M 408C
September 15, 2010

1. Find the derivatives of the following:
$$f(u) = \sqrt{2u} + \sqrt{3u} \quad g(z) = (z^{-2} + z^{-3})(z^5 - 2z^2) \quad h(t) = \csc t(t + \cot t)$$
$$f(\theta) = \sin\sqrt{\theta} \qquad\qquad g(\theta) = \sqrt{\sin\theta} \qquad\qquad h(\theta) = \tan^2(3\theta)$$

2. Find an equation of the tangent line to $y = \dfrac{2x}{x+1}$ 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 $\dfrac{dy}{dx}$ 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 $\dfrac{d}{dx}|x|$ using the piecewise definition of $|x|$. Find $\dfrac{d}{dx}|x|$ using the fact that $|x| = \sqrt{x^2}$. Do your answers agree? Find $\dfrac{d}{dx}|\cos x|$.