ED 4161 Teaching Secondary Math (Margo Kondratieva) September 30, 2009

1 TI-83 Activity:Quadratic Functions → The Parabola

Welcome to reality - where you are expected to complete an assignment on time and interpret the results. You are going to compare the function $y=x^2$ to the graph of $y=a(x-h)^2+k$. **YOU** will pick integer values for a, h and k and note the effects on the graph. The lab consists of **FIVE** (5) parts - therefore you should not waste your time. Any question - **ASK!!**

Instructions

You will be using a Texas Instrument TI-83 graphing calculator to help you sketch parabolic functions.

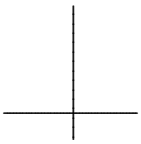
PART I - Graphing the function $y=x^2$

Zoom → Standard

This section will review how to type in an equation to be graphed. Underneath the screen is a blue row of keys. Press the **y=** button. If there are equations on the screen, move the blue arrow key to the line with the equation (the blinking square shows which line you are on) and press **CLEAR**.

Move the cursor to the line $y1=$ by suing the arrow keys. Then press **X,T,O,n** and x^2 and **GRAPH**.

You should have a graph of the function $y=x^2$ on your screen.

1. Sketch the graph on the axes provided. 
2. What are the coordinates of the vertex? Vertex=.....
3. Does the graph open upward or downward? Direction of Opening:.....
4. Determine the Domain and Range of the function: Domain:..... Range:.....

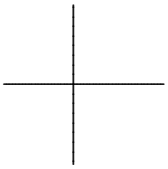
You are now ready to compare the effects the variables a,h and k have on the graph $y=x^2$

PART II - Vertical Shift. Comparing the functions $y=x^2$ and $y=x^2+k$

(On your calculator return to the screen where you entered $y=x^2$ by pressing y=)

1. (a) Predict what the graph of $y=x^2$-5 will look like, compared with the graph of $y=x^2$.
   (b) Use your calculator to graph the two eauations in part (a). Did the results agree with your application?Sketech the graph on the appropriate set of axes below and fill in the required information.

$y=x^2-5$



(c) For additional confirmation, press [2 nd] [TABLE]. How do the numbers in the $y2$ column compare with those in $y1$ column? Use the arrow keys to compare the results for other values of x that are not shown.

.....

(d) Press [TRACE] and use the arrow keys to compare the coordinates of points on both parabolas. Are the reults what you expected? Explain.

.....

2. In the second equation of exercise 1, change the constant -5 to other numbers, graph the reults on the axes below and record the required information. Use both positive and negative constants. Are the reults what you expected?

(a) $y=x^2+(...)$	(a) $y=x^2+(...)$	(a) $y=x^2+(...)$
		
(b) Shift:	(b) Shift:	(b) Shift:
(c) k-Value=	(c) k-Value=	(c) k-Value=
(d) Vertex:	(d) Vertex:	(d) Vertex:
(e) Domain:	(e) Domain:	(e) Domain:
(f) Range:	(f) Range:	(f) Range:

3. What happens to the graph when k is positive? Negative? Describe the effect on the graph of $y=x^2+k$ as the value of k varies. Why do you think these changes occur?

Determine the vertex and the vertical shift of the following (check you answer using TI-83):

1. $y=x^2-7$	1. $y=x^2-1$	1. $y=x^2+6$
2. Vertex:	2. Vertex:	2. Vertex:
3. Vertical Shift:	3. Vertical Shift:	3. Vertical Shift:

Summarize your findings: In $y=x^2+k$:

1. When k is positive the graph shifts:
2. When k is negative the graph shifts:
3. (a) Does the value of k affect the way graph opens?

(b) If the value of k is 12, how many units will the graph move up or down?

4. What is the vertex of $y=x^2+15$?

PART III - Horizontal Stretch . Comparing the functions $y=x^2$ and $y=ax^2$

1. Clear any graphs from your screen by pressing [y=] and clearing all equations. Graph the following six functions and sketch them on the axes provided. Include a graph of $y=x^2$ on each in a different colour. Label the vertex on each graph

(a) Function: $y=-2x^2$

(b) Stretch:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) Function: $y=3x^2$

(b) Stretch:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) Function: $y=-4x^2$

(b) Shift:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) Function: $y=\frac{1}{2}\ x^2$

(b) Stretch:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) Function: $y=-\frac{1}{2}\ x^2$

(b) Stretch:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) Function: $y=-\frac{1}{4}\ x^2$

(b) Shift:

(c) a-Value=

(d) Vertex:

(e) Domain:

(f) Range:

2. What happens to the graph when a is positive? Negative? Write down how the value of a effects the direction and the "stretch" (thickness/thinness) of the graph.

