Write your **student number** in the boxes above. **Letter**

# Mathematical Methods ½

## Examination 1 (Tech-Free)

### Question and Answer Book

VCE Examination (Term 1 Mock) – April 2025

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- Reading time is **15 minutes**.
- Writing time is **1 hour**.

### Materials Supplied

- Question and Answer Book of 13 pages.

### Instructions

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

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### Contents



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**Student's Full Name:** _____

**Student's Email:** _____

**Tutor's Name:** _____

**Marks (Tutor Only):** _____

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# Section A

## Instructions

- Answer **all** questions in the spaces provided.
- Write your responses in English.

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**Question 1** (3 marks)

Given that $(x-2)$ is a factor of the polynomial $p(x) = 12x^3 - 19x^2 - 13x + 6$, solve the equation $12x^4 - 19x^3 - 13x^2 + 6x = 0$.

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**Question 2** (3 marks)

Consider the following set of simultaneous equations:

$$-2x + ky = 4$$
$$(1 - k)x + y = 2$$

Where $k$ is real constant.

Find the value of $k$, such that the set of simultaneous equations has infinitely many solutions.

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**Question 3** (3 marks)

The quadratic curves with equations $y = k(2x^2 + 1)$ and $y = x^2 - 2x$, where $k$ is a constant, intersect each other **exactly once**. Determine the possible values of $k$.

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**Question 4** (5 marks)

$A$ and $B$ are events such that $\Pr(A) = 0.6$, $\Pr(A' \cap B) = 0.2$ and $\Pr(A \cap B') = 0.1$.

**a.** Find:

**i.** $\Pr(B)$. 1 mark

**ii.** $\Pr(A \cap B)$. 1 mark

**iii.** $\Pr(A \cup B')$. 1 mark

**iv.** $\Pr(A' \mid B')$. 1 mark

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**b. Hence,** explain whether events $A$ and $B$ are mutually exclusive. 1 mark

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**Question 5** (6 marks)

A group of five co-workers go to a live comedy show. There are three members from Team $A$ and two members from Team $B$.

**a.** If all five co-workers must sit in a row, how many possible seating arrangements exist? 1 mark

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**b.** If the three Team $A$ members must sit together, how many possible seating arrangements exist? 1 mark

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On one occasion, only four seats remain for the comedy show that the co-workers wish to attend.

**c.** If the three Team $A$ members and one Team $B$ member attend, how many possible combinations of co-workers exist? 1 mark

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**d.** If at least two Team $A$ members attend, how many possible combinations of co-workers exist? 2 marks

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**e.** If the group is selected randomly, what is the probability that it consists of exactly two members from Team $A$ and two members from Team $B$? 1 mark

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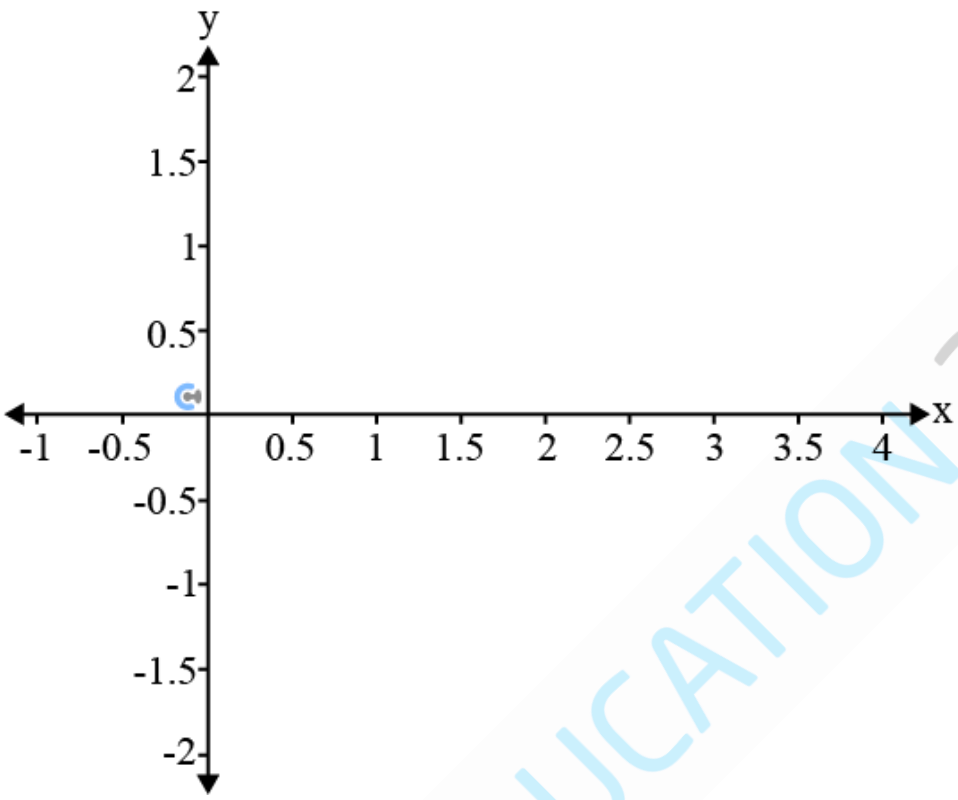
**Question 6** (3 marks)

Sketch $y = 1 - \frac{1}{(3-2x)^2}$ and label the asymptotes and the intercepts with the axes.

