Name: ______________________________ Date: ________________________

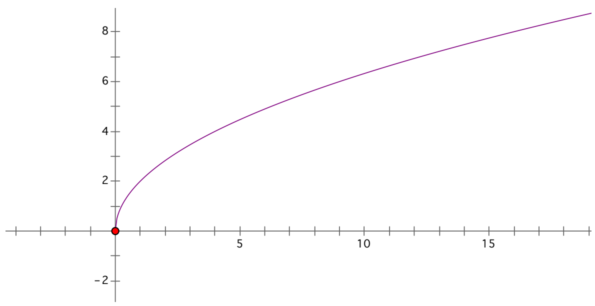
Window Shades and Rate of Change

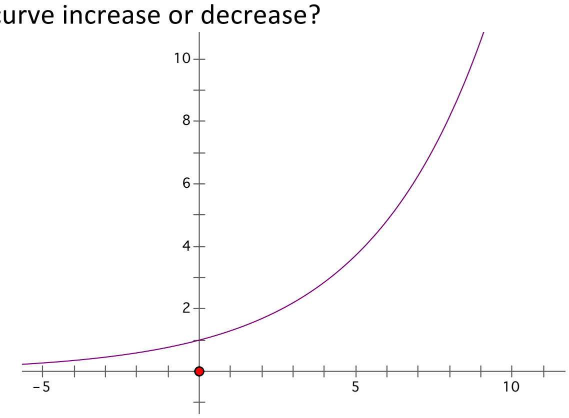
Teacher: Rachel Chou

WordBank: *constant* *slope* *equal* *increases* *decreases* *distance*

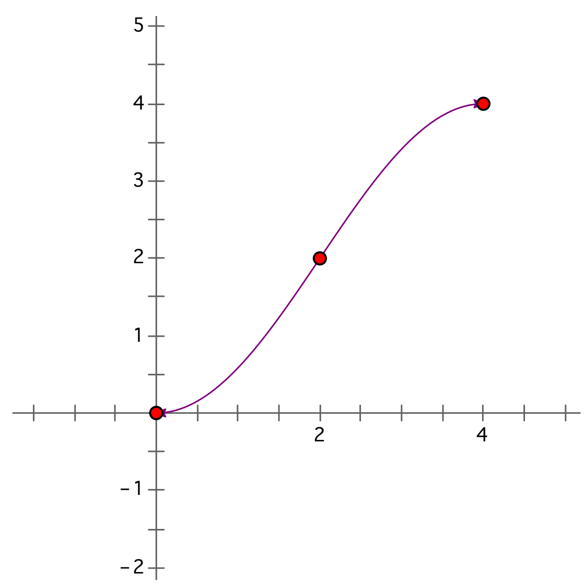
1. A line is a collection of points on which the _________________ stays ________________.

2. On non-linear curves, as the value of x changes, the slope changes. Consider the curves shown below. As the value of x moves from 0 to ∞, does the steepness of the curve increase or decrease?





3. In the graph below, as the value of x increases from 0 to 4, the value of y clearly ____________________.



(a) Is the value of y increasing at a constant rate? [yes or no?]

(b) On which x *interval* is the *steepness* of the graph increasing?

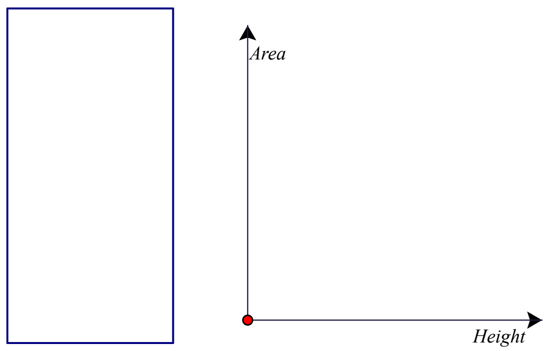
(c) On which x *interval* is the *steepness* of the graph decreasing?

(d) On which x *interval* is the value of y increasing at an increasing rate?

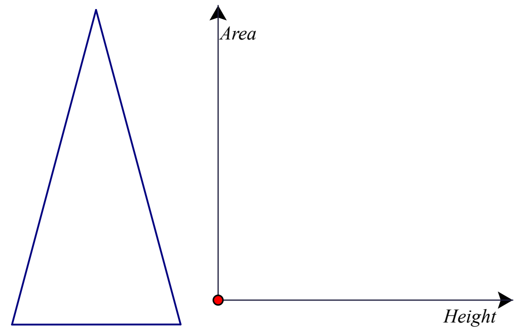
(e) On which x *interval* is the value of y increasing at a decreasing rate?

