



**‘2016 Examination Package’ -
Trial Examination 2 of 5**

STUDENT NUMBER

Figures

Words

Letter

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MATHEMATICAL METHODS

Units 3 & 4 – Written examination 1

(TSSM’s 2012 trial exam updated for the current study design)

Reading time: 15 minutes

Writing time: 1 hour

QUESTION & 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

Let $f(x) = \log_e(x + 3)$ and $g(x) = x^4 + 2$.

- a.** Write down a rule for $f(g(x))$.

2 marks

- b.** Find the derivative of $f(g(x))$.

2 marks

- c.** Hence evaluate the derivative in part **b.** when $x = -2$, ie. $f'(g(-2))$.

1 mark

Question 2

- a. Find a given that $\int_0^a (5x - 10) dx = 0, a \neq 0$.

2 marks

- b. Find the area between the curve $y = \cos\left(\frac{x}{2}\right)$, the x -axis and the lines $x = 0$ and $x = \pi$.

2 marks

TURN OVER

Question 3

Consider the function $f: R \rightarrow R, f(x) = -4e^{\frac{x}{2}} + 1$.

- a. Write down a rule for $f^{-1}(x)$.

3 marks

- b. Find the domain of $f^{-1}(x)$.

1 mark

- c. Solve for $f^{-1}(x) = 0$.

2 marks

Question 4

Given $f: \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \rightarrow \mathbb{R}, f(x) = 3\cos(2x)$

- a.** Find the exact values of x for which $f(x) = -\frac{3\sqrt{3}}{2}$.

2 marks

- b.** Find the exact values of x for which $f'(x) = 0$.

2 marks

- c.** Write down the interval over which the rate of change is negative.

1 mark

TURN OVER

Question 5

A bag contains 3 blue balls and 7 red balls. If we take a random sample of size 4, find:

- a. The probability that the sample proportion of blue balls is $\frac{1}{4}$.

2 marks

- b. The probability that the sample proportion of blue balls is at least $\frac{1}{4}$

2 marks

Total 4 marks

Question 6

Find the equation of the tangent to $f(x) = e^{2x}$ at the point where $x = 1$.

3 marks

Question 7

Find the general solution to the equation $\sin(2x) - \cos(2x) = 0$

3 marks

TURN OVER

Question 8

The time taken to complete a task (in hours) is a random variable X with probability density function:

$$f(x) = \begin{cases} k(x-1)(4-x) & 1 < x < 4 \\ 0 & \text{elsewhere} \end{cases}$$

where k is a constant, find

- a.** the value of k .

3 marks

- b.** $\Pr(X > 3)$

2 marks

Question 8 - continued

Question 9

Sue makes handmade soaps. The mass of soaps X grams is a normally distributed random variable with mean 220 grams and a standard deviation of 10 grams and let Z be the random variable with the standard normal distribution.

- a. $\Pr(m < X < 240) \approx 0.95$, find the value of m .

1 mark

- b. Sue randomly selects a handmade soap from a box containing several soaps. What is the probability that the soap's mass is less than 210 grams? (Use $\Pr(Z > 1) = 0.16$)

2 marks

- c. Sue randomly selects a handmade soap that had a mass more than the mean mass. What is the probability that its mass is more than 230 grams?

2 marks

END OF QUESTION AND ANSWER BOOK