Math 171H Exam 2
October 24, 2014
S. Witherspoon

Name_____

There are 6 questions, for a total of 100 points. Point values are written beside each question. Calculators may be used only for basic arithmetic operations. *Show your work for full credit.*

1. Find $\dfrac{dy}{dx}$.

(a) [10] $y = x^2 \cos x$

(b) [10] $y = \dfrac{x+1}{e^{2x}}$

(c) [10] $y = \sec(\sqrt{x^2+1})$

2. [15] Find the point(s) on the curve

$$x = t - \frac{\pi}{2}, \quad y = t + \cos t$$

where the tangent is horizontal.

3. [15] A balloon is released from the ground 100 meters away from you. The balloon rises straight up at a rate of 5 meters per second. How fast is the distance from you to the balloon increasing when the balloon is 50 meters high?

4. Find the following limits.

(a) [10] $\lim_{x \to 0} \dfrac{\cos\left(x + \frac{\pi}{2}\right)}{x}$

(b) [10] $\lim_{x \to 2} \left(\log_2(x^2 - 4) - \log_2(x - 2)\right)$

5. For each of the following functions, find $f^{(100)}(x)$; that is, find the hundredth derivative of f.

(a) [5] $f(x) = x^{50} + \sin x$

(b) [5] $f(x) = e^{2x}$ (You may leave your answer in terms of powers of 2.)

6. (a) [5] Is the function $f(x) = \cos|x|$ differentiable at 0? Justify your answer.

(b) [5] Is the function $f(x) = \sin|x|$ differentiable at 0? Justify your answer.