4. Mr. Blick has some weirdly shaped windows at his house. Lately, as he has been pulling up the windowshades (For some strange reason, Mr. Blick installed his windowshades such that he pulls them up to cover the windows instead of installing them up high. Don't ask. ☺), his curiosity was stimulated. He needs your help! Mr. Blick wonders how the area that is covered by the window shade varies as a function of time. In each part below, is a window. Draw a [rough] sketch of how area would vary as a function of height, as Mr. Blick pulls up the shade on each of the following windows:

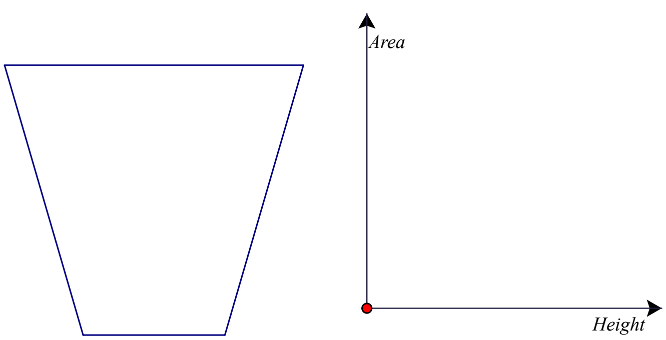
(a)



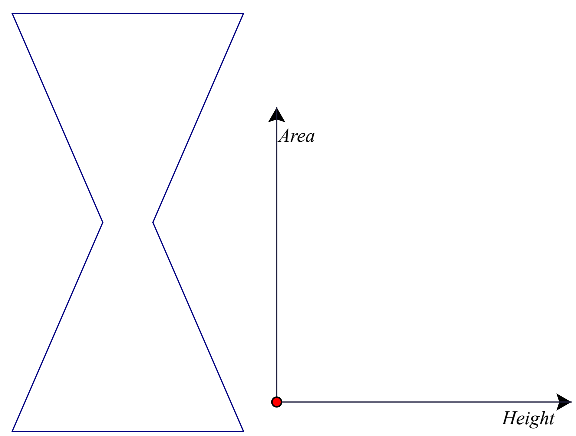
(b)



(c)

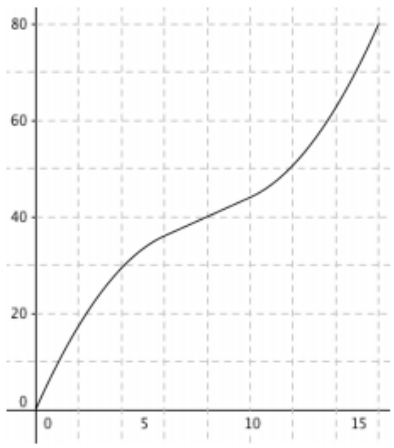


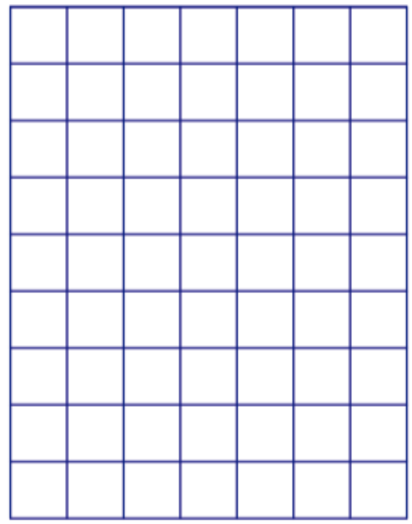
(d)

