1. Use this information to practice with product rule, quotient rule, constants, etc. Given:
\( f'(2) = -5, \ g'(2) = 3, \ f''(2) = 1/2, \) and \( g''(2) = 0.4. \)

(a) Find the derivative of \( 6f(x) \) at \( x = 2. \)
\[ g \cdot f'(x) = 6(\frac{1}{2}) = 3 \]

(b) Find the derivative of \( f(x) \cdot g(x) \) at \( x = 2. \)
\[ f(x) \cdot g'(x) + g(x) \cdot f'(x) \]
\[ (-5)(\frac{1}{2}) + 3(\frac{1}{2}) = -2 + \frac{3}{2} = \frac{1}{2} \]

(c) Find the derivative of \( \frac{f(x)}{g(x)} \) at \( x = 2. \)
\[ \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2} = \frac{3(\frac{1}{2}) - (-5)(\frac{1}{4})}{3} = \frac{\frac{3}{2} + \frac{5}{2}}{9} = \frac{\frac{7}{2}}{9} = \frac{7}{18} \]

2. What is the average rate of change of \( f(x) = e^x \) on the interval \(-4 \leq x \leq -1\)? (3 decimal places)
\[ \text{avg rate of change} = \frac{f(-1) - f(-4)}{(-1) - (-4)} = \frac{e^{-1} - e^{-4}}{3} \approx 0.106 \]

*USE TI-89

3. Let \( f(x) = \sin x \) and \( g(x) = p \ln x \) in the closed interval \( 0 \leq x \leq \frac{\pi}{2} \). For what value of \( p \) will the tangents to the curves at their points of intersection be perpendicular?

\( f'(x) = \cos x \)
\( g'(x) = \frac{p}{x} \)

At points of perpendicularity, \( \cos x = -\frac{x}{p} \Rightarrow p = -\frac{x}{\cos x} \rightarrow x \approx 0.409 \text{ or } 0.410 \)

\[ p \approx -0.447 \]

4. A line tangent to the curve \( f(x) = \frac{1}{2^x} \) at the point \((a, f(a))\) has a slope of -1. What is the x-intercept of this tangent?
\[ f(x) = 2^{-2x} \]
\[ f'(x) = -2(\ln 2)(\frac{1}{4})^x \]

Set \( f'(x) = -1 \)

So, we have

5. For what values of \( a \) and \( b \) is the function differentiable? \( f(x) = \begin{cases} \frac{ax^3-bx+5}{\sqrt{2a}} & \text{if } x \leq 2 \\ \sqrt{ax-x+b} & \text{if } x > 2 \end{cases} \)

Continuity @ \( x = 2 \)
\[ 8a - 2b + 5 = \sqrt{2a} - 2 + b \]

Differentiability @ \( x = 2 \)
\[ 3a^2x^2 - b = \frac{\sqrt{a}}{2} x^{-\frac{1}{2}} - 1 \]
\[ 12a - b = \frac{\sqrt{a}}{2 - \frac{1}{2}} - 1 \]

Step here!
You would solve a system, but p. 146 - #1 - 10 this one is pretty nasty!