MATH 191, Sections 1 and 3
Calculus I
Fall 2009

Sections 1.1 and 1.2: Precalculus preliminaries (functions and graphs)

This worksheet is the first of a few that will help you break the rust of of those gears and jog your memories of precalculus preliminaries dealing with algebra and trigonometry.

Working in the groups into which you've been divided, complete the first part of this worksheet.

1. In the space at the right below, draw a *Venn diagram* illustrating the relationships between the folloing kinds of numbers:

   - *real numbers*, $\mathbb{R}$
   - *natural numbers*, $\mathbb{N}$
   - *integers*, $\mathbb{Z}$
   - *rational numbers*, $\mathbb{Q}$
   - *irrational numbers*

2. For each of the following numbers, indicate (using the symbols introduced above, if you'd like) which of the sets above the number is an element of. (Recall that a number can be in more than one set!)

   (a) 1.3
   (b) $\frac{22}{7}$
   (c) $1.\overline{3} = 1.3333...$
   (d) $\pi \approx 3.14159265...$
   (e) -7
   (f) 100
   (g) 1.01001000100001...

3. Simplify each of the following formulas as much as you can.

   (a) $|1 - 7|$

   (b) $|2 - |13 - 16||$

   (c) $|6 - x|$ (for this one write an expression that does not involve absolute values; you'll need a *piecewise* expression to do this!)

4. Solve each of the following inequalities for the variable it includes. Draw a number line on which you indicate the values of x described by your solution.

   (a) $3x + 1 \leq 7$

   (b) $|t| \leq 5$

   (c) $|\frac{x}{2} - 3| > 4$

Here's where we'll reconvene as a class!
(Feel free to keep working if other groups are not yet done.)

5. Indicate the *domain* and *range* of each of the functions given below. (Please try to use *interval notation* whenever possible.)

   (a) $f(x) = \sin(x)$

   (b) $g(r) = \sqrt{r}$

   (c) $h(z) = \sqrt{3z - 1}$ (for this one remember that you need what's under the radical sign to be nonnegative!)

6. Find the *roots* of each function given below. (Remember to write your answer in the form "$x = ...$" or "$t = ...$") Also, for each function draw a set of axes and sketch a graph of the function on those axes.

   (a) $F(x) = 4x + 1$

   (b) $g(t) = \cos(t)$

   (c) $f(x) = x^2 + x - 12$

7. Draw the graph of a single function f which has the following properties:

   - f is *increasing* on the intervals $(-\infty, -3)$ and $(3, \infty)$,
   - f is *decreasing* on the interval $(-3, 3)$,
   - f has *odd symmetry* (that is, it is *symmetric about the origin*), and
   - f's *maximum value* is 7 and its *minimum value* is -7.

Here's where we'll reconvene as a class once more!
(Feel free to keep working if other groups are not yet done.)

8. Explain the *Vertical Line Test* in your own words, and draw pictures showing it in action!

9. Draw a set of axes below, and on these axes draw the graph of the function $f(x) = x^2$.

Now, for each of the following functions, describe how to obtain the graph of the function by modifying the graph you drew above. Go back to your graph and add graphs of each function below.

(a) $g(x) = x^2 - 4$

(b) $h(x) = (x + 4)^2$

(c) $D(x) = (x - 1)^2 + 2$