

QUADRATIC FUNCTIONS IN THE VERTEX FORM

APPENDICES

Worksheet 1A

1. Using Geometer Sketchpad, open up the file called “Introduction to Parabolas”.
2. Choose Graph | Plot New Function. The Calculator dialog box that appears has a key labelled x . Enter ax^2 as the function definition. Click on the “a = “ text box to enter “a” into your function.
3. Select the text box with your new function in it. Right click and select Plot Function.
4. Grab hold of the point on the blue line below the “a = “ text box. What happens to the parabola as you change the value of a ?

5. Do you notice anything special that happens when a is positive?

6. What happens when a becomes a negative number?

7. What happens to the parabola when $a = 0$?

8. Describe the difference between the parabolas when $a = 2$ and when $a = 0.5$.

9. Set $a = 3$. What are the vertex and the axis of symmetry for this parabola?

10. Do the vertex and axis of symmetry change when you change your value for a ?

11. If a is positive, is the vertex a maximum point or a minimum point on the parabola?

Worksheet 1B

Calculate the y values for each x value in these tables of values. Once complete, plot each set of data onto a single set of axes on graph paper using different colors for each set of data.

$$y=3x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=-2x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=6x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=-4x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=7x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=-6x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=11x^2$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$y=-7x^2$$

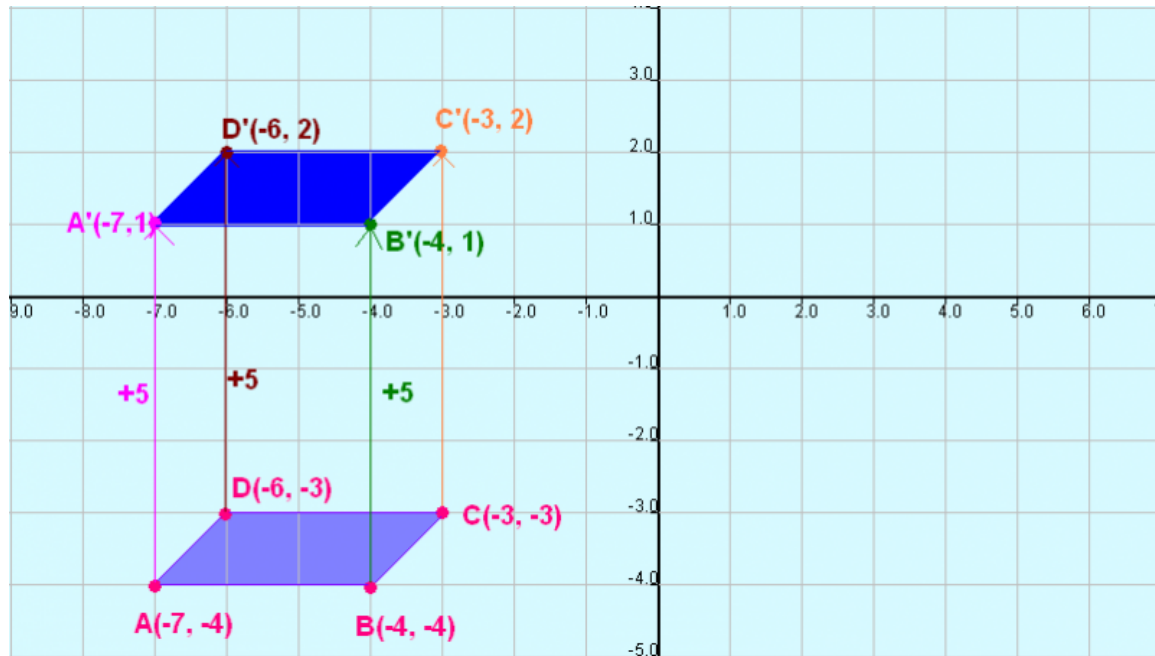
x	y
-3	
-2	
-1	
0	
1	
2	
3	

Day 1 Homework

Create a table of values and a graph for each Quadratic Relation listed below. Use your choice of constructing these by hand (pencil and paper) or on the computer (using a spreadsheet program or other capable software). Complete the sheet below by filling in the blanks.

	Quadratic Relation	a Value	Vertex	Axis of Symmetry	Graph Opening up or Down
A	$y = 2x^2$				
B	$y = 4x^2$				
C	$y = 5x^2$				
D	$y = 8x^2$				
E	$y = -x^2$				
F	$y = -3x^2$				
G	$y = -6x^2$				

Day 2 Minds-On Slide



Look at the picture above and answer the following questions.

By moving the bottom shape to the new location, how would you move it (\uparrow , \downarrow , \leftarrow , \rightarrow)?

Compare the x-coordinates of the top and bottom shape. What did you notice?

Compare the y-coordinates of the top and bottom shape. What did you notice?

Worksheet 2A

To be used with the on-line tutorial.

1. On your computers, enter the following address in the browser:
<http://www.analyzemath.com/quadratics/quadratics.htm>
2. Scroll down the page until you see the "click here to start" button. Click the button to start the applet and maximize the window obtained.
3. Use the sliders on the left panel of the applet to set a to 1 and k to 0. Write down the coordinates of the vertex and determine whether it is a minimum or a maximum point. Write down the equation of the graph.

4. Use the sliders on the left panel of the applet to set k to the values listed in the table below. Write down the coordinates of the vertex for each value of k .

k	Vertex (x,y)
1	
2	
3	
-1	
-2	
-3	

Which way is the graph moving as you change the values of k (horizontally or vertically)?

