

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