal surface by a horizontal force of 50 newtons, as shown in the diagram.



- a.** On the diagram above, mark in the forces acting on the block. 1 mark
- b.** Find the magnitude of the normal reaction force acting on the block. 1 mark

The acceleration of the block is 2 m/s^2 .

- c.** Find the magnitude of the friction force acting on the block. 2 marks

Question 3 (4 marks)

Consider the function $g(x) = x^2 e^{-x}$, $x \geq 0$.

Find the x -coordinates of the points of inflection on the graph of g .

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

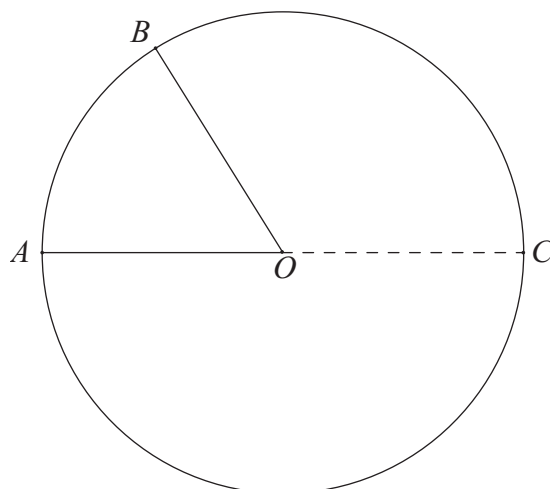
Question 6 (4 marks)

Solve $z^2 = 5 - 12i$, $z \in \mathbb{C}$.

Express your answers in the form $z = x + yi$, $x, y \in \mathbb{R}$.

Question 7 (3 marks)

A circle with centre O is shown below. The points A , B and C lie on the circumference of the circle and AC is a diameter.



Let $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

Prove that $\angle ABC$ is a right angle.

Question 8 (6 marks)

A curve C is defined by $x^3y - \sin\left(\frac{\pi y}{2}\right) = 7$.

The point $P(k, 1)$ lies on C .

a. Show that $k = 2$.

2 marks

b. For this value of k , find the gradient at P .

4 marks

Question 9 (4 marks)

The acceleration, $a \text{ m/s}^2$, of a body at a displacement x metres from a fixed origin O is given by $a = \frac{2x}{x^2 + 1}$.

Find the velocity, $v \text{ m/s}$, of the body given that $v = 1$ when $x = 0$.

Question 10 (5 marks)

Consider the equation $\frac{(z + i)^n}{z^n} = 1$ where n is a positive integer.

- a. Use De Moivre's theorem to show that $z = \frac{i}{\text{cis}\left(\frac{2k\pi}{n}\right) - 1}$, $k = 1, 2, \dots, n - 1$. 2 marks