For what values of k is the graph moving upwards?

For what values of k is the graph moving downwards?

5. Use the sliders to set a to 3 and k to 2. Write down the position of the vertex and whether it is a minimum or a maximum point. Write down the equation for this graph.
6. Use the sliders to set a to -2 and k to 3. Write down the position of the vertex and whether it is a minimum or a maximum point. Write down the equation for this graph.

Worksheet 2B

Compare and contrast the pen-and-pencil method and the on-line applet when used to analyze quadratic graphs. Think about when it would be better to use one or the other. What are the limitations of each?

Pen-and-Paper	On-line Applet

Day 2 Homework

Create a table of values and a graph for each Quadratic Relation listed below. Use your choice of constructing these by hand (pencil and paper) or on the computer (using one of the technologies discussed in class or other capable software). Complete the sheet below by filling in the blanks.

	Quadratic Relation	a Value	k Value	Vertex (x,y)	Axis of Symmetry	Graph Opening up or Down
A	$y = x^2 + 3$					
B	$y = x^2 - 3$					
C	$y = 2x^2 + 2$					
D	$y = 2x^2 - 2$					
E	$y = -2x^2 + 4$					
F	$y = -2x^2 - 4$					

In words using correct syntax and terminology, answer the following questions:

What happens to the graph when $a=1$ and $k>0$?

What happens to the graph when $a=1$ and $k<0$?

What happens to the graph when $a>1$ and $k>0$?

What happens to the graph when $a>1$ and $k<0$?

What happens to the graph when $a<-1$ and $k>0$?

What happens to the graph when $a<-1$ and $k<0$?

Worksheet 3

Complete this worksheet using spreadsheet computer program (this worksheet has instructions on MS Excel):

Plot $y = x^2$

1. Enter the following x values: $x = \{-10, -8, -6, -5, -3, -1, 0, 1, 3, 5, 6, 8, 10\}$ in the first column.
2. Enter in an adjacent (second) column “=”; highlight the first cell that contains the previously entered value of the first column “-10”; type “ * ” for multiplication; highlight cell “-10” of the first column again; then click ENTER .
3. Drag the first cell of the second column by the grapping the bottom right corner of the cell to the row where the value “10” in the first column appears.
4. Once the table of “ x ” and “ y ” is created, highlight the table and click on “insert” of the top bar menu; then click on “Scatter” to obtain a plot; then select any of the available style plot.
5. Fill the worksheet accordingly including a sketch on the plot.

Plot the remaining functions

Repeat the above mentioned steps 1 to 5; however, in step 2 you need to create the given equation. This can be done by typing given equation but instead if the typing the letter “ x ”, you need to high light the corresponding value from the first column.

	x	$y = x^2$ Vertex (,)	$y = (x-1)^2$ Vertex (,)	$y = (x-3)^2$ Vertex (,)	$y = (x+1)^2$ Vertex (,)	$y = (x+3)^2$ Vertex (,)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

Plot						
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Day 3 Homework

Complete this worksheet using the following interactive website:

<http://www.heymath.com/main/samples/us21/teacherstemplate.html> , then select “Grapher” from the top right corner pull-down-menu:

	Quadratic Function In Vertex Form $y = (x - h)^2$	a Value	h Value	k Value	Describe the Transformations	Quadratic Function In standard Form $y = ax^2 + bx + c$	Vertex	Plot the graph Showing Transformations
1	$y = (x+2)^2$							
2	$y = (x-1)^2$							
3	$y = (x+4)^2$							
4	$y = (x-5)^2$							
5	$y = (x-8)^2$							
6	$y = (x+3)^2$							

7	$y = (x-7)^2$							
8	$y = (x-10)^2$							

Worksheet 4

Complete this worksheet using one of the technologies covered in class.

	Quadratic Function In Vertex Form $y = a(x - h)^2 + k$	a Value	h Value	k Value	Vertex (x, y)	Name of Transformations: - Translation - Reflection in x-axis (opening up/down) - Vertical Stretch/Compression
1	$y = 2x^2$					
2	$y = -3x^2$					
3	$y = 7(x+4)^2$					
4	$y = -4x^2 - 3$					

5	$y = 3(x-1)^2 + 2$					
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Cumulating Activity

Use a technology that was covered in the class to graph the quadratic function, $y = x^2$.

Then, graph the following four quadratic equations and compare their widths to the standard width of the quadratic function $y = x^2$. graph.

1. $y = 2x^2$ Twice as wide or twice as narrow? _____
2. $y = 1/4x^2$ 4 times wider or 4 times narrower? _____
3. $y = -3x^2$ 3 times wider or 3 times narrower? _____
4. $y = 1/5x^2$ 5 times wider or 5 times narrower? _____

Graph the following four equations using a technology used in the class and find the vertex and plot of each parabola.

	a	h	k	vertex
1. $y = 3(x - 5)^2 + 2$				
2. $y = -1/4(x + 1)^2 + 3$				
3. $y = -2(x - 1)^2 - 5$				
4. $y = -1/3(x + 2)^2 - 6$				

Note: Please use a separate sheet to draw the graphs for each function.

Fill in the missing information in the table below.

Equation	a	h	k	vertex
$y = 3(x - 1)^2 - 4$				
	-1/2			(-4,-5)
	-4	3	9	
	-1			(-5, 0)

In words, explain your choice of technology for this activity (either use the compare & contrast table, or list advantages of this technology over others).
