Neap:

Trial Examination 2017

VCE Mathematical Methods 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: any technology (calculators or software), notes of any kind, blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question and answer booklet of 9 pages.

Formula sheet.

Working space is provided throughout the booklet.

Instructions

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

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

All written responses must be in English.

At the end of the examination

You may keep the formula sheet.

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 2017 VCE Mathematical Methods Units 3&4 Written Examination 1.

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Instructions

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

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 booklet are **not** drawn to scale.

Question 1 (4 marks)

a. Let $y = \sqrt{3x^2 - 4}$.

Find $\frac{dy}{dx}$. 1 mark

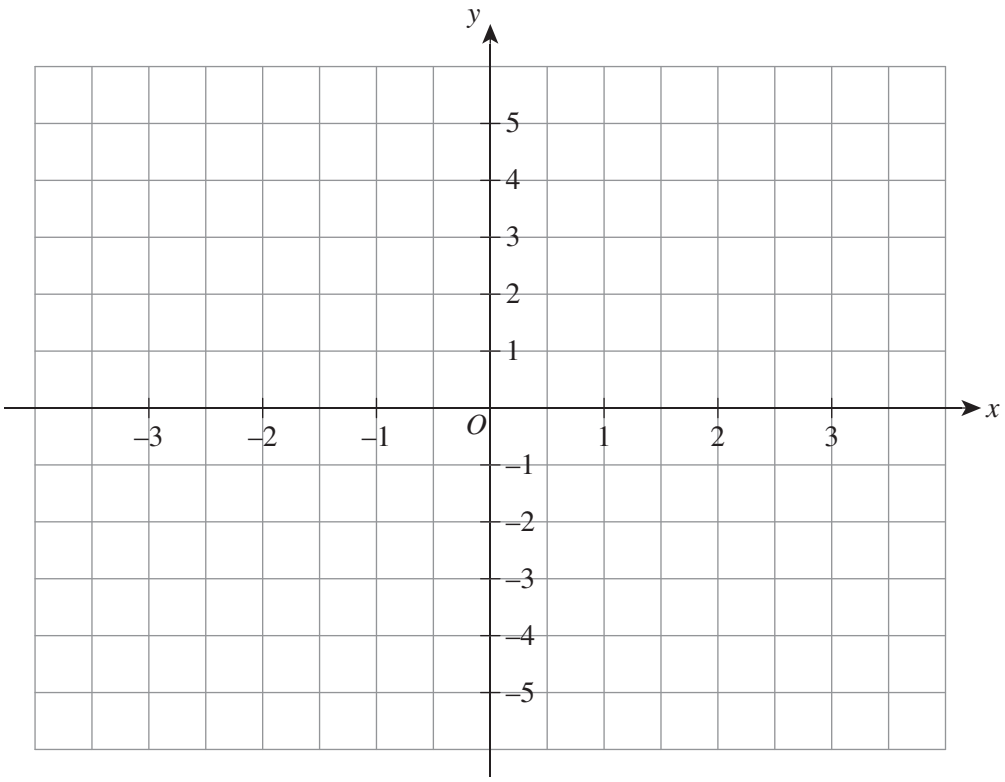
b. Let $f(x) = x^2\tan(2x)$.

Evaluate $f'\left(\frac{\pi}{2}\right)$. 3 marks

Question 2 (5 marks)

Let $f : R \setminus \{-1\} \rightarrow R$, where $f(x) = 1 - \frac{2}{x+1}$.

a. Sketch the graph of f. Label any intercepts with their coordinates and label any asymptotes with the appropriate equation. 3 marks



b. Calculate the exact area enclosed by the graph and the lines $x = 0$ and $x = 1$. 2 marks

Question 3 (3 marks)
Solve $2(2^{4b}) + 7(2^{2b}) = 4$ for b.

Question 4 (2 marks)
Let $f : R \to R$, where $f(x) = e^{3x} + 4$.

Find the rule for $f^{-1}(x)$.

