1. Evaluate the integral.

(a) \( \int \frac{x}{x^2 + 1} \, dx = \frac{1}{2} \ln(x^2 + 1) + C \)

(Why don’t we need the absolute value symbols around \( x^2 + 1 \) in the answer?)

(b) \( \int_0^1 xe^{-x^2} \, dx = \frac{1}{2} \left( 1 - \frac{1}{e} \right) \)

(c) \( \int \frac{e^{2x}}{1 + e^{2x}} \, dx = \frac{1}{2} \ln(1 + e^{2x}) + C \)

(Again, why don’t we need the absolute value symbols in the answer?)

(d) \( \int \frac{\sqrt{2 + \ln x}}{x} \, dx = \frac{2}{3} (2 + \ln x)^{3/2} + C \)

(e) \( \int_{\sqrt{6}}^3 x \sqrt{x^2 - 5} \, dx = \frac{7}{3} \)

2. The answer to each of the following questions is the value of a definite integral. In each of these problems, set up the integral that gives the answer to the question, but DO NOT EVALUATE THE INTEGRAL.

Example: "What is the area under the curve \( y = x^2 \) on the interval \([0, 1]\)?"

ANSWER: area = \( \int_0^1 x^2 \, dx \)

(a) What is the area of the region bounded by the curves \( y = x^2 - 1 \) and \( y = x + 1 \)?

ANSWER: area = \( \int_{-1}^2 x + 2 - x^2 \, dx \)

(b) A population grows at a rate of \( R(t) = te^t \) members per year. What is the cumulative change in the size of the population over the six-month period beginning at \( t = 1 \)?

ANSWER: cumulative change = \( \int_1^{1.5} te^t \, dt \)
(c) The injection of a drug causes a patient’s pupils to dilate so that its radius, in millimeters, \( t \) seconds after the injection is given by the function

\[
r(t) = te^{-t} + 2.
\]

What is the average radius of the pupil during the five seconds immediately following the injection?

ANSWER: average radius \( = \frac{1}{5} \int_{0}^{5} te^{-t} + 2 \, dt \)