1. (a) The total distance is \( \int_0^4 (50 + 3\sqrt{t}) \, dt \) \( = (50t + 2t^{3/2}) \bigg|_0^4 = 216 \) miles.
   (b) The average velocity is \( \frac{216}{4} = 54 \) mph.

2. (a) Right endpoints: \((\pi/2)(\sin(\pi/2) + \sin(\pi) + \sin(3\pi/2) + \sin(2\pi)) = 0\)
   (b) Left endpoints: \((\pi/2)(\sin(0) + \sin(\pi/2) + \sin(\pi) + \sin(3\pi/2)) = 0\)
   (c) Midpoints: \((\pi/2)(\sin(\pi/4) + \sin(3\pi/4) + \sin(5\pi/4) + \sin(7\pi/4)) = 0\)

3. Let \( F(x) \) be an antiderivative of \( x^{-1}e^x \). Then by Fundamental Theorem of Calculus, \( f(t) = F(2t) - F(1) \). So \( f'(t) = 2F'(2t) = t^{-1}e^{2t} \) and \( f''(t) = 2t^{-1}e^{2t} - t^{-2}e^{2t} \).

4. (a) Substitute \( u = 1 + x^2 \):
   \[
   \int_1^2 \frac{x}{1 + x^2} \, dx = \frac{1}{2} \int_2^5 \frac{1}{u} \, du
   = \frac{1}{2} \ln |u| \bigg|_2^5 = \frac{1}{2}(\ln 5 - \ln 2)
   \]
   (b) Substitute \( u = 3x \):
   \[
   \int_0^2 e^{3x} \, dx = \frac{1}{3} \int_0^6 e^u \, du
   = \frac{1}{3} \left| e^u \right|_0^6 = \frac{1}{3}(e^6 - 1)
   \]
   (c)
   \[
   \int \sqrt{x}(x + \sqrt{x}) \, dx = \int x^{4/3} \, dx + \int x^{5/6} \, dx
   = \frac{3}{7}x^{7/3} + \frac{6}{11}x^{11/6} + C
   \]
   (d) Substitute \( u = e^x + 1 \):
   \[
   \int e^x \sqrt{e^x + 1} \, dx = \int \sqrt{u} \, du
   = \frac{2}{3}u^{3/2} + C = \frac{2}{3}(e^x + 1)^{3/2} + C
   \]

\[1\text{http://www.math.ucsb.edu/~xichen/math3b02w/mid1sol.pdf}\]