

1. Calculate the following integrals.

(a)  $\int_0^1 e^{-\sqrt{x}} dx.$

(b)  $\int_{1/e}^e |\ln x| dx.$

(c)  $\int_0^\pi x^2 \cos x dx.$

(d)  $\int_1^{\sqrt{3}} \arctan x dx.$

2. Find the following integrals.

(a)  $\int_0^2 x^3 \sqrt{4-x^2} dx.$

(b)  $\int_0^1 x^2(1-x)^{10} dx.$

(c)  $\int_0^\pi \sin^3 x dx.$

(d)  $\int_{-\pi/6}^{\pi/3} \sec^2 x \tan x dx.$

3. Calculate the following integrals.

(a)  $\int_{-1}^0 \frac{x}{x^2 + 2x + 4} dx.$

(b)  $\int_{-\pi}^0 \sin^2 x \cos^2 x dx.$

(c)  $\int_{-3}^3 \sqrt{9-x^2} dx.$

(d)  $\int_0^1 \frac{1}{\sqrt{x^2+1}} dx.$

4. (a) Find the length of the curve given by the equation  $y = e^x$ ,  $0 \leq x \leq 1$ .

(b) Find the length of the curve given by the parametric equations

$$x = \cos^3 t, \quad y = \sin^3 t \quad \text{for } 0 \leq t \leq \pi.$$

5. Let  $f$  be a continuous function on  $[0, 1]$ . Prove the following identities:

$$\int_0^{\pi/2} f(\cos x) dx = \int_0^{\pi/2} f(\sin x) dx = \frac{1}{2} \int_0^\pi f(\sin x) dx.$$