3. Determine the vertex, direction of opening and stretch of the followingequations(check your answers using TI-83).

(a) $y=-6x^2$	(a) $y=9x^2$	(a) $y=-\frac{1}{4}\ x^2$
(b) Vertex:	(b) Vertex:	(b) Vertex:
(c) Direction of Opening:	(c) Direction of Opening:	(c) Direction of Opening:
(d) Stretch:	(d) Stretch:	(d) Stretch:

4. Describe the effect on the graph of $y=ax^2$ as the value of a varies. Why do you think these changes occur?
   .....

Summarize your findings: In $y=ax^2$:

1. When a is positive the graph shifts:.....
2. When a is negative the graph shifts:.....
3. Explain the value of a affects both the direction and the shape(stretch).
   .....
4. Does the value of a affect the vertex? Explain.
   .....
5. Which way will th equation $y=\frac{-2}{7}\ x^2$ open?
   .....

PART IV - Horizontal Shift . Comparing the functions $y=x^2$ and $y=(x-h)^2$

1. To graph $y=(x+3)^2$ type the following:
   y= and **(** and **X,T,O,n** and **+** and **3** and **)** and x^2 and **GRAPH**.

   You should now have the graph on your screen. Write the vertex in this space:.....

   (a) Did the graph of $y=x^2$ move up or down?.....
   (b) Did the graph of $y=x^2$ move left or right?.....
   (c) Compare the graph of $y=(x+3)^2$. What do you notice?
   .....

2. Graph the following six functions and sketch them on the axes provided. Include a graph of $y=x^2$ on each in a different colour. Label the vertex on each graph. Make sure you include the brackets!!

(a) $y=(x+2)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

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

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) $y=(x+3)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) $y=(x-1)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) $y=(x+4)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) $y=(x-3)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

3. What happens to the graph when h is positive? Negative? Describe the effect on the graph of $y=(x-h)^2$ as the value of h varies. Whay do you think these changes occur?
.....

Summarize your findings:

1. When h is positive the graph shifts:.....
2. When h is negative the graph shifts:.....
3. Explain the value of h affects the vertex of the graph. Does h value affectthe direction of opening?
.....
4. Which way will the function $y=(x+5)^2$ open? Which way will the function shift?
.....

Combining the effects of a and h, in $y=\mathbf{a}(x-h)^2$:

1. Graph the following functions on the axes provided. Include a graph of $y=x^2$ on each in a different colour.

(a) $y = -(x+2)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

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

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

(a) y=-$(x+3)^2$

(b) Shift:

(c) h-Value=

(d) Vertex:

(e) Domain:

(f) Range:

2. Determine the vertex,direction of opening and horizontal shift of the following functions. (Check yuour answers using TI-83):

(a) $y = -(x-7)^2$

(b) Vertex:

(c) Direction of Opening:

(d) Horizontal Shift:

(a) $y = (x+5)^2$

(b) Vertex:

(c) Direction of Opening:

(d) Horizontal Shift:

(a) $y = -(x+1)^2$

(b) Vertex:

(c) Direction of Opening:

(d) Horizontal Shift:

PART V - Translations and Stretching. Comparing functions y=x^2 and y=$\mathbf{a}(x-h)^2+k$

In this section you will combine the effects of all the three variables a,h and k on the graph y=x^2. For each of the following, determine a,h and k, the vertex, direction of opening. Sketch the graph on the axis provided. **Try to do these without the calculator**:-(You may use the calculator to **check**. Label the vertex.

1. $y = -2(x+1)^2 + 2$

2. a=...,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex:

1. y=$-2(x+5)^2 - 4$

2. a=....,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex:

1. $y = 3(x-1)^2 - 3$

2. a=....,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex:

1. $y=-4(x-5)^2+3$

2. a=...,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex:

1. $y=-2(x+5)^2+1$

2. a=....,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex:

1. $y=\frac{1}{2}\ (x-3)^2-5$

2. a=....,
   h=...,
   k=...

3. Direction of Opening:

4. Vertex: