1. Find $1 + (f'(x))^2$ for the following functions $f(x)$:

   (a) $f(x) = 2e^x + \dfrac{1}{8}e^{-x}$

   (b) $f(x) = \dfrac{2}{3}x^{3/2} - \dfrac{1}{2}x^{1/2}$

2. Find $1 + (g'(y))^2$ for the following functions $g(y)$:

   (a) $g(y) = 3y^{4/3} - \dfrac{3}{32}y^{2/3}$

   (b) $g(y) = \dfrac{(y+2)^{3/2}}{3}$

3. Simplify $\sqrt{1 + (f'(x))^2}$ for each of the functions in #1. Simplify $\sqrt{1 + (g'(y))^2}$ for each of the functions in #2. What do you notice?

4. (**) Find the length of the curve $g(y) = 3y^{4/3} - \dfrac{3}{32}y^{2/3}$ from $y = 1$ to $y = 8$. Simplify your answer.

5. (**) Consider the arc of the curve $y = \sqrt{x}$ from $x = 0$ to $x = 4$.

   (a) What happens when you try to find the length of the curve? What's going on?

   (b) Set up an integral for the length of the curve in terms of y. Is this a valid integral?

6. (**) Suppose you know that the arc length of a certain smooth function $f(x)$ from $x = 0$ to $x = 2\pi$ is

$$L = \int_0^{2\pi} \sqrt{1 + 36\sin^2(2x)}\, dx.$$

   What can we say about $f(x)$?