



University of Ruhuna – Faculty of Technology
Bachelor of Engineering Technology Honors Degree
Bachelor of Information & Communication Technology Honors Degree
Level 1 (Semester II) Examination,
November/December 2025
Academic year 2023/2024

Course Unit: TMS1213(R): Applied Calculus II

Duration: 3 hours

- All symbols have their usual meanings.
- Answer all (06) questions.
- Calculators are not allowed.

1. Consider the following equation, where A, B and C are constants.

$$\frac{x^2 + 3}{x - 1} = Ax + B + \frac{C}{x - 1}$$

- i. Determine the values of the constants A, B and C. (40 marks)
- ii. Hence evaluate the following integral. (60 marks)

$$\int_2^4 \frac{x^2 + 3}{x - 1} dx$$

2. Evaluate the integral to derive the given answer. (100 marks)

$$\int_{\sqrt{2}}^2 \frac{1}{x^2 \sqrt{x^2 - 1}} dx = \frac{1}{2} (\sqrt{3} - \sqrt{2})$$

(Hint: Use the substitution $x = \sec \theta$)

3.

$$f(x) = x^3 - 3x^2 + 2x$$

- i. What are the x intercepts and y intercepts of the above function $f(x)$. (10 marks)
- ii. Find the intervals where the function is increasing and decreasing. (30 marks)
- iii. Find the intervals where the function is concave up and concave down. (20 marks)
- iv. Find inflection points. (20 marks)
- v. Find the behavior of the function at extreme ends ($x \rightarrow \infty$; $x \rightarrow -\infty$) (10 marks)
- vi. Based on the information you have obtained from the above parts, sketch the shape of the function $f(x)$ on a 2D cartesian plane. (10 marks)

4.

Calculate the Arc length of the following function over the given interval.

$$y = \frac{4}{3} x^{3/2} \quad \text{over the interval } [0,1] \quad (100 \text{ marks})$$

5.

- i. Clearly show (with shading) the area that is bound by the function $f(x) = \sqrt{x}$, $y = 1$ and $x = 5$ in the 1st(first) quadrant of the 2D Cartesian plane. (30 marks)
- ii. Calculate the volume of the solid object formed by revolving the above-mentioned area around the x - axis. (70 marks)

6.

- i. Find the solution to the following first order differential equation.

$$\frac{dy}{dx} + x^2 y = 0; \quad (40 \text{ marks})$$

- ii. Consider the following second order differential equation,

$$\frac{d^2 y}{dx^2} + \frac{dy}{dx} - 6y = 0$$

- a) Find the values of k such that $y = e^{kx}$ is a solution of the given differential equation. (30 marks)
- b) Hence find the general solution. (05 marks)
- c) Determine the values of the constants of the general solution using the initial conditions, $y(0) = 1$ and $y'(0) = 0$

(25 marks)