



THIS BOX IS FOR ILLUSTRATIVE PURPOSES ONLY

**‘2016 Examination Package’ -
Trial Examination 1 of 5**

STUDENT NUMBER

Figures

Words

Letter

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MATHEMATICAL METHODS

Units 3 & 4 – Written examination 1

(TSSM’s 2011 trial exam updated for the current study design)

Reading time: 15 minutes

Writing time: 1 hour

QUESTION AND ANSWER BOOK

Structure of book

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
9	9	40
		Total 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, blank sheets of paper, white out liquid/tape or a calculator of any type.

Materials supplied

- Question and answer book of 9 pages.
- Working space is provided throughout the book.

Instructions

- Print your name in the space provided on the top of this page.
- All written responses must be in English.

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

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 book are **not** drawn to scale.

Question 1

- a. Differentiate $f(x) = \log_e(2 - x)^4$ with respect to x .

2 marks

- b. Evaluate $f^{-1}(0)$ where f^{-1} is the inverse function of f .

3 marks

- c. For $g(x) = x^2 e^{\sin(x)}$, find $g'\left(\frac{\pi}{2}\right)$.

2 marks

Question 2

- a. Find an anti-derivative of $\sqrt{x} - 2 \sin\left(\frac{\pi x}{4}\right)$ with respect to x .

2 marks

- b. Find m given that $\int_0^2 (2x - 1)^3 dx = e^{\log_e m}$

2 marks

TURN OVER

Question 3

- a. Write down the amplitude and the period of the function $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = -3 \cos\left(\frac{\pi-x}{5}\right)$.

2 marks

- b. Solve the equation $-\cos(2x) = \sin(2x)$ for $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

3 marks

- c. Sketch the graph of $y = \tan(2x)$ for $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, showing the exact values of the axial intercepts and asymptotes.

2 marks

Question 4

The transformations $T: R^2 \rightarrow R^2$ is defined by $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{bmatrix} -4 & 0 \\ 0 & 2 \end{bmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{bmatrix} 3 \\ -1 \end{bmatrix}$. The image of the curve $y = 2 \log_e(4x) + 1$ under the transformation T has equation $y = a \log_e(bx + c) + d$. Find the values of a , b , c , and d .

4 marks

Question 5

Find the equation of the tangent line(s) to $h(x) = \frac{1}{(x-2)^2} - 1$ at the point(s) when the graph crosses the x axis.

3 marks

TURN OVER

Question 6

A sample of n people were asked whether they thought Australia's gun control laws were adequate, 18% said no.

- a. What is the value of the sample proportion, $\hat{p}$?

1 mark

- b. Find an expression for M , the margin or error for this estimate at the 95% confidence level, in terms of n .

1 mark

- c. If the number of people in the sample were halved, what would be the effect on M ?

2 marks

Total 4 marks

Question 7

The continuous random variable X has a distribution with probability density function given by

$$f(x) = \begin{cases} m \cos(x) & x \in \left[\frac{\pi}{2}, \frac{3\pi}{2}\right] \\ 0 & \text{elsewhere} \end{cases}$$

where m is a constant, find

- a.** the value of m .

3 marks

- b.** $Pr(X > \pi)$

2 marks

TURN OVER

Question 8

Let X be a normally distributed random variable with mean 11 and variance 4 and let Z be the random variable with the standard normal distribution. Find

a. $Pr(X < 7)$

1 mark

b. m such that $Pr(X < 8) = Pr(Z > m)$

2 marks

Question 9

a. Show that $\frac{3-2x}{x+2} = \frac{7}{x+2} - 2$

2 marks

b. Hence, find $\int \frac{3-2x}{x+2} dx$.

1 mark

END OF QUESTION AND ANSWER BOOK