This weeks lecture cover 4 sections in the book: p5 and 1.1-1.3

1 P5: Solving inequalities

In short summary, solving inequalities is trying to find **all** values of x (typically) that **satisfy** the inequality.

In other words, we find all the numbers that work. Unlike an equation which usually has 1 or just a few answers, the answers to inequalities often involve an intervals worth of answers.

This section is meant as a review. Let me just highlight the basic types of problems:

- intersection of lines. Lok at example 2 in the book. The graphic shows the lines $y = 1 - (3x)/2$ and $y = x - 4$. Why do they graph these? Well to find solutions to the inequality, they graph the left side and right side and find where they intersect. The x value of the intersection solves the equality (when $1 - (3x)/2 = x - 4$). The inequality then figures out which other x also work.
- Absolute value problems. For some reason, these are difficult! Keep in mind that an absolute value really has two inequalities with it. That is

  $$|x| < 3 and - 3 < x < 3$$

  and

  $$|x| > 3 and x > 3 or x < -3$$

  mean the same thing. Read $-3 < x < 3$ as $-3 < x$ and $x < 3$. Also, pay special attention to the role of and and or.

  Notice there are two types of answers depending on the inequality. Look at example 5 to see the first type.
- There are other types mentioned in the text, but these don't appear in the homework. You can skip these.

2 1.1 Functions

Don't be scared off by the initial part of this section. Mathematicians, like myself, think of functions as anything that returns an output based on an input. Students, like yourself, think of a function as anything that looks like $f(x) = \dots$. Somewhere in the middle we will meet but keep in mind functions are more general than you probably think.

Okay that said, the most difficult thing about functions is just getting used to the notation. To those in the know, this is simple, for those learning it seems hard. If you don't know, pay special attention to example 3 and example 9.

In this section you also learn some language about functions: The domain and range. If you think of a function taking an input and returning an output (like I do) then the domain is all possible inputs and the range is all possible outputs. If you think of a function as $f(x) = \dots$ then the domain is all x's that work and the range is all values that $f(x)$ can be. In the next section, there will be an interpretation in terms of the graph. In this class, I won't emphasize these two concepts.

3 1.2 Graphs of functions

Your calculator can do an excellent job of graphing functions. We will learn how in a few lectures. The reason for this is that your calculator just loves to plot points (x, y) and connect them with lines. So let's try to think of a graph this way.

The graph of a function $y = f(x)$ is all the points (x, y) where when you find $f(x)$ you get y.

It is important to note that the graph of a function and the function itself give the same information, just differently. Please make sure that you can read a graph of a function. That is if I give you a value of x you can tell me what $f(x)$ is from the graph.

Now a function is nice to graph, as for each x there is only one y to be found. This is summarized in the vertical line test for functions which says functions must intersect vertical lines at most once. (It might miss altogether)

This section introduces some language that becomes important in a calculus class: increasing-, decreasing-, even- and odd functions. The first two are clear from the graph, the last two deal with how a graph is symmetric. Please make sure you understand what we mean by the graph is symmetric, If not speak up.

4 1.3 Shifting etc.

This section is intended to make it easy to graph functions. I'm not sure it actually helps students right away wit this, but it is important to realize that in mathematics we like to organize things that are related. In this case, functions which more or less have the same graph.

Look ar the figures 1.19 and 1.20 in the book. They show what I mean by related. The two graphs have the same shape, *they are just placed in different positions on the graph.* These two graphs are related and so their functions should be too.

But how?

Well, the first figure has a shift up. Basically we add to each y value, and notationally we do the same $f(x) + 2$ is the graph compared to $f(x)$.

The second we shift to the right. Now we do something to the x value first, then square. It is tricky but to shift right, we subtract from the x. So the graph is $f(x - 2)$.

These are vertical and horizontal shifts. Try to pay special attention to these and make sure you understand notationally and conceptually why these things are different:

$$f(x), f(x + c) f(x) + c.$$

Another one is to flip the graph upside down. Mathematically, instead of plotting y we plot $-y$ and notationally the function we graph is $-f(x)$. Check out example 3 for details.

There are two more to consider, but we won't in this class. You might wish to see if you can figure out what they do using your calculator. Here they are $f(cx)$ and $cf(x)$.