Question 5 (3 marks)

The transformation $T : R^2 \rightarrow R^2$ is defined by

$$T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} -2 & 0 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -1 \\ -2 \end{bmatrix}$$

The image of the curve $y = \frac{1}{x} + 3$ under the transformation T has equation $y = \frac{a}{x+b} + c$.

Find the values of a, b and c.

Question 6 (3 marks)

A binomial experiment has mean 3 and variance $\frac{12}{5}$.

Calculate the number of trials n and the probability of success, p.

Question 7 (4 marks)

a. Let $f : R \rightarrow R$, where $f(x) = x\cos(2x)$.

Find $f'(x)$. 1 mark

b. Hence, find the value of $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} x\sin(2x)dx$. 3 marks

Question 8 (4 marks)

Let the random variable X be normally distributed with mean 3.1 and standard deviation 0.4.

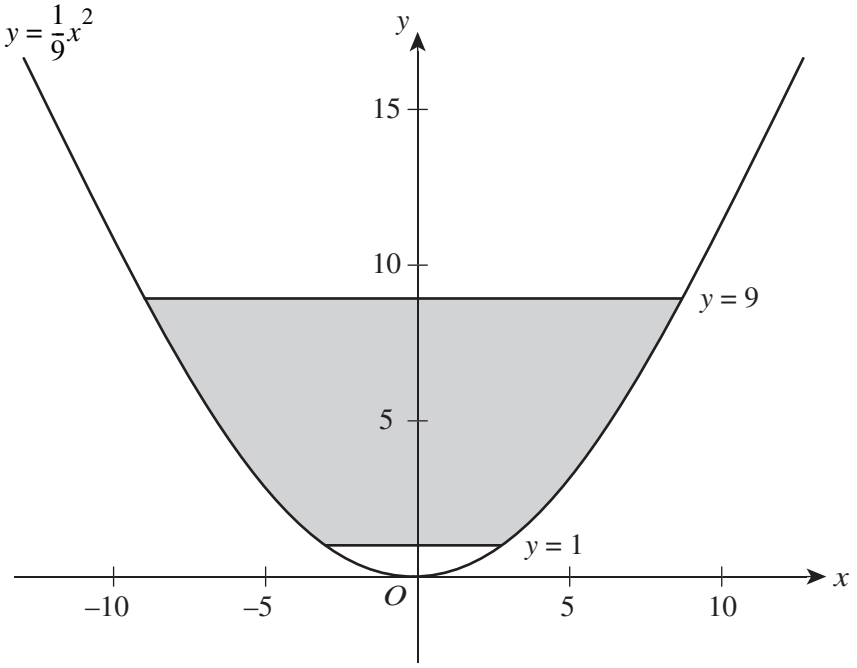
Let Z be the standard normal random variable, such that $Z \sim N(0, 1)$.

a. Find c such that $\Pr(Z > c) = \Pr(X < 2.3)$. 1 mark

b. Using $\Pr(Z < -1) = \frac{16}{100}$, calculate $\Pr(X < 2.7 \mid X < 3.5)$. 3 marks

Question 9 (12 marks)

A small pot plant is in the shape of a prism. The cross-section is formed by the lines $y = \frac{1}{9}x^2$, $y = 1$ and $y = 9$ where x represents the length in cm, as shown in the shaded section of the image below.



a. **i.** Calculate the area of the cross-section of the pot plant. 3 marks

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ii. If the length of the pot plant is 18 cm, what is the maximum volume in cm^3? 1 mark

_____

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The pot plant is filled with water. However, it has a small hole and water starts to leak out. The rate at which the water leaks out is modelled by the function $R(t) = 3t^2 - 4t + 1$, where t is time in hours.

b. After how long is the rate at which the water leaks out at a maximum? 2 marks

c. How long does it take for the water in the pot plant to empty? 4 marks

d. 850 cm^3 of water is added after 10 hours.
Will the pot plant overflow? Justify your answer. 2 marks

END OF QUESTION AND ANSWER BOOKLET