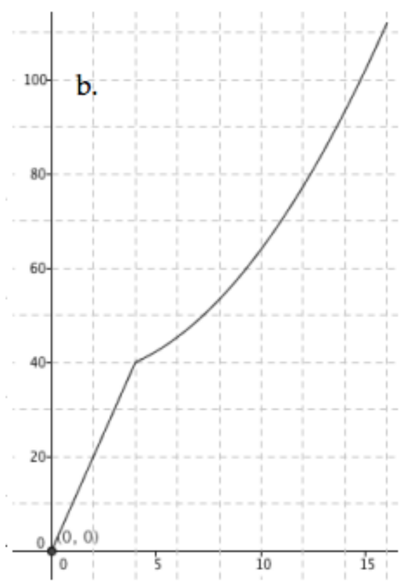


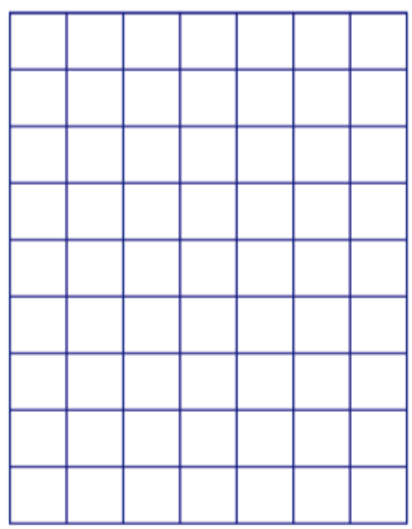
5. This time, your task is different. For each graph given, draw a window that would have this area (y) versus height (x) graph. Use the applet at: https://www.mathedpage.org/lessons/dr-dim/dde.html. Using the applet will be demonstrated during class.

a.

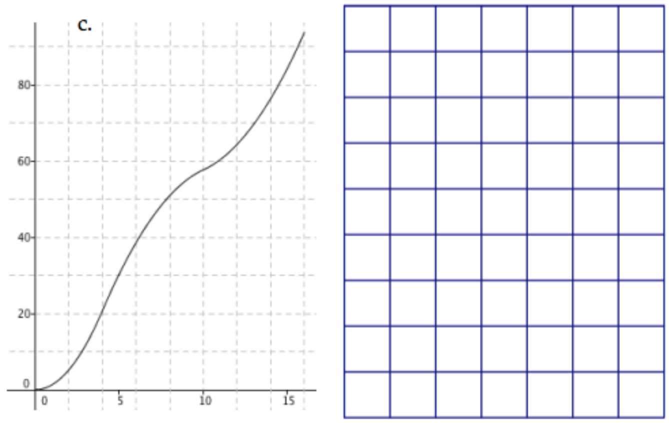




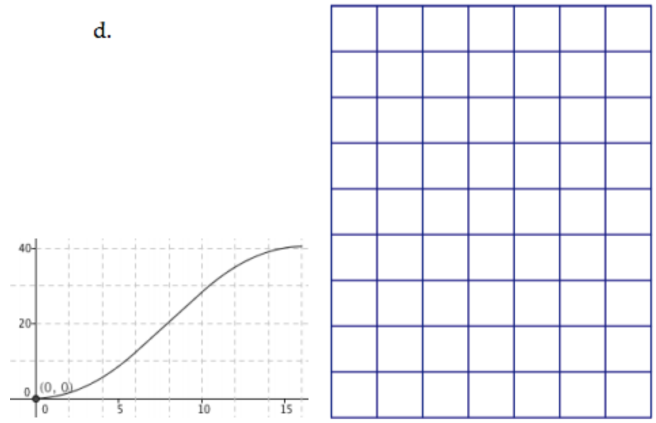




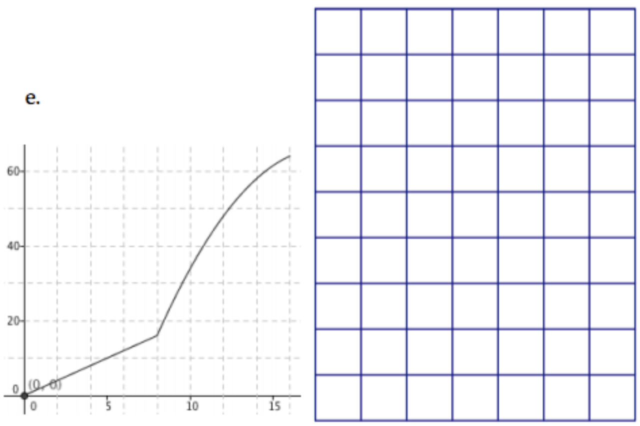
c.



