1. Evaluate the following indefinite integrals.

   (a)

$$\int \sin x \cos x \; dx$$

   (b)

$$\int \frac{x-1}{x+1} \; dx$$

2. Evaluate the following definite integrals.

   (a)

   $$\int_0^1 \sqrt{1 + 2r}\ dr$$

   (b)

   $$\int_{-1}^1 1 - \sqrt{1 - x^2}\ dx$$

3.

$$\int_{-1}^{4} |x| \, dx$$

4.

$$\int \frac{1}{e^x + e^{-x} + 2} \, dx$$

5. For x with $0 \leq x \leq 1$, define $g(x) = \int_0^\pi t(\sin t)^x \, dt$. Find the maximum value of g over the interval $[0, 1]$.

6. Find $\lim_{x \to 0} \frac{1}{x} \int_0^x \cos(t^2) \, dt$.

7. The gas mileage of a car depends on its velocity. When the velocity is v, the gas mileage is $f(v) = e^{-v^2}$ miles/gallon. If the velocity at time t is $v(t) = t$ miles/hour, how many gallons of gas are used after 5 hours? (Hint: Use the net change theorem.)