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KOGI STATE UNIVERSITY, KABBA
FACULTY OF SCIENCE AND COMPUTING (Department of Mathematical Sciences)
COURSE TITLE: ELEMENTARY MATHEMATICS II (CALCULUS)
COURSE CODE: MTH102 UNITS: 2

Session: 2023/2024 Semester: Second Date: 20/9/2024 Time Allowed: 2 Hours.

Instructions: ANSWER THREE (3) QUESTIONS, QUESTION ONE IS COMPULSORY

1. (a) Define function $y = f(x)$
(b) Given that $f(x) = x^2 + 2$, $g(y) = 3y - 1$, $h(t) = \sqrt{t - 3}$, evaluate
i. $f(-3)$
ii. $f(g(4))$
iii. $g(h(12))$
(c) Differentiate $y = 5x^2 + 2$ using first principle
(d) If $y = 15x^3 - 6x^2 + 10$, find $\frac{dy}{dx}$ at $x = 1$
(e) $\int_{-1}^1 (t^3 + 4t^2 - 2) dt$
(f) Discuss the continuity of $f(x) = \frac{1}{x-1}$

(30Marks)

2. (a) Differentiate $y = x^3 \sin x$
(b) Differentiate $y = (2x + 8)^2$
(c) $\int \frac{4x-8}{x^2-4x+5} dx$

(20Marks)

3. (a) $\int \frac{x+1}{x^2-3x+2} dx$
(b) If $y = 2x^4 - 5x^3 + 3x^2 - 2x + 4$, find $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$, $\frac{d^3y}{dx^3}$

(20Marks)

4. (a) $\int x^2 e^{3x} dx$
(b) Differentiate $\frac{\sin x}{x^2}$

(20Marks)

5. (a) Determine the integral $I = \int (9x^3 + 11x^2 - x - 3) dx$ given that when $x = 1$, $I = 2$
(b) If $x^3 + y^3 + 3xy^2 = 8$, find $\frac{dy}{dx}$
(c) Determine the area bounded between $x = -1$ and $x = 2$ and the curve $y = x^3 + 2x^2 + x + 1$

(20Marks)

$$18x^3 - 46(1) - 12(1)$$

$$x dx +$$

$$\int (x^3 + 2x^2 + x + 1) dx$$