1. Let \( f \) be the function shown below. Which of the following is the best estimate of \( \int_{1}^{8} f(x) \, dx \): -24, 9, 20, 38? Justify your answer.

![Graph of function f(x) with x-axis from 0 to 8 and y-axis from 0 to 8]

2. Suppose that a car travels on a north-south road with northward velocity \( v(t) = 40 - 10t \) mph at time \( t \) hours.

   a. Evaluate \( \int_{0}^{5} v(t) \, dt \). Where is the car relative to its starting point at the end of 5 hours?

   b. Let \( s(t) \) be the car's speed at time \( t \) (recall that \( s(t) = |v(t)| \)). Evaluate \( \int_{0}^{5} s(t) \, dt \). What is the total distance traveled by the car at the end of 5 hours?
3. Use the fact that \( \int_1^4 t^2 \, dt = 21 \) along with the rules for manipulating integrals, to evaluate the following definite integrals:

a. \( \int_1^4 r^2 \, dr \)

b. \( \int_1^4 (3r^2 - 1) \, dx \)

4. Let \( f(x) = x \) and \( A_f(x) = \int_4^x f(t) \, dt \). By computing the (signed) area represented by the integral, show that \( A_f(x) = \frac{x^2}{2} - 8 \) for all values of \( x \) (you need to consider \( x > 4 \), \( 0 < x < 4 \), and \( x < 0 \)). (Draw pictures!)

5. Evaluate the following definite integrals using the Fundamental Theorem of Calculus.

a. \( \int_0^4 \sqrt{x} \, dx \)

b. \( \int_0^\pi \cos x \, dx \)