Calculus III (Maths 201–DDB)

1. Evaluate the following integrals:

   (a) $\int \cos^2 t \, dt$ (b) $\int \sin^3 x \, dx$ (c) $\int_0^{2\pi} \sqrt{1-\cos t} \, dt$

   (d) $\int x \arctan x \, dx$ (e) $\int \frac{dx}{\sqrt{4x-x^2}}$ (f) $\int \sqrt{x^2+1} \, dx$

   (g) $\int \frac{x^3 \, dx}{\sqrt{x^2+1}}$ (h) $\int \frac{dx}{x^2-x-6}$ (i) $\int_2^4 \sqrt{1+\left(x-\frac{1}{4x}\right)^2} \, dx$

2. Find the area of the region bounded by $y = x^2 - 4x$ and $y = 2x$.

3. Find the volume of the solid of revolution obtained by rotating the region under $y = \sqrt{x}$ from $x = 0$ to $x = 9$ (i) about the x-axis, and (ii) about the y-axis.

4. Evaluate $\lim_{x \to 0} \frac{x - \tan^{-1} x}{x^3}$.