



FINAL
Examination Paper

(COVER PAGE)

Session : January 2020

Programme : Foundation in Science (CFSI)

Course : **MAT1211: Mathematics 2**

Date of Examination : 6 April 2020 (Monday)

Time : 9:00am – 1:00pm

Duration : 4 Hours Reading Time : Nil

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.

All questions carry equal marks.

IMPORTANT NOTE : THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL

Materials Permitted : Non-Programmable Calculator

Materials Provided : Formula Booklet

Examiner(s) : **Mr. Goh Chok Huat**

Moderator : Dr. Ch'ng Pei Eng

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

INTI INTERNATIONAL COLLEGE PENANG

FOUNDATION IN SCIENCE (CFSI)

MAT1211: MATHEMATICS 2

FINAL EXAMINATION: JANUARY 2020 SESSION

Instruction: This paper consists of **FOUR (4)** questions. Answer **ALL FOUR (4)** questions. All questions carry equal marks.

Question 1

(a) Given $z_1 = 1 + \sqrt{3}i$, $z_2 = 2 + i$, $z_3 = 3 - i$. Express each of the following in the form $a + bi$.

(i) $z_2 z_3$. (2 marks)

(ii) $\frac{1}{z_1}$. (3 marks)

(b) Given $z = \sqrt{2} + \sqrt{2}i$.

(i) Express z in polar form. (3 marks)

(ii) Use De Moivre's theorem to find z^5 , giving your answer in the form of $a + bi$. (4 marks)

(c) (i) Evaluate $\int_0^1 \sqrt{x}$ using direct integration. (2 marks)

(ii) Evaluate $\int_0^1 \sqrt{x}$ using trapezoidal rule with 5 function values, giving your answers correct to 4 decimal places. (4 marks)

(iii) Hence, calculate the percentage error with the approximation used in (ii). (2 marks)

(d) Obtain approximate solutions of the differential equation

$$y' = x + y^2, y(0) = 1,$$

on the interval $[0, 0.6]$ using the method of Euler with a step size of $h = 0.2$.

What is the approximate value of y when $x = 0.8$?

(5 marks)

Question 2

(a) Given $A = \begin{bmatrix} 0 & 1 & -1 \\ 1 & -1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.

(i) Find A^{-1} . (7 marks)

(ii) Hence or otherwise, find the solutions to the following linear system:

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

(4 marks)

(b) (i) By using the Maclaurin Series of e^x and $\sin x$ available in the formula booklet, write down the first four terms of the Maclaurin Series of e^{-x} and $\sin 2x$. (3 marks)

(ii) Hence, write down $e^{-x}\sin 2x$ up to and including the term in x^3 . (2 marks)

(iii) Hence, find an approximation of $\int_0^1 e^{-x}\sin 2x \, dx$. (3 marks)

(c) The power (in watts) consumed in an electrical resistor is given by $= \frac{E^2}{R}$. If $E = 200$ volts and $R = 8$ ohms, find the approximate change in power if E is decreased by 5 volts and R is decreased by 0.2 ohms. (6 marks)

Question 3

(a) Given the differential equation $xy' - y = x^3e^x$.

(i) Find the integrating factor of the differential equation. (3 marks)

(ii) Hence, find the particular solution of the differential equation which satisfies $y'(0) = 0$. (6 marks)

(b) Find the general solution for each of the following:

(i) $y'' + 4y' + 13y = 0$ (3 marks)

(ii) $y'' + 4y' + 13y = 2e^{-x}$. (5 marks)

(c) Find the general solution of

$$y' = \frac{x^2 + y^2}{2xy}$$

by putting $y = vx$, where v is a function of x . (8 marks)

Question 4

(a) The frequency distribution for the ages (in years) of a sample of 50 participants in a motivation programme is as follows:

<u>Age</u>	<u>Number of Participants</u>
8-10	5
11-13	10
14-16	12
17-19	17
20-22	6

Find the mean, mode and standard deviation of the above sample. (10 marks)

(b) There is a booth that has two spins. One spin has 10 equal slices with 6 red slices, 3 blue slices and 1 yellow slice. The other spin has 5 equal slices with number 1 to 5 written on the slices, respectively. If a person spins the spins, what is the probability that the person

(i) gets yellow on the first spin and number 1 on the second spin? (2 marks)

(ii) gets red on the first spin and odd number on the second spin or blue on the first spin and even number on the second spin? (3 marks)

- (c) The position vectors of points A and B are $\begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix}$ respectively, relative to the origin O .
- (i) Calculate the angle AOB . (5 marks)
- (ii) The point C is such that $\overrightarrow{AC} = 2\overrightarrow{AB}$. Find the unit vector in the direction of \overrightarrow{OC} . (5 marks)

~ The End ~

MAT1211(F),JAN2020/formatted