



SIR ARTHUR LEWIS COMMUNITY COLLEGE
ACADEMIC YEAR (2024/2025) – SEMESTER ONE
END OF SEMESTER EXAMINATION

COURSE CODE : MAT243
COURSE TITLE : Calculus II
LECTURER(S) : Vercilli Gustave-Lord
DATE : 10th December 2024
TIME : 9 a.m. – 11:30 a.m.
DURATION : 2 ½ Hours
STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

- Students must sign **IN** and **OUT** on the examination class list.
- Write your ID number on the question paper.

READ THESE INSTRUCTIONS CAREFULLY

- This question paper comprises two questions.
- Answer BOTH questions, showing all steps where necessary.
- Write your answers in the space provided.
- If you need to rewrite an answer or there is not enough space on the original page, you may use additional sheets to complete your answer. Be sure to include your ID, the question number and part on any additional sheets used.

Examination Materials Permitted

- Silent, non-programmable calculators.
- Mathematical formula.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. Given that $I_n(x) = \int_0^1 x^n e^{3x} dx$,

(i) Show that $I_n(x) = \frac{1}{3}e^3 - \frac{n}{3}I_{n-1}(x)$ for $n \geq 1$.

[5]

(ii) Hence, find $\int_0^1 x^3 e^{3x} dx$. Leave your answer in terms of e .

[8]

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b) i) Given that $\frac{15-13x+4x^2}{(1-x)^2(4-x)} = \frac{A}{1-x} + \frac{B}{(1-x)^2} + \frac{C}{4-x}$, find the values of A, B and C .

[6]

ii) Hence evaluate the EXACT value of $\int_2^3 \frac{15-13x+4x^2}{(1-x)^2(4-x)} dx$.

[6]

Total 25 mark

2. (a) The parametric equations of a curve are defined in terms of θ by

$$x = 4 + 2\cos\theta, \quad y = 2\cos 2\theta.$$

- i) Show that $\frac{dy}{dx} = 4\cos\theta$.

[5]

- ii) Determine $\frac{d^2y}{dx^2}$.

[3]

iii) Find the equation of the tangent to the curve at $\theta = \frac{\pi}{2}$.

[2]

(b) i) Given that $6x^3 + 12x^2y^2 - 3y^2 = 0$, determine $\frac{dy}{dx}$.

[5]

ii) A function f is defined as $f(x, y) = \ln \left| \frac{2x+y}{x-1} \right|$.

Show that

$$\frac{\partial^2 f}{\partial y \partial x} - 2 \frac{\partial^2 f}{\partial y^2} = 0.$$

[6]

c) Differentiate $\sin^{-1} \sqrt{1-2x}$.

[4]

Total 25 marks