MATH 171 Activity #4: Piecewise / Absolute Functions	Homework: 2.4: 7, 11, 13, 45, 49, 57 2.5: 3, 13, 31, 47

We've studied linear functions in-depth. Now we'll use what we've learned to investigate piecewise functions and absolute functions.

A *piecewise-defined* function is "defined by different rules over different subsets of its domain." In plain English, a piecewise function is a bunch of functions put together. Consider the *absolute value* function (a simple example of a piecewise-defined function):

1. Complete the following table. Graph f(x) and g(x) over the interval (-6, 6).

x	$f(x) = x - 3$	$g(x) = \|x - 3\|$
-6		
-4		
-2		
0		
2		
4		
6		

2. Explain the difference between the two functions. Identify the domain and range of each function.

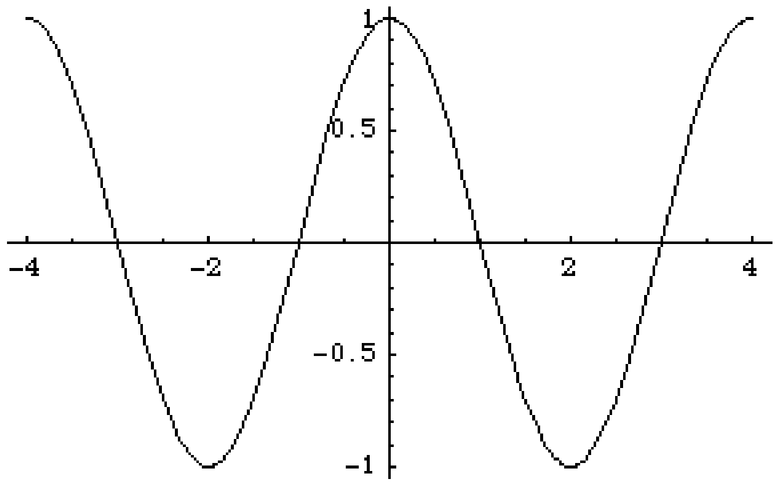
The absolute value function, $g(x) = |x|$, is never negative. If we input a positive value for x, the function yields a positive output. If we input a negative value for x, the function still yields a positive output. Therefore, we can write the absolute value function as a piecewise-defined function.

$$f(x) = |x| = \begin{cases} x & ,x \ge 0 \\ -x & ,x < 0 \end{cases}$$

We can use absolute values in two ways to create new functions from old. First, we can take the absolute value of the output of a function. Second, we can take the absolute value of the input of a function.

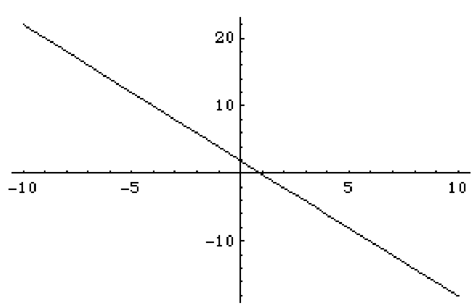
In other words, given a function *f(x)*, we can create the following new functions: $y = |f(x)|$ and $y = f(|x|)$

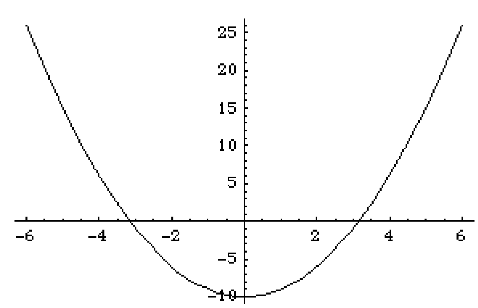
3. The graph of the function $f(x) = 10\cos\left(\frac{\pi x}{2}\right)$ is displayed below. Your goal is to graph and clearly label the following: $g(x) = |f(x)|$ and $h(x) = f(|x|)$



Explain how g(x) and h(x) differ from the original function. Identify the domain and range of each function.

4. For each of the following functions, sketch the graphs of: $g(x) = |f(x)|$ and $h(x) = f(|x|)$





5. Just as we solved linear equations analytically and graphically, we can solve absolute value equations and inequalities. Solve the following analytically and/or graphically

$|x-4|=|7x+12|$

$|x-4|>|7x+12|$, solve graphically

6. As was stated earlier, a piecewise-defined function is defined by different rules over different subsets of its domain. Here's an example of a piecewise function:

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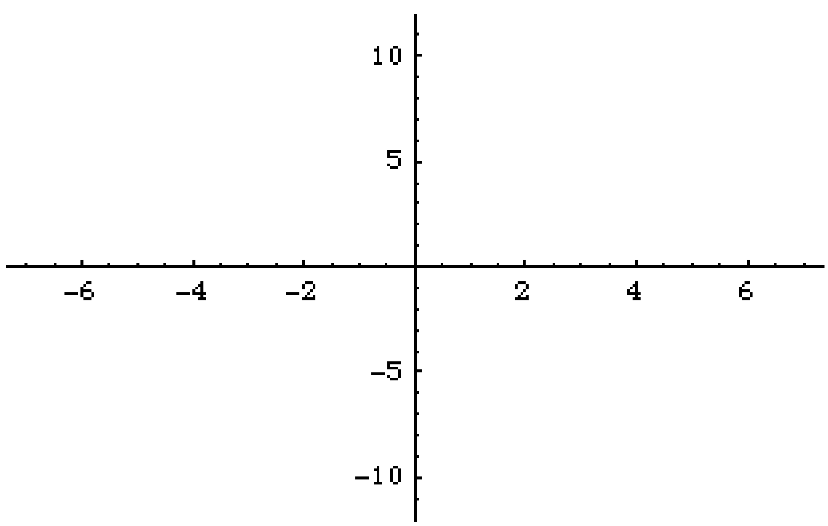
$$f(x)=\begin{cases} 3x+1 & ,x\le 0 \\ 1 & ,0<x<4 \\ (x-3)^2 & ,x\ge 4 \end{cases}$$

Graph this function on the following axes.



To graph this function on your calculator, you need to enter the following:

$$Y_1 = (3x+1)*(x \le 0)$$
$$Y_2 = (1)*(x > 0)(x < 4)$$
$$Y_3 = ((x-3)^2)*(x \ge 4)$$

The inequality symbols are listed under **TEST** (above the **MATH** key)

Situation: In a triathlon, an athlete's distance is a function of time. Suppose a triathlon consists of the following legs:

1. You swim for 2.4 miles at 2 mph
2. You ride a bicycle at 20 mph for 112 miles
3. You run a 26.2 mile marathon at a speed of 9 mph

Your goal is to graph your distance as a function of time and write out the piecewise function

Extra-credit Question (worth quite a few points):

Three telecommunications companies offer the following wireless service plans.

Company A: $17.95 monthly fee plus 73 cents per minute

Company B: $27.95 monthly fee includes 15 free minutes. Each additional minute is 53 cents

Company C: $49.95 monthly fee includes 60 free minutes. Each additional minute is 35 cents

Company D: $75.95 monthly fee includes 150 free minutes. Each additional minute is 35 cents.

Graph the monthly bill as a function of the minutes used. Then write the piecewise function for the cheapest service plan from 0 – 180 minutes.