1. Evaluate \( \int_1^e \frac{\sqrt{\ln x}}{x} \, dx \).

2. Compute the area enclosed by the parabola \( y = x^2 \) and the straight line \( y = 2x \).

3. If \( f(x) = \int_0^{x^2} \tan(t^2 + 1) \, dt \), then find \( f'(x) \).
4. Evaluate the integral $\int_{-2}^{2} \sqrt{4-x^2} \, dx$ by interpreting it in terms of areas.

5. Find $\int_{1}^{2} \frac{x}{x+1} \, dx$.

6. Suppose it is given $f(5) = 3$, $f'(5) = 2$, $f(1) = 4$, and $f'(1) = -1$. Compute $\int_{1}^{5} xf''(x) \, dx$. 
7. If \( g(x) = \int_{\ln(x)}^{10} \sqrt{t^2 + 1} \, dt \), then find \( g'(x) \).

8. Find the integral \( \int x^5 e^x^2 \, dx \).

9. If \( h(x) = \int_{\cos(x)}^{5x} \cos(t^2) \, dt \), then find \( h'(x) \).
10. Find the area bounded by the curves \( x + y^2 = 2 \) and \( x + y = 0 \).

11. Let \( R \) denote the region enclosed by the x-axis, the line \( x = 1 \), and the curve \( y = \sqrt{x} \). Use the method of cylindrical shells to calculate the volume of the solid obtained by rotating the region \( R \) about the line \( x = 1 \).

12. Find \( \int \frac{x^3}{\sqrt{x^2 + 1}} \, dx \).
13. An animal population is increasing at a rate of $200 + 50t$ per year (where $t$ is measured in years). By how much does the animal population increase between the fourth and tenth years?

14. Find the interval on which the curve

$$y = \int_0^x \frac{1}{1 + t + t^2} dt$$

is concave upward.

15. The velocity function (in meters per second) is given for a particle moving on a line as follows

$$v(t) = t^2 - 2t - 8, \quad 1 \leq t \leq 6$$

Find (a) the displacement and (b) the distance traveled by the particle during the given time interval.