



FINAL EXAMINATION
NOVEMBER 2023

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| COURSE TITLE | CALCULUS |
| COURSE CODE | EMAT3113 |
| DATE/DAY | 14 FEBRUARY 2024 / WEDNESDAY |
| TIME/DURATION | 02:00 PM - 04:00 PM / 02 Hour(s) 00 Minute(s) |

INSTRUCTIONS TO CANDIDATES:

1. Please read the instruction under each section carefully.
2. Candidates are reminded not to bring into examination hall/room any form of written materials or electronic gadget except for stationery that is permitted by the Invigilator.
3. Students who are caught breaching the Examination Rules and Regulation will be charged with an academic dishonesty and if found guilty of the offence, the maximum penalty is expulsion from the University.

(This Question Paper consists of 3 Printed Pages including front page)

*****DO NOT OPEN THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO*****

This question paper consists of ONE (1) section. Answer all questions in the answer booklet provided. **[50 MARKS]**

SECTION A **(50 Marks)**

There are FIVE (5) questions in this part. Answer ALL questions in the answer booklet.

QUESTION 1 **(10 Marks)**

Solve each of the following equations, giving the final answers correct to three significant figures, where appropriate.

(a) 2×3^x **(5 marks)**

(b) $\log_2 (7y - 1) = 3 + \log_2 (y - 1)$ **(5 marks)**

QUESTION 2

Given $f(x) = x^4 - 4x$, $x \in \mathbb{R}$. **(10 Marks)**

(a) Find a simplified expression for $f(2+h) - f(2)$. **(6 marks)**

(b) Use the first definition of the derivative as a limit to show that $f' = 28$. **(4 marks)**

QUESTION 3

(10 Marks)

The curve C has equation

$$y = \frac{x+13}{(x-2)(x+3)}, x \neq -3, 2.$$

The point A lies on C and has $x = 1$.

(a) Find the value of $\frac{dy}{dx}$ at A. **(6 marks)**

(b) Find an equation of the tangent to C at A in the form of $ax + by + c = 0$, where a, b and c are integers. **(4 marks)**

QUESTION 4

(10 Marks)

From the identity given,

$$\frac{4}{(x-1)(x^2+1)} \equiv \frac{A}{x-1} + \frac{Bx+C}{x^2+1}$$

(a) evaluate the values of A, B and C .

(5 marks)

(b) Hence, calculate

$$\int \frac{4}{(x-1)(x^2+1)} dx$$

(5 marks)

QUESTION 5

(10 Marks)

The volume, $V \text{ cm}^3$, of a metallic cube of side length $x \text{ cm}$, is increasing at the constant rate of $0.108 \text{ cm}^3 \text{ s}^{-1}$.

(a) Determine the rate at which the side of the cube is increasing when the side length reaches 3 cm .

(5 marks)

(b) Find the rate at which the surface area of the cube, $A \text{ cm}^2$, is increasing when the side length reaches 3 cm .

(5 marks)

*** END OF QUESTION PAPER ***