KATHMANDU UNIVERSITY

First In-Semester Exam - 2025

Subject: MATH 104 **Time - 1 hr** **F.M. = 20** **Group: CE**

1. Fill in the blank spaces.
   (a) The Cartesian form of the equation, $r = \dfrac{1}{2\sin\theta - 3\cos\theta}$ is _____.
   (b) The spherical form of the point $(1, 0, 0)$ is _____.
   (c) If $w = f(x, y, z)$, $x = g(t)$, $y = k(t)$ and $y = h(t)$, then $\dfrac{dw}{dt} =$ _____.
   (d) $\displaystyle\int_0^1 \int_0^2 \int_0^3 dx\, dy\, dz =$ _____.

2. Test for symmetry and sketch the graph of $r = 3 - 2\cos\theta$. Find the area inside one loop of the lemniscate $r^2 = 4\sin 2\theta$.

3. Show that the limit of the function $f(x, y) = \dfrac{2x^2y}{x^4 + y^2}$ doesn't exist at (0, 0). Find the derivative of $f(x, y, z) = x^3 - xy^2 - z$ at $P_0(1, 1, 0)$ in the direction of $\vec{A} = 2\vec{i} - 3\vec{j} + 6\vec{k}$.

4. Find the greatest and smallest values that the function $f(x, y) = xy$ takes on $\dfrac{x^2}{8} + \dfrac{y^2}{2} = 1$.

5. Sketch the region of integration for the integral $\displaystyle\int_0^4 \int_{\sqrt{y}}^{y/2} (4x + 2)dxdy$. Write an equivalent integral with the order of integration reversed and then evaluate the integral.

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