1. Show the following inequality.

\[ 1 \leq \int_0^1 \sqrt{1 + x^2} \, dx \leq \sqrt{2} \]

2. The velocity function in metres per second for a particle moving along a line is given by \( v(t) = t^2 - 2t - 3 \), for \( 2 \leq t \leq 4 \).

(a) Find the displacement of the particle during the interval.

(b) Find the distance travelled by the particle during the interval.

3. Suppose that \( f \) is continuous on \([a, b]\) and \( f \) is differentiable on \((a, b)\) with \( f' \) continuous on \([a, b]\). Find \( \int_a^b 2f(x)f'(x) \, dx \).

4. Find the indefinite integrals.

(a) \( \int \tan^4(x) \sec^4(x) \, dx \)

(b) \( \int \tan^3(x) \sec^3(x) \, dx \)

5. Find \( \int \sec \theta \, d\theta \). \( (\text{Hint: Multiply the integrand by } \frac{\sec \theta + \tan \theta}{\sec \theta + \tan \theta}. \)