



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
SECOND SEMESTER EXAMINATIONS, APR/MAY 2019

COURSE NO: MN/MR/GM/GL/PE/ES 150

COURSE NAME: CALCULUS

CLASS: MN/MR/GM/GL/PE/ES I

TIME: 3 HOURS

Name: _____ Index Number: _____

Answer QUESTION 1 and ANY OTHER question.

QUESTION 1

i. You have been contracted as an engineer to construct a box whose base length is 3 times the base width. The material used to build the top and bottom cost $10Gh\text{¢} / ft^2$ and the material used to build the side cost $6Gh\text{¢} / ft^2$. If the box must have a volume of $50ft^3$, determine the dimensions that will minimize the cost to build the box. **[8 marks]**

ii. Using Leibnitz' theorem, find the fourth (4^{th}) derivative of $e^{ax} \sin bx$ with respect to x . **[6 marks]**

iii. Evaluate the following:

a. $\int_1^2 x^2 e^{5x} dx$ **[4 marks]**

b. $\int \sin^{-1} x dx$ **[4 marks]**

c. $\int \frac{x^2}{(x+1)(x-1)^2} dx$ **[5 marks]**

d. $\int_0^{\infty} t^3 e^{-t} dt$ **[3 marks]**

e. $\int 2^x dx$ **[4 marks]**

iv. Solve the differential equation $\left(1 + e^{\frac{x}{y}}\right) dx + e^{\frac{x}{y}} \left(1 - \frac{x}{y}\right) dy = 0$ **[6 marks]**

QUESTION 2

i. The parametric equations of a function are given by $y = 3\cos 2t$, $x = 2\sin t$. Find

a. $\frac{dy}{dx}$ [4 marks]

b. $\frac{d^2y}{dx^2}$ [4 marks]

ii. Evaluate the following:

a. $\int \frac{4x^2 + 26x + 5}{2x^2 + 9x + 4} dx$ [5 marks]

b. $\int \cos 6x \cos 4x dx$ [3 marks]

iii. Find all the first order partial derivatives of $f(x, y) = \left[\cos\left(\frac{4}{x}\right) \right] \left[e^{x^2y-5y^3} \right]$ [4 marks]

QUESTION 3

i. Solve

$$(x + 2y^3) \frac{dy}{dx} = y \quad [6 \text{ marks}]$$

ii. Evaluate

a. $\int_0^1 x^4 (1-x)^3 dx$ [3 marks]

b. $\int_0^\infty x^n e^{-2x} dx$ [3 marks]

iii. Show that the $L(te^{4t}) = \frac{1}{(s-4)^2}$ [4 marks]

iv. Find all the first order partial derivatives of $h(s, t) = t^7 \ln(s^2) + \frac{9}{t^3} - \sqrt[7]{s^4}$ [4 marks]

Examiners: **K. AGYARKO/Dr P. Boye**