Sorry, I got the axes swapped around for supply and demand curves... The quantity of the product goes on the x axis and the price on the y axis... As far as I can tell, this is because economists just decided to use the opposite convention to everyone else in the world.

Sorry about this...

Homework:

We have a grader. Homework will be turned in at discussion sections, starting next Tuesday.

See

`http://www.math.uic.edu/~groves/teaching/2011-12/165/`

for the assignments. These lecture slides (from the beginning of the course) will be posted there.

[I realize that a lot of you have the Solutions Manual. Using it is only going to hurt yourself, since the HW doesn't count for points.]

Continuity:

Recall: A function $f(x)$ is **continuous at** c if

$$\lim_{x \to c} f(x) = f(c).$$

We say that $f(x)$ is **continuous on the open interval** $a < x < b$ if it is continuous at c for every point c so that $a < c < b$.

Again, polynomial functions are continuous an any open interval, and rational functions are continuous if they're defined at every point in the interval.

Continuity on a closed interval:

The function $f(x)$ is **continuous on the closed interval** $a \leq x \leq b$ if

1. It is continuous on the open interval $a < x < b$,

2. $\lim_{x \to a^+} f(x) = f(a)$,

3. $\lim_{x \to b^-} f(x) = f(b)$.

Example:

Let's talk about the continuity of the following function:

$$f(x) = \begin{cases} \frac{x-1}{x+3} & x \le 0 \\ x^2 + 2 & x > 0 \end{cases}$$

The Intermediate Value Property

Suppose that $f(x)$ is continuous on the **closed** interval $a \le x \le b$, and that L is between $f(a)$ and $f(b)$. Then there is some c with $a \le c \le b$ so that $f(c) = L$.

[PICTURE]

Application/Example:

Let $f(x) = x^3 + 3x^2 - 2x - 1$. Show that there is some number c between 0 and 1 so that $f(c) = 0$.

(Work out where this number is to some degree of accuracy...)

Example 2:

Show that there is some number x between -1 and 1 so that

$$\frac{x^2 - x - 1}{x + 3} = \sqrt{x + 4} - 2.$$

The Derivative

Let $f(x)$ be a function and suppose that c is in the domain of f. The **derivative of f at c** is

$$\lim_{h \to 0} \frac{f(c+h) - f(c)}{h}$$

(supposing that this limits exists).

The **derivative of $f(x)$** (as a function of x) is

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}.$$

[The domain of this function is the set of values for which this limit exists.]

Things the derivative can mean:

[More details on all of these later]

• The slope of the tangent line. [The tangent line at $x = c$, in turn, is the best linear approximation to f at the point $(c, f(c))$.]

• The instantaneous rate of change of f.

• If $f(x)$ measures where a point is, $f'(x)$ measures the **velocity** of the function.

[The derivative also allows us to calculate maximum (or minimum) values of $f(x)$.]

The tangent line to $f(x)$ at $x = c$...