

Trial Examination 2014

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
9	9	40

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and 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 9 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 2014 VCE Specialist Mathematics Units 3&4 Written Examination 1.

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Instructions

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

Unless otherwise specified, 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 $g = 9.8$.

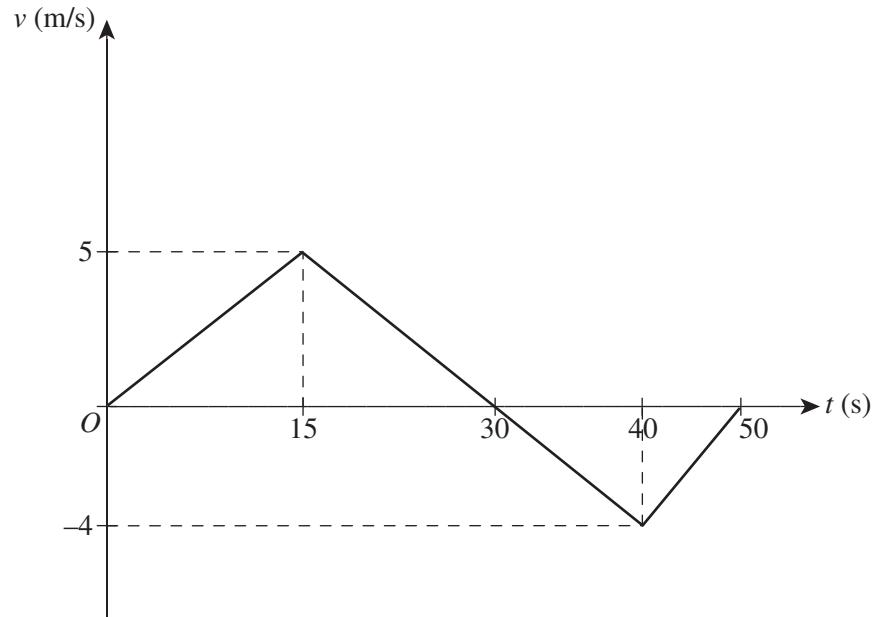
Question 1 (2 marks)

Consider $P(z) = z^3 - z^2 - 5$, $z \in \mathbb{C}$.

Find the remainder when $P(z)$ is divided by $z + i$.

Question 2 (3 marks)

The graph below shows the velocity, v m/s, of a particle at time t seconds as it moves in a straight horizontal line.



At time t seconds the particle's displacement from a fixed origin, O , is x metres.

At $t = 0$ the particle is at O .

Find the displacement of the particle at the end of its motion.

Question 3 (4 marks)

A body of mass m kg is acted upon by three concurrent coplanar forces: $\vec{R}$, $\vec{S}$ and $\vec{T}$, where $\vec{R} = -\vec{i} - 2\vec{j}$,
 $\vec{S} = 4\vec{i} - \vec{j}$ and $\vec{T} = 3\vec{i} + 11\vec{j}$.

The forces are measured in newtons.

- a.** Find the magnitude of the resultant force acting on the body. 2 marks

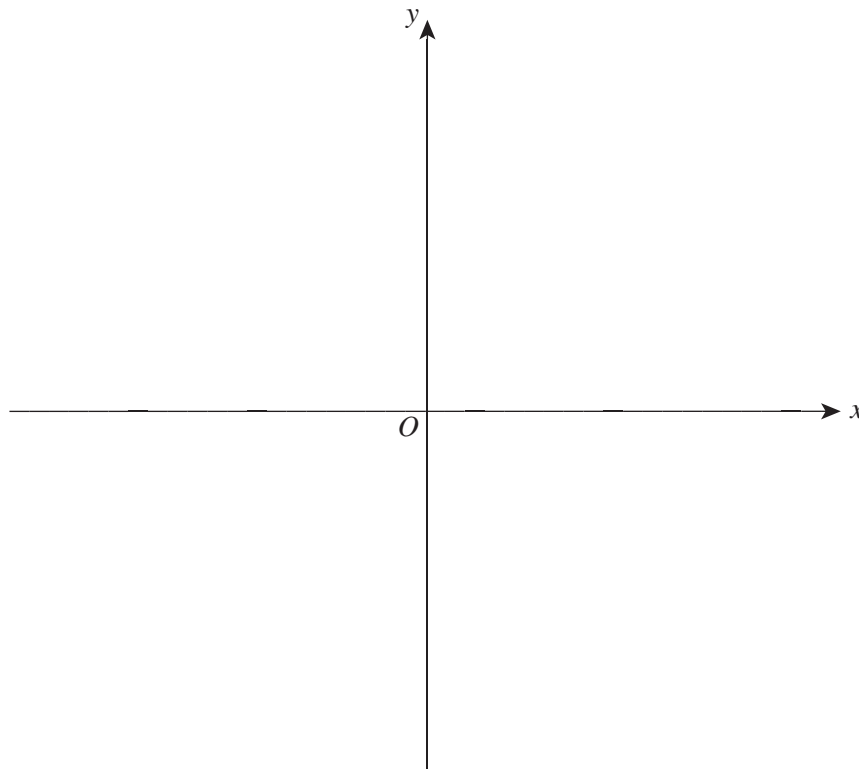
When these three forces act on the body it has an acceleration of $(1.5\vec{i} + 2\vec{j}) \text{ m/s}^2$.

- b.** Find the mass of the body. 2 marks

Question 4 (7 marks)

- a.** State the maximal domain and the range of $y = \arcsin(2x + 3)$. 2 marks

- b.** Sketch the graph of $y = \arcsin(2x + 3)$ over its maximal domain. Label the endpoints with their coordinates. 2 marks



- c.** Find the gradient of the tangent to the graph of $y = \arcsin(2x + 3)$ at $x = -\frac{5}{4}$. 3 marks

Question 8 (5 marks)

The decrease in a thermometer's temperature reading is modelled by the differential equation

$$\frac{dT}{dt} = -k(T - T_0), k > 0, \text{ where } T_0^\circ\text{C is the outdoor temperature.}$$

A thermometer kept at a constant room temperature of 25°C is placed outside.

After five minutes outside the temperature reading is 15°C.

Five minutes later the temperature reading is 10°C .

If T_0 °C is the thermometer's temperature reading t minutes after being placed outside, find T_0 .

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.

