**Math 106 Practice Exam #1 Spring 2014**

• This is a closed-book examination. No books, notes, calculators, cell phones, communication devices of any sort, or webpages, or other aids are permitted.

• Please *show* all of your work and *justify* all of your answers.

**1.** Differentiate each of the following functions. **Do not** simplify your answers.

(a) $f(x) = \cos^4\left(\sin\left(\dfrac{7}{x}\right)\right)$

(b) $y = \sec^2(3x) \cdot \sec x$

(c) $g(t) = \dfrac{t^3 + \tan\left(\dfrac{1}{t}\right)}{1 + t^2}$

**2.** Consider the equation $\sec(x^2 y) + \cos x = y^{\frac{3}{2}}$. Compute $\dfrac{dy}{dx}$.

**3.** Compute the equation of the tangent line for $\tan\left(\dfrac{x}{y}\right) + y = \sqrt{1-x}$. at the point $(0, 1)$.

**4.** A child riding in a car driving along a straight road is looking through binoculars when she sees a water tower off to the side. The tower is located 1500 ft from the nearest point on the road. At a particular moment, the car is moving at 80 feet per second, and the car is 800 feet from that nearest point to the tower. How fast must the child be rotating the angle that the binoculars are pointing to keep the tower in view?

**5.** Find a function $f$ such that $f''(x) = 2x^3 + 3x^2 - 4x + 5$ and $f(0) = 2$ and $f(1) = 0$.

**6.** Find the general antiderivative for each of the following:

(a) $\dfrac{\sqrt{x} + \dfrac{1}{x}}{x^{\frac{3}{5}}}$

(b) $\left(x^{\frac{3}{4}} + \dfrac{1}{\sqrt{x}}\right)\left(x - \dfrac{1}{x^{\frac{3}{4}}}\right)$

**7.** Jack throws a baseball straight downward from the top of a building. The initial *speed* of the ball is 25 feet per second. It hits the ground with a speed of 153 feet per second. How tall is the building?

Hint: Use $a(t) = -32$ feet per second squared as acceleration due to gravity on the falling body.