

1. Compute the improper integral

$$\int_0^{\infty} \frac{\cos 2x}{(x^2 + 1)^2} dx$$

2. Show that

$$\int_0^{\infty} \frac{(\ln x)^2}{x^2 + 1} dx = \frac{\pi^3}{8}$$

3. Evaluate the integral

$$\int_0^{2\pi} \frac{d\theta}{5 + 4 \sin \theta}$$

4. Show that

$$\int_{-\pi}^{\pi} \frac{d\theta}{1 + \cos^2 \theta} = \pi\sqrt{2}$$

5. Use the formula for the Inverse Laplace Transform to evaluate the inverse of the function  $F(s) = \frac{1}{(s^2 + 1)^2}$ .

6. Show that  $2z^5 + 8z - 1 = 0$  has exactly four roots in the annulus  $1 < |z| < 2$ .