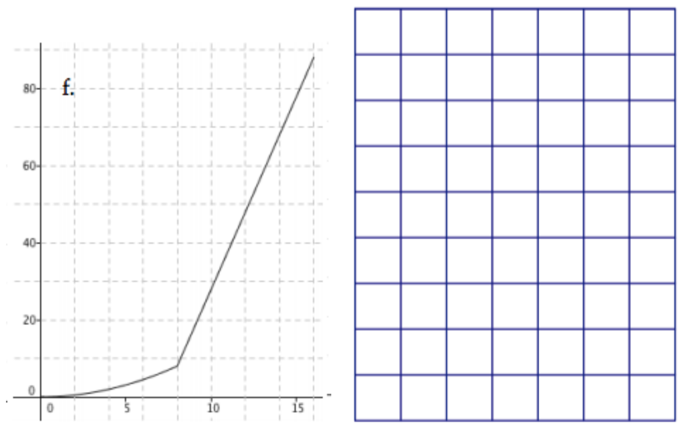
d.



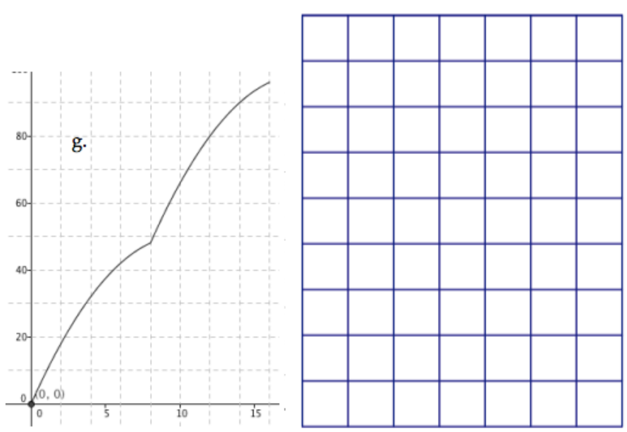
e.



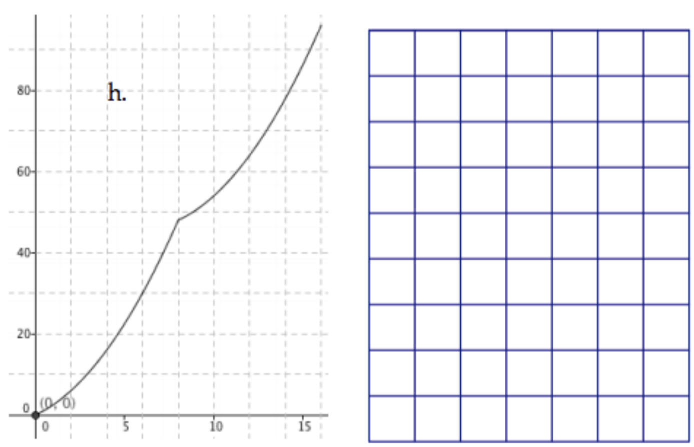
f.



g.

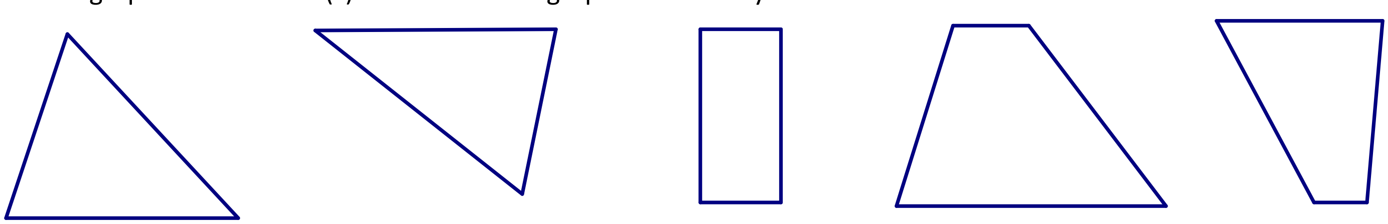


h.



6. Compare your answers with the members of your group.
   (a) In the event that you got different answers, verify that your window gives you the correct graph.
   (b) Explain how you can alter any of your correct answers to form a new window (which is not congruent to your original) to arrive at a new window which gives the same graph.

7. Of the windows shown below, which one(s) will have “smiley” graphs? Which one(s) will have “frowney” graphs? Which one(s) will have linear graphs? How do you know?



