# Homework 01

- Due 22nd March, 2024 11:59 pm.

- Upload your work as pdf file on LMS (Image files are not acceptable.)

- Write all the details. Attach code if necessary.

1. Prove that $\dfrac{d \sinh^{-1} x}{dx} = \dfrac{1}{\sqrt{1 + x^2}}$.

2. Compute $\displaystyle\int_1^3 \sqrt{x^2 + 1}\, dx$.

3. Compute the volume of the region obtained by rotating $(x - 4)^2 + y^2 = 1$ about the $y$-axis.

4. Find the limit of $\displaystyle\sum_{n=1}^{\infty} \dfrac{1}{n} \left(\dfrac{1}{3}\right)^n$.

5. Find the taylor series of $\dfrac{1}{x^2 + 1}$ at $x = 0$ and its radius of convergence.

6. Find the radius of convergence and the interval of convergence of $\displaystyle\sum_{n=0}^{\infty} \left(\dfrac{2}{3}\right)^n x^{2n}$.