1. Evaluate $\int \sin(\ln t)\, dt$.

2. Evaluate $\int \dfrac{dx}{\sqrt{9x^2 + 16}}$.

3. a) Does the following series converge or diverge? Give your reasons.

$$\sum_{n=1}^{\infty} \frac{\ln n + \sin n}{n^{3/2}}.$$

b) Does the following integral converge or diverge? Give your reasons.

$$\int_0^{\infty} \frac{\sin x}{x^2}\, dx.$$

4. Approximate the following integral with an error less than 10^{-3}. Show your work.

$$\int_0^{1/10} \cos \sqrt{t}\, dt.$$

5. Find $\lim\limits_{x \to 0} \dfrac{x \cos x - x e^{-x^2}}{\sin^3 x}$.

6. Find all solutions, in Cartesian form $(a + ib)$, of $z^4 + 8iz = 0$.

7. The region bounded by the curve $y = x^3 + 1$, the line $x = 0$, and the line $y = 9$ is revolved around the line $x = 3$. Find the volume.

8. Find the length of the curve given in parametric form by $x = \sin^{-1} t$, $y = \ln \sqrt{1 - t^2}$ for $0 \le t \le \frac{1}{2}$.

9. Find all real solutions to the differential equation $x\dfrac{dy}{dx} + 2y = \sin x$.

10. Find all real solutions to the differential equation $y'' - 4y' + 8y = 16x^2$.