Name: ______________________________ Date: August 23rd, 2018

Piecewise Functions + More Window Shades

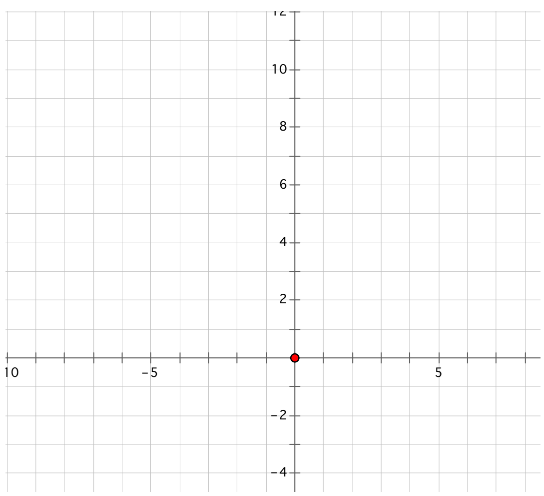
Teacher: Rachel Chou

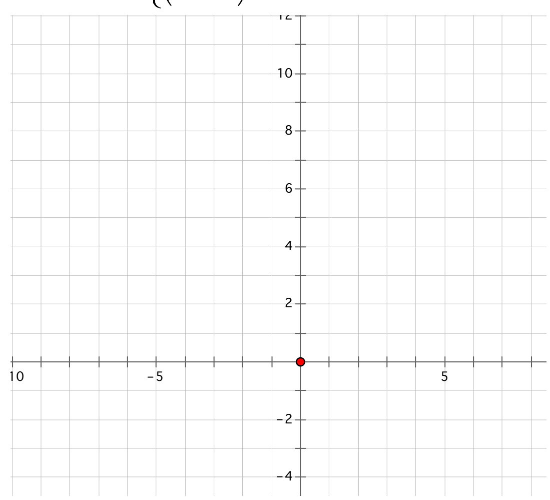
Background/Introduction: Piecewise functions are functions which are defined in pieces. Some of the stuff we did with Mr. Blick's window shades lends itself to a neat context for piecewise functions! First, let's do a little of piecewise functions practice.

1. Graph each function.

$$a(x)=\begin{cases} x+3 & x\le 0 \\ 2x+3 & x>0 \end{cases}$$

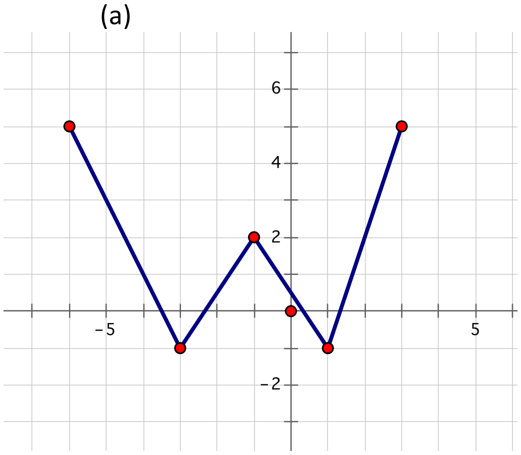
$$b(x)=\begin{cases} -x+1 & x\le -2 \\ (x+2)^2+3 & x>-2 \end{cases}$$



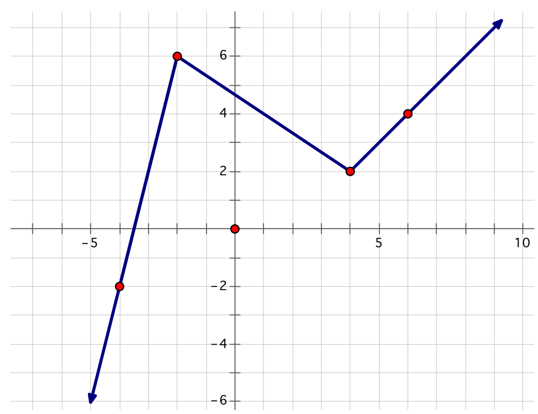


2. For each of the following graphs below, give a ***piecewise*** definition for each! To get you started, answer these questions: In part (a), I will need ________ "pieces" to my definition. For part (b), I will need ________ pieces.

