



Student Name: \_\_\_\_\_

## MATHEMATICAL METHODS

### UNITS 3&4 Exam 2

### 2021 Written Trial Examination

Reading time: 15 minutes

Writing time: 2 hours

### QUESTION AND ANSWER BOOK

#### Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	4	4	60
			Total 80

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, set squares, aids for curve sketching, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved computer-based CAS, full functionality may be used.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials supplied

- Question and answer book of 19 pages
- Formula sheet
- Answer sheet for multiple-choice questions

#### Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- 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.**

## SECTION A – Multiple Choice Questions

**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the questions.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

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

**Question 1**

The largest domain for which the function  $f(x) = \frac{1}{\sqrt{x-3}}$  is defined is:

- A.  $[3, \infty)$
- B.  $[-3, \infty)$
- C.  $(-\infty, 3)$
- D.  $(3, \infty)$
- E.  $R \setminus \{3\}$

**Question 2**

Let  $g : [a, 2] \rightarrow R$  where  $g(x) = 4x - 4x^2$ . Is  $a$  is the smallest real value such that  $g$  has an inverse function  $g^{-1}$ , then  $a$  equals:

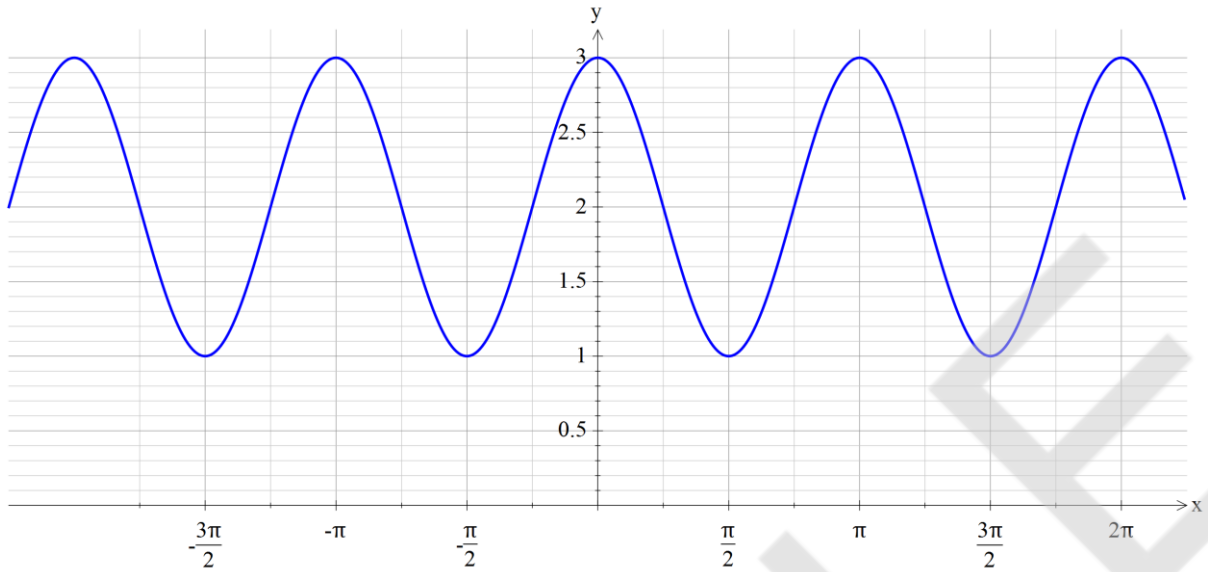
- A.  $-1$
- B.  $0$
- C.  $1$
- D.  $-2$
- E.  $\frac{1}{2}$

**Question 3**

The expression  $\log_2 \left( \sqrt[3]{\frac{x^3}{y}} \right)$  is equivalent to:

- A.  $\frac{1}{3} [\log_2(x) - \log_2(y)]$
- B.  $\log_2(x) - \frac{1}{3} \log_2(y)$
- C.  $\frac{1}{3} [\log_2(x) + \log_2(y)]$
- D.  $\log_2(x) + \frac{1}{3} \log_2(y)$
- E.  $\frac{1}{2} [3 \log_2(x) - \log_2(y)]$

## Question 4



Which of the following equations best describes the graph above?

- A.  $y + \cos\left(2x - \frac{\pi}{2}\right) = 2$
- B.  $y + \cos\left(2x + \frac{\pi}{2}\right) = 2$
- C.  $y + \sin\left(2x + \frac{\pi}{2}\right) = 2$
- D.  $y - \sin\left(2x - \frac{\pi}{2}\right) = 2$
- E.  $y + \sin\left(2x - \frac{\pi}{2}\right) = 2$

## Question 5

Find  $\{x : 2 \sin(x) + 1 = 0, 0 \leq x \leq 2\pi\}$

- A.  $\left\{\frac{\pi}{3}, \frac{5\pi}{3}\right\}$
- B.  $\left\{\frac{7\pi}{6}, \frac{11\pi}{6}\right\}$
- C.  $\left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$
- D.  $\left\{\frac{2\pi}{3}, \frac{4\pi}{3}\right\}$
- E.  $\left\{-\frac{\pi}{6}, \frac{5\pi}{6}\right\}$

## SECTION B

**Instructions for Section B**

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 book are **not** drawn to scale.

**Question 1** (12 marks)

A jet ski is moored near a jetty where the depth of the water can be modelled by  $D(t) = \cos\left(\frac{\pi t}{6}\right) + 3$  where the depth,  $D$ , is in metres and  $t$  is the time in hours after 9.00am on a Monday.

- a. State the range of depth for the jet ski.

1 mark

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b.

- i. What is the period of the function,  $D(t)$ .

1 mark

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- ii. At what time does the jet ski reach the highest depth for the first time.

3 marks

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When someone sits on the jet ski, it lowers in the water. The length between the surface of the water and the lowest part of the jet ski,  $L(t)$ , in metres can be modelled as  $L(t) = e^{0.02t} + 0.5$ , where the time is also in hours from the same initial time.

- c. What is the length from the surface of the water to the bottom of the jet ski at 3.15pm on Monday afternoon, correct to the nearest centimetre?

2 marks

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- d. Sketch both graphs for  $D(t)$  and  $L(t)$ , for the whole first day.

4 marks

- e. Find the smallest value between  $D(t)$  and  $L(t)$ , correct to the nearest millimetre.

2 marks

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