LAS Calculus
Instantaneous Rates of Change
Homework 2

1. A derivative is not the same as an average rate of change. (So, for example, an instantaneous velocity is not actually a distance divided by a time length.) What is the connection between a derivative and an average rate of change?

2. For some function $y = f(x)$, we know the following:

   - The average rate of change from $x = 1$ to $x = 1.1$ is $\frac{\Delta y}{\Delta x} = 4.3$.
   - The average rate of change from $x = 1$ to $x = 1.01$ is $\frac{\Delta y}{\Delta x} = 4.02$.
   - The average rate of change from $x = 1$ to $x = 1.005$ is $\frac{\Delta y}{\Delta x} = 4.001$.
   - The average rate of change from $x = 1$ to $x = 1.001$ is $\frac{\Delta y}{\Delta x} = 4.000002$.

   Give a reasonable guess for $f'(1)$.

3. In t minutes, an object is $y = f(t)$ meters away. We know the following:

   - The object's average velocity from $t = 5$ to $x = 5.1$ seconds is 12.6 m/sec.
   - The object's average velocity from $t = 5$ to $x = 5.05$ seconds is 12.55 m/sec.
   - The object's average velocity from $t = 5$ to $x = 5.01$ seconds is 12.507 m/sec.
   - The object's average velocity from $t = 5$ to $x = 5.001$ seconds is 12.501 m/sec.

   Give a reasonable guess the object's velocity in $t = 5$ seconds.

4. Let $f(x) = 2x^2$. Use our definition of the derivative to find $f'(3)$. Be sure to explain (use words) how you got the final number.

5. Let $f(x) = x^2 - 2x$. Use our definition of the derivative to find $f'(4)$.

6. An object is traveling so that in t minutes, its position will be $f(t) = 2t^2 - 4t + 3$ feet away. What is the velocity of the object in $t = 2$ minutes?

7. Let $f(x) = 2x^2$. Find an equation for the tangent line to the graph $y = f(x)$ at $x = 3$. (Note that you found $f'(3)$ in problem 4.)

8. Let $f(x) = x^2 - 2x$. Find an equation for the tangent line to the graph $y = f(x)$ at $x = 4$. (Note that you found $f'(4)$ in problem 5.)

9. Let $f(x) = 3x^2 - 2x$. Find an equation for the tangent line to the graph $y = f(x)$ at $x = 1$.