Section 3.3

Test for Increasing and Decreasing Functions: Let f be a function that is continuous on the closed interval $[a, b]$ and differentiable on the open interval (a, b).

1. If $f'(x) > 0$ for all x in (a, b), then f is increasing on $[a, b]$.
2. If $f'(x) < 0$ for all x in (a, b), then f is decreasing on $[a, b]$.
3. If $f'(x) = 0$ for all x in (a, b), then f is constant on $[a, b]$.

Guidelines for Finding Intervals on Which a Function is Increasing or Decreasing: Let f be continuous on the interval (a, b). To find the open intervals on which f is increasing or decreasing, use the following steps.

1. Locate the critical numbers of f in (a, b), and use these numbers to determine test intervals.
2. Determine the sign of $f'(x)$ at one test value in each of the intervals.
3. Use the test for increasing and decreasing functions (above) to determine whether f is increasing or decreasing on each interval.

These guidelines are also valid when the interval (a, b) is replaced by an interval of the form $(-\infty, b), (a, \infty)$, or $(-\infty, \infty)$.

The First Derivative Test: Let c be a critical number of a function f that is continuous on an open interval I containing c. If f is differentiable on the interval, except possibly at c, then $f(c)$ can be classified as follows.

1. If $f'(x)$ changes from negative to positive at c, then f has a *relative minimum* at $(c, f(c))$.
2. If $f'(x)$ changes from positive to negative at c, then f has a *relative maximum* at $(c, f(c))$.
3. If $f'(x)$ is positive on both sides of c or negative on both sides of c, then $f(c)$ is neither a relative maximum nor a relative minimum.

1) Find the open intervals on which $f(x) = \frac{2}{3}x^3 - 2x$ is increasing or decreasing. To do this, fill in the table below (similar to the one in example 1), evaluating $f'(x)$ at test values in each interval determined by the critical numbers.

Interval			
Test Value			
Sign of $f'(x)$			
Conclusion			

2) Find the relative extrema of the function $f(x) = \tan x - 2x$ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. Fill in the table below to help you.

Interval			
Test Value			
Sign of $f'(x)$			
Conclusion			

3) Find the relative extrema of $f(x) = (x^2 + x - 2)^{2/3}$. Fill in the table below to help you.

Interval			
Test Value			
Sign of $f'(x)$			
Conclusion			

4) Find the relative extrema of $f(x) = \frac{x^2 - 3}{x^3}$. Fill in the table to help you.

Interval				
Test Value				
Sign of $f'(x)$				
Conclusion				

Homework for this section: Read the section and watch the videos/tutorials. Then do these problems in preparation for the quiz: #5, 9, 25, 43, 59, 70