PRACTICE PROBLEMS

1. Let \( u(t) = 2t^2 \).
   A) Find the average rate of change of \( u \) over the interval \( 0 \leq t \leq 1 \).
   B) Find the instantaneous rate of change of \( u \) at \( t = 0 \).
   C) Find the instantaneous rate of change of \( u \) at \( t = t_0 \).
   D) The average rate of change is the slope of a certain secant line and the instantaneous rate of change is the slope of a certain tangent line. Sketch the graph of \( u = u(t) \) together with those two lines illustrating parts A) and B).

2. Use the definition of the derivative to compute \( \frac{d}{dx} \sqrt{1 + x} \) at \( x_0 = 8 \).

3. Find \( \frac{d}{dx} (1 - x)(1 + x)(1 + x^2)(1 + x^4) \) at \( x = 1 \).

4. Find
   \[
   \frac{d^2}{dx^2} \left( \frac{3x - 2}{5x} \right).
   \]

5. Find all values of \( x \) at which the tangent line to \( y = \frac{x^2 + 1}{x+1} \) is parallel to \( y = x \).

6. Find
   \[
   \frac{d}{dx} \left( \frac{\sin x \sec x}{1 + x \tan x} \right).
   \]

7. Show that \( y = x \sin x \) is a solution to \( y'' + y = 2 \cos x \).

8. Write the equation of the tangent line to the graph of \( y = \tan x \) at \( x = -\pi/4 \).