Homework 7
Math 147 (section 501–502–503), Spring 2015

This homework is due on Wednesday, March 4.

0. Read Sections 4.4 and 4.5.

1. Consider the following function:

\[ f(x) = \begin{cases} 
    \sin x & \text{if } x < \frac{\pi}{2} \\
    mx + b & \text{if } x \geq \frac{\pi}{2}
\end{cases} \]

(a) Which ordered pairs \((m, b)\) of real numbers make \(f(x)\) continuous? (Describe the set of those pairs.)

(b) Which pairs \((m, b)\) make \(f(x)\) differentiable?

2. Consider the following function:

\[ f(x) = \begin{cases} 
    x + 1 & \text{if } x \leq 0 \\
    1 & \text{if } 0 < x < 1 \\
    (x - 1)^2 + 1 & \text{if } 1 \leq x
\end{cases} \]

(a) Graph \(f(x)\).

(b) Where is \(f(x)\) discontinuous? Where is \(f(x)\) NOT differentiable?

(c) Graph \(f'(x)\).

(d) Where is \(f'(x)\) discontinuous? Where is \(f'(x)\) NOT differentiable?

(e) Graph \(f''(x)\).

3. An ant is walking around the unit circle. Let \(\theta(t)\) denote the angle of the ant at time \(t\). Let \((x(t), y(t))\) denote the position of the ant at time \(t\).

(a) State an expression for \(x'(t)\) in terms of \(\theta(t)\).

(b) State an expression for the second derivative \(y''(t)\) in terms of \(\theta(t)\).

4. Section 4.4 # 14, 36, 46, 52, 58, 64, 70, 86

5. Section 4.5 # 28, 52, 64

6. (These problems are *not* to be turned in!)

(a) Section 4.4 # 5, 9, 21, 33, 35, 41, 45, 47, 51, 55, 61, 69, 77, 85, 87

(b) Section 4.5 # 5, 9, 23, 27, 29, 39, 43, 59, 63, 67