

Tribhuvan University
Institute of Science and Technology
2075

Bachelor Level / First Semester / Science

Computer Science and Information Technology(MTH112)

((TU CSIT) Mathematics I (Calculus))

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Full marks: 80

Pass marks: 32

Time: 3 hours

Attempt any three questions:

1. (a) A function is defined by $f(x) = |x|$, calculate $f(-3)$, $f(4)$, and sketch the graph.

(b) Prove that the $\lim_{x \rightarrow 2} \frac{|x-2|}{x-2}$ does not exist

2. (a) Find the domain and sketch the graph of the function $f(x) = x^2 - 6x$.

(b) Estimate the area between the curve $y = x^2$ and the lines $y = 1$ and $y = 2$.

3. (a) Find the Maclaurin series for $\cos x$ and prove that it represents $\cos x$ for all x .

(b) Define initial value problem. Solve that initial value problem of $y' + 2y = 3$, $y(0) = 1$.

(c) Find the volume of a sphere of a radius a .

4. (a) If $f(x, y) = \frac{y}{x}$ does $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ exist? Justify.

4(b) Calculate $\iint_R f(x, y) dA$ for $f(x, y) = 100 - 6x^2y$ and $R = \{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1\}$

Attempt any ten Questions:

5. If $f(x) = \sqrt{2-x}$ and $g(x) = \sqrt{x}$, find $f \circ g$ and $f \circ f$.

6. Define continuity on an interval. Show that the function $f(x) = \sqrt{x+2}$ is continuous on the interval $[-1, 1]$.

7. Verify Mean value theorem of $f(x) = x^3 - 3x + 2$ for $[-1, 2]$.

8. Starting with $x_1 = 2$, find the third approximation x_3 to the root of the equation $x^3 - 2x - 5 = 0$.

9. Evaluate $\int_0^{\infty} x^3 \sqrt{1-x^4} dx$

10. Find the volume of the resulting solid which is enclosed by the curve $y = x$ and $y = x^2$ is rotated about the x -axis.

11. Find the solution of $y'' + 4y' + 4 = 0$.

12. Determine whether the series $\sum_{n=1}^{\infty} \frac{n^2}{5n^2 + 4}$ converges or diverges.

13. If $a = (4, 0, 3)$ and $b = (-2, 1, 5)$ find $|a|$, the vector $a - b$ and $2a + b$.

14. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if z is defined as a function of x and y by the equation $x^3 + y^3 + z^3 + 6xyz = 1$.

15. Find the extreme values of the function $f(x, y) = x^2 + 2y^2$ on the circle $x^2 + y^2 = 1$.