



School of Education (SEDU)
September – December 2020/2021
Bachelor of Arts in Education (BED)
MAT 121: Calculus II

Date:

Time: 2hr

INSTRUCTIONS:

Answer QUESTION ONE (Compulsory) and any other TWO QUESTIONS

SECTION A

QUESTION 1 (30 marks)

a) Find the Taylor's series generated by $f(x) = x^4 + x^2 + 1$ at $x = -2$

(5 marks)

b) Find the Taylor's polynomial of order 0, 1 and 2 generated by the function $f(x) = \sqrt{x}$ at $x = 4$

(5 marks)

c) Find the value of c that satisfies the equation below given that $f(x) = \sqrt{x-1}$ is continuous on a closed interval $[1, 3]$.

(5 marks)

$$\frac{f(b) - f(a)}{b - a} = f'(c)$$

d) Integrate;

(i) $\int x^3 \sin x^4 dx$ (3 marks)

(ii) $\int x^2 \ln(x+1) dx$ (5 marks)

e) Express $\frac{6x+7}{(x+2)^2}$ as a sum of partial fractions (3 marks)

f) Use the trapezoidal rule with $n = 4$ to estimate (4 marks)

$$\int_1^2 x^2 dx$$

SECTION B

QUESTION 2 (15 marks)

- a) If R is the regions bounded above by the graph of the function

$$f(x) = 9 - \left(\frac{x}{2}\right)^2 \text{ and below by the graph of the function } g(x) = 6 - x, \text{ find the area of region}$$

R . (6 marks)

- b) Find the volume of the solid of revolution generated by rotating the region between the graph of $f(x) = \sqrt{x}$ and the x-axis over the interval $[1, 4]$ around the x-axis.

(5 marks)

- c) Use the Simpson's rule with $n = 4$ to estimate (4 marks)

$$\int_0^1 5x^4 dx$$

QUESTION 3 (15 marks)

- a) Express $\frac{2x^3 - 4x^2 - x - 3}{x^2 - 2x - 3}$ as a sum of partial fractions, hence determine (6

marks)

$$\int \frac{2x^3 - 4x^2 - x - 3}{x^2 - 2x - 3} dx$$

- b) Integrate; (5 marks)

$$\int e^{3x} \cos 2x dx$$

- c) Evaluate (4 marks)

$$\int_0^1 \frac{dx}{(x+1)(x^2+1)}$$

QUESTION 4 (15 marks)

- a) If $z = 5x^4 + 2x^3y^2 - 3y$ find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ (4 marks)

- b) Given $y = 4 \sin 3x \cos 2t$ find $\frac{\partial y}{\partial x}$ and $\frac{\partial y}{\partial t}$ (5 marks)

- c) Integrate;

(i) $\int \frac{1}{x \ln x} dx$ (3 marks)

(ii) $\int \frac{x}{2+3x^2} dx$

(3 marks)

QUESTION 5 (15 marks)

a) Evaluate

(i) $\int_0^1 4 \sin^5 t \, dt$ (3 marks)

(ii) $\int_0^4 \int_1^2 (3x^2 - 2) \, dx \, dy$ (5 marks)

b) Determine the general solution of $x \frac{dy}{dx} = 2 - 4x^3$ (3 marks)

c) Determine the particular solution of $(y^2 - 1) \frac{dy}{dx} = 3y$ given that $y=1$ when $x=2\frac{1}{6}$ (4 marks)