الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

ACADEMIC YEAR 2023 - 2024

Program	Year	Semester	Paper
MEO	2	4	MAIN

MODULE NAME:	**MATHEMATICS - III**		
MODULE CODE:	**MMATH - III**	**EXAM DATE:**	**21.05.2024**
INSTRUCTOR's NAME:	**Dr. Yaqoob Mubarak Al Rahbi**	**DURATION:**	**2 hrs.**

Questions to be answered on:	**Allowed tools:**	**Number of pages**
✓ Space provided on the question paper	Pen, Pencil & Calculator	(Incl. cover page)**:** **12**

Points of attention:

- For each question, the maximum earned points are mentioned between brackets at the end of each question.
- Write very clearly! Answers that are not readable are not marked and don't get points!
- Make sure your answers are written to the point.
- All answers should be written **in English.**
- Write all the answers in **blue or black pen only.**
- Use the **pencil** only for **diagrams & graphs.**
- Show all the calculation steps in the given space.
- When finished submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

		FINAL MARKS
STUDENT NAME:		**40**
STUDENT ID:		**10**

Number of answer scripts:……..…….

Invigilator:……..……..…..

Student's signature: ……

Time of receipt:……..….

ANSWER ALL THE QUESTIONS

1. Find the derivative of the following function by using the definition. **[4 Marks]**

$$f(x) = x^2 - 7$$

2. Evaluate the following indefinite integrals. **[6 Marks]**

I. $\int (x^2 - 3x^5)\, dx$

II. $\int (x^4 + 3)^4\, (8x^3) dx$

III. $\int_1^5 9\sqrt{3x+1}\, dx$

3. Determine one real root of **[4 Marks]**

$$x^3 + 4 = 0$$

by using Newton's method (keep your results in 4 decimal places).

4. A package of relief supplies is dropped and moves according to the parametric equations $x = 45t$ and $y = -4.9t^2$ (x and y in m, t in s). **[4 Marks]**

I. Find the magnitude of the velocity when $t = 3$ s.

II. Find the direction of the velocity when $t = 3$ s.

5. Find the area under the curve **[6 Marks]**

$$y = \frac{1}{x^2}$$

between $x = 1$ and $x = 5$.

6. Find the volume generated by revolving the region bounded by $y = 4 - 2x$, and $y = 0$ about the $x - axis$. **[4 Marks]**

7. A wheel that can be represented by **[4 Marks]**

$$x^2 + y^2 = 25$$

is rotating when a particle is ejected tangentially from the point $(4, 3)$.

a) Find the slope of the line along which the particle traveled.

b) Find the tangent line of the wheel equation.

8. Find a general solution of the following ordinary differential equation. **[4 Marks]**

$$y^3 y' + x^3 = 0$$

9. Solve the initial value problem **[4 Marks]**

$$y' + 2y = 4e^{2x}, y(0) = 3.$$

Draft Paper

Formulas sheet:

No	Formula
1)	Definition of Derivative: $f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$
2)	Instantaneous Velocity*:* $v = \lim_{h\to 0} \frac{s(t+h)-s(t)}{h}$
3)	$\frac{d}{dx}(c) = 0$, *where* c *is any constant number.* $\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(cu) = c\frac{du}{dx}$ $\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$
4)	*Product rule:* $\frac{d(uv)}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$
5)	*Quotient rule:* $\frac{d(\frac{u}{v})}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
6)	*Chain rule:* $\frac{dy}{dx} = \frac{dy}{du}\,\frac{du}{dx}$
7)	*Power of a function rule:* $\frac{d}{dx}(u^n) = nu^{n-1}\left(\frac{du}{dx}\right)$
8)	$y - y_1 = m(x - x_1)$ $y - y_1 = \frac{-1}{m}(x - x_1)$