1. Find the derivatives of the following:

\[ f(u) = \sqrt{2}u + \sqrt{3}u \quad g(z) = (z^{-2} + z^{-3})(z^5 - 2z^2) \quad h(t) = \csc(t(t + \cot t)) \]

\[ f(\theta) = \sin(\sqrt{\theta}) \quad g(\theta) = \sqrt{\sin(\theta)} \quad h(\theta) = \tan^2(3\theta) \]

2. Find an equation of the tangent line to \( y = \frac{2x}{x + 1} \) at (1, 1).

3. Find an equation of the tangent line and the normal line to \( g(x) = (1+2x)^2 \) at (1, 9).

4. Assuming that we know the derivatives of \( \sin x \) and \( \cos x \), derive the derivatives of the other four trigonometric functions.

5. What is \( \frac{dy}{dx} \) at (6, 2) when \( y^6 + x^2 = 100 \)? What about at (6, -2)?

6. Is it true that all differentiable functions are continuous? Is it true that all continuous functions are differentiable? Is it true that the derivative of a differentiable function is continuous? Give arguments or counterexamples.

7. Find \( \frac{d}{dx}|x| \) using the piecewise definition of \( |x| \). Find \( \frac{d}{dx}|x| \) using the fact that \( |x| = \sqrt{x^2} \). Do your answers agree? Find \( \frac{d}{dx} \cos x \).