

FINAL
Alternative Assessment

(COVER PAGE)

Session : April 2020

Programme : Foundation in Science (CFSI)

Course : **MAT1211: Mathematics 2**

Date of Examination : 6 August 2020 (Thursday)

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.

All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s) : **Dr. Nurulanati binti Othman**

Chief Moderator : Mr. Teo Chun Yew

This paper consists of 4 printed pages, including the cover page.

FOUDATION IN SCIENCE (CFSI)
 MAT1211: MATHEMATICS 2
 FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks. Working must be shown.

Question 1

(a) Express $z = -\sqrt{7} + \sqrt{7}i$ in polar form. Use De Moivre's Theorem to evaluate z^8 , give your answer in standard Cartesian form. (8 marks)

(b) Given that the matrix $\mathbf{A} = \begin{bmatrix} 3 - k & 6 \\ 2 & 4 - k \end{bmatrix}$ has no inverse, find the values of k . (4 marks)

(c) Solve the following system of linear equations using elementary row operations:

$$\begin{aligned} 3x + 7y + z &= 40 \\ x + y + 5z &= 36 \\ 2x + 2z &= 16 \end{aligned}$$

(7 marks)

(d) If $u = z \sin\left(\frac{y}{x}\right)$, where $x = 3r^2 + 2s$, $y = 4r - 2s^3$ and $z = 2r^2 - 3s^2$, use chain rule to find $\frac{\partial u}{\partial r}$ at $(x, y, z) = (4, \pi, 3)$. Simplify your answer. (6 marks)

Question 2

(a) Evaluate

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

using the trapezoidal rule by dividing the interval into 4 sub-intervals. Give your answer in four decimal places. (8 marks)

(b) Given $f(x) = \sin x$.

(i) Derive Maclaurin series of $f(x)$ up to third non-zero term. (3 marks)

(ii) Derive Taylor series for $f(x)$ about $\frac{\pi}{6}$ up to third non-zero term. (4 marks)

(iii) Hence, evaluate $\int_0^{\frac{\pi}{5}} \sin x dx$ using one of the series from part b(i) or b(ii). Give your answer correct to 5 decimal places. (4 marks)

(c) Verify inexactness of the following ordinary differential equation.

$$2x + xy - \left(\frac{x^2}{2} + 6y\right) \frac{dy}{dx} = 0$$

(6 marks)

Question 3

- (a) Solve the following first-order differential equation using integrating factor technique. Simplify your answer.

$$\frac{dv}{dt} = 9.8 - 0.196v$$

(8 marks)

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

$$y'' - 8y' + 17y = 0$$

(5 marks)

- (c) Solve the following non-homogeneous second-order differential equation using undetermined coefficients method.

$$y'' + 3y' + 2y = 12x$$

(12 marks)

Question 4

- (a) The position vectors of points P and Q are $\begin{pmatrix} -1 \\ 8 \\ 5 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ 4 \\ 6 \end{pmatrix}$, respectively.

- (i) Calculate angle $POQ = \theta$.

(5 marks)

- (ii) The point R is given such that $\overrightarrow{PR} = 3\overrightarrow{PQ}$. Find the unit vector in the direction of \overrightarrow{OR} .

(5 marks)

- (b) The sample of data below shows the weights of 48 students in a Mathematics class.

Class Interval	Frequency
40 – 44	8
45 – 49	14
50 – 54	20
55 – 59	5
60 – 64	1

- (i) Find the mean of the data.

(1 mark)

- (ii) Find the mode of the data.

(3 marks)

- (iii) Find the median of the data.

(3 marks)

- (iv) Find the standard deviation of the data.

(3 marks)

(c) A packet of candies contains 5 red candies and 14 green candies. Two candies are selected at random without replacement.

(i) Find the probability that the two candies are of different colors. (3 marks)

(ii) Hence, find probability that the two candies are same colors. (2 marks)

-THE END-
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