(a)



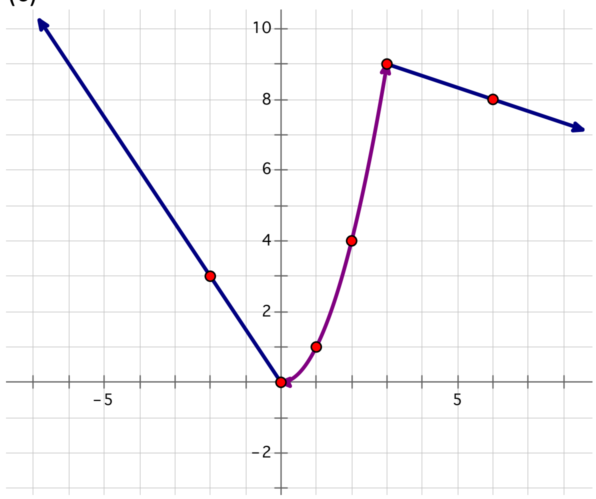
(b)



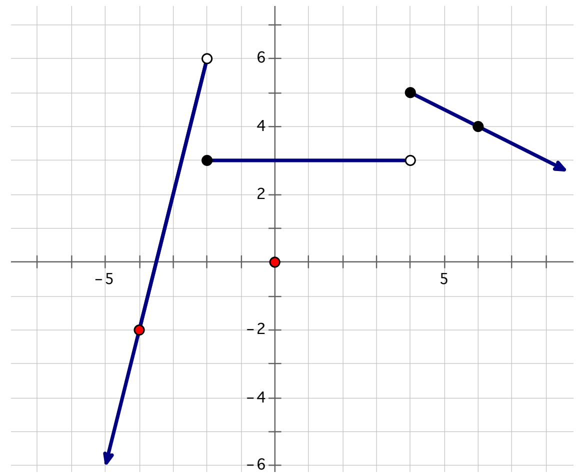
$$a(x)=\Bigg\{$$

$$b(x)=\Bigg\{$$

(c)



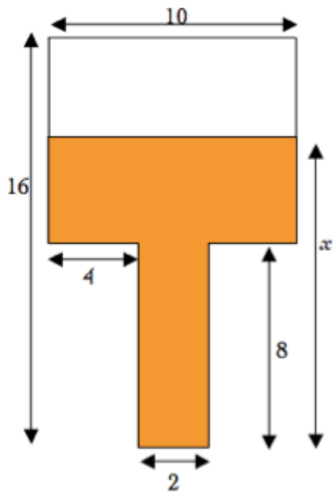
(d)



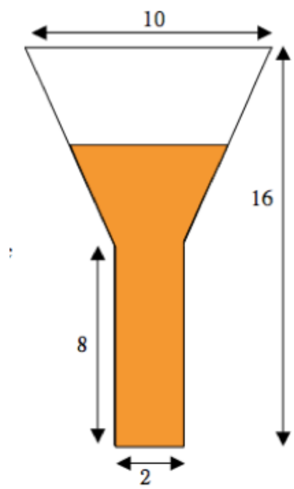
$$c(x) = \begin{cases} \\ \\ \end{cases}$$

$$d(x) = \begin{cases} \\ \\ \end{cases}$$

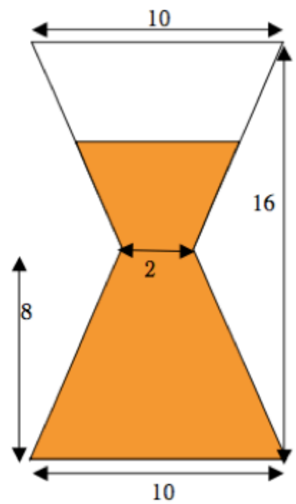
3. Below are three different windows in Mr. Blick's house.



Window A



Window B



Window C

For each of the windows, your job is to:

(i) Find a function for the amount of area covered by Mr. Blick's window shade (y) as a function of the height of the window shade (x).

(ii) Sketch a quick graph of each function.

(iii) Check that each of your functions work by plugging in values of x, such as 8 and 16.

4. All three of your functions should have been ***piecewise*** functions. Moreover, each of your functions was defined in two ***pieces***. In the space below, draw a window that would have 3 different pieces, each of which is a linear piece: Comment on what characteristics you have to give your window to contribute to the 3 different **linear** pieces.

5. Each of your functions was a ***strictly increasing function*** (that is, as the value of x increases, the value of y also increases.) Is it possible to draw a window that would have a decreasing function, or possibly a decreasing piece? Why or why not?

6. Two of your windows had quadratic ***pieces***. Draw a window whose area covered as a function of height graph would have one piece that is:
   (a) Quadratic and "smiley."
   (b) Quadratic and "frowney."