FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**January 2022**
Programme	:	Foundation in Science (CFSI)
Course	:	**MAT1211: Mathematics 2**
Date of Examination	:	8 March 2022 (Tuesday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions in the foolscap paper.
All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**Ms. Siti Syazwani Sazali**
Chief Moderator	:	Dr. Saras Krishnan

This paper consists of 5 printed pages, including the cover page.

FOUNDATION IN SCIENCE (CFSI)
MAT1211: MATHEMATICS 2
FINAL ALTERNATIVE ASSESSMENT: JANUARY 2022 SESSION

Instructions: This paper consists of FOUR (4) questions. Answer ALL question in the foolscap paper. All questions carry equal marks.

Question 1

(a) Simplify $\left(\frac{i^5-i^3}{3+i}\right)$.

(4 marks)

(b) Given that $z = 1 + \sqrt{3}i$ and $w = 2 + 2i$.

i. Express $2z - w$ in $a + bi$ form.

(2 marks)

ii. Graph z in an Argand diagram. State the modulus and argument of z.

(3 marks)

iii. Use DeMoivre's theorem to find w^3, giving your answer in the form of $a + bi$.

(5 marks)

(c) Given that

$$A = \begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}, B = \begin{bmatrix} x & -3 \\ -2 & y \end{bmatrix} \text{ and } C = \begin{bmatrix} 16 & 4 \\ -7 & -25 \end{bmatrix}$$

Find the value x and y such that $\boldsymbol{A^{-1}B = C}$.

(4 marks)

(d) Given that the system of linear equations is

$$\begin{aligned} 2x + y - z &= 1 \\ 3x + 2y + 2z &= 13 \\ 4x - 2y + 3z &= 9 \end{aligned}$$

Use Cramer's Rule to find the value of x, and y.

(7 marks)

Question 2

(a) Evaluate

$$\int_0^{2\pi} 13\cos(x^2)\ dx$$

using the Trapezoidal rule by dividing into 4 sub-intervals. Give your answer to 4 decimal places.

(6 marks)

(b) Use Euler's method to find an approximate solution of y for $x = 0.4(0.1)(0.8)$ to the differential equation $\frac{dy}{dx} = 2(3 + x^2) - y$ at $x_0 = 0.4$ and $y_0 = 1$. **Perform all of calculation correct to 4 decimal places.**

(6 marks)

(c) Find the first four non-zero terms of the Taylor's series for $f(x) = \frac{3}{x^2}$ about $x = 1$.

(6 marks)

(d) Given that

$$f(x) = cos\ x$$

i. Derive Maclaurin series up to second non-zero term.

(5 marks)

ii. Hence, evaluate $\int_0^{\frac{\pi}{2}} cos\ x\ dx$ using series from (i). Give your answer correct to 4 decimal places.

(2 marks)

Question 3

(a) Solve the following differential equations by using the method separation of variables.

$$\frac{d\theta}{dt} = \frac{\theta}{t^2 + 4}$$

subject to condition that $\theta = 1$ when $t = 2$.

(5 marks)

(b) Solve the following homogenous second-order differential equation.

$$y'' - 2y' + 12y = 0$$

if $y' = 2$, and $y = 1$ when $x = 0$.

(7 marks)

(c) Use method of integrating factor to find the particular solution for the differential equation.

$$dy = (1 - 2y)x\,dx$$

when $x = 0$ and $y = 2$.

(6 marks)

(d) Find the general solution for the non-homogenous differential equation below using method of undetermined coefficients.

$$y'' - 16y = 2e^{-x}$$

(7 marks)

Question 4

(a) Relative to an origin O, the position of the vectors P and Q are given by

$$\overrightarrow{OP} = \begin{pmatrix} -3 \\ 6 \\ 3 \end{pmatrix} and\ \overrightarrow{OQ} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$$

i. Find the angle POQ.

(5 marks)

ii. Find the unit vector in the direction of $\overrightarrow{PQ}$.

(3 marks)

(b) Find the resultant vector $(\mathbf{b} - \mathbf{a})$ and its magnitude, given that $\mathbf{a} = (-\mathbf{1}, \mathbf{2}, -\mathbf{3})$ and $\mathbf{b} = (\mathbf{3}, \mathbf{4}, -\mathbf{5})$.

(4 marks)

(c) An airline's record showed that the percent of on-time flights each day for a 10-day period was as follows:

$$72, 75, 76, 70, 77, 73, 80, 75, 82, 85$$

Determine the mean, median and mode for the given record.

(5 marks)

(d) A bag contains 5 red marbles and 6 blue marbles. Two marbles are selected at random without replacement.

i. Draw a tree diagram to represent the information above.

(4 marks)

ii. Find the probability that the two marbles are of different colours.

(2 marks)

iii. Find the probability that at least one of the marbles is blue.

(2 marks)

~THE END~