Worksheet 5: Chapter 3 (Product, quotient, and chain rule)

1. Find any horizontal tangents in the interval $0 \leq x \leq 2\pi$.

    (a) $y = x + \sin x$

    (b) $y = x - \cot x$

2. Find the derivative of the function.

    (a) $y = (2x + 4)^3 (x + 1)^{-2}$

    (b) $y = (1 - x)e^{x^3}$

    (c) $r = 12(\sec \theta - \tan \theta)^{1/3}$

3. The height in feet of a ball above the ground t seconds after it is thrown is given by

$$s(t) = -4.9t^2 + 20t + 6.$$

    (a) What is the height of the ball $t = 4$ seconds after it is released? What about $t = 2$ seconds after release?

    (b) At the apex of the balls trajectory, it's velocity is momentarily zero. Find the time that this occurs.

    (c) Find the second derivative of $s(t)$. What do you notice about the function $a(t) = s''(t)$? Interpret your answer in the context of the problem.

4. Find the derivative of $y = \dfrac{x^2 - 1}{x^3 + 1}$. What is the slope of the line tangent to the graph of the function at $x = 2$?

5. First simplify the expression, then take the derivative.

$$y = \frac{(2x-1)(x^2-3x)}{x^3}$$

6. Find $f''(x)$ where

$$f(x) = \frac{x^3+2}{x}.$$

7. Find the equation of the line that is tangent to the graph of $y = xe^x$ at $x = 1$.