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**Question 7** (7 marks)

The graph of $f(x) = -\sqrt{9(x-2)} + 4$ undergoes the following transformations in the order given by:

$$g(x) = f\left(\frac{x}{4} - 3\right)$$

$$h(x) = -g(x) + 5$$

**a.** Describe a set of transformations given by $g(x) = f\left(\frac{x}{4} - 3\right)$ that maps the graph of $f$ to the graph of $g$. 2 marks

**b.** Describe the transformations given by $h(x) = -g(x) + 5$ that maps the graph of $g$ to the graph of $h$. 2 marks

**c.** Show that the image function is given by: 3 marks

$$h(x) = \frac{3}{2}\sqrt{x - 20} + 1$$



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**Question 8** (2 marks)

Consider the function $f: \mathbb{R} \to \mathbb{R}, f(x) = 2x^2 - 3$. State the domain and range of $f$, and state why $f$ does not have an inverse function, justifying your answer. Also, state a possible maximal domain so $f$ **does** have an inverse function.

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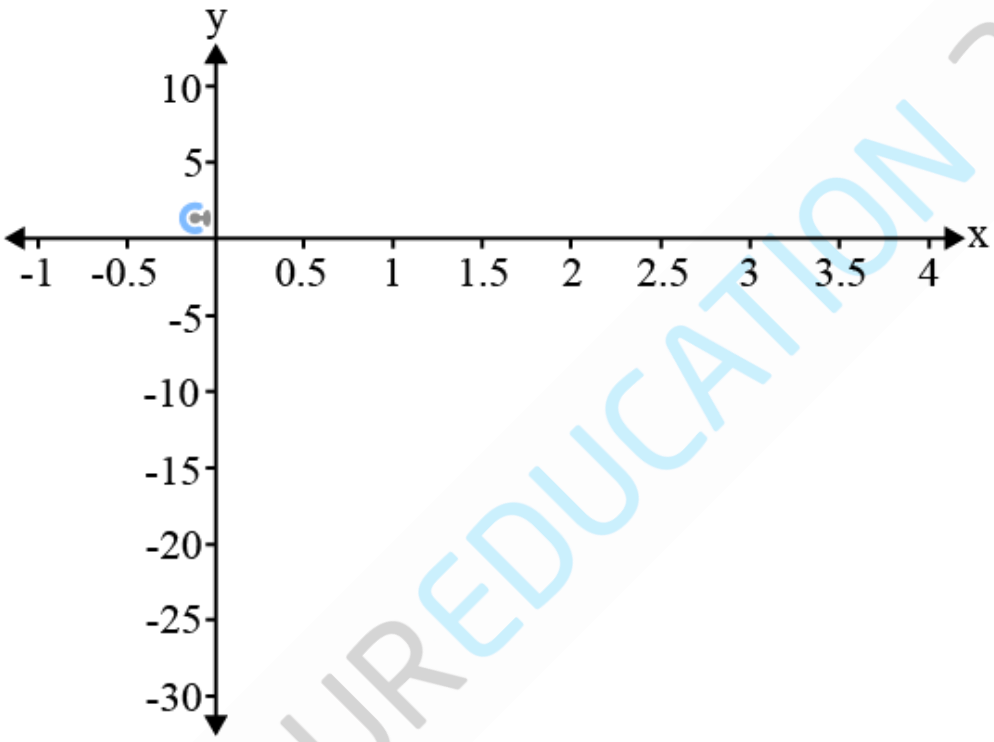
**Question 9** (4 marks)

An object is thrown by a 5 metre tall giant from the top of a high-rise building. The trajectory can be represented by the equation $H = 8x - 4x^2 + 5, x \in [0,4]$, where $H$ is the vertical distance from the top of the building and $x$ is the horizontal distance from the building (both distances measured in metres).

Sketch the path of the object, labelling endpoints and turning point and calculate the maximum and minimum heights of the object.

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**Question 10** (4 marks)

Consider the function $f: D \to \mathbb{R}, f(x) = \frac{\sqrt{10-2x}}{x^2-4x}$.

**a.** Find the maximal domain $D$ of the function. Express your answer using interval notation. 3 marks

Consider $g: (4,5) \to \mathbb{R}, g(x) = \frac{\sqrt{10-2x}}{x^2-4x}$.

**b.** Given that $g$ is a one-to-one function, state the range of $g$. 1 mark

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