Welcome to Session #164:
Understanding Quadratic Functions through Transformations

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Session Goal: Create a visual approach for students when working with quadratic functions and equations.

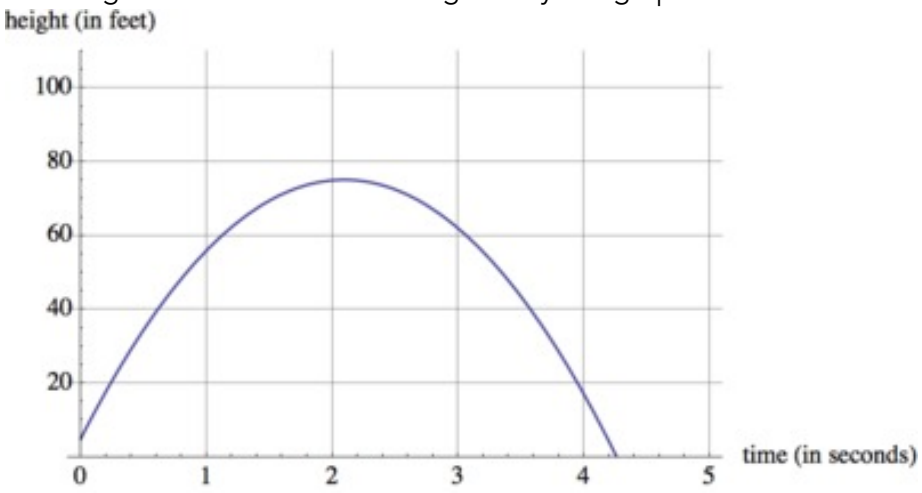
Part 1: Opening Task: Solve this problem through a student's mind. They have not been introduced to graphing quadratics or solving for key aspects of quadratic functions algebraically. How would you approach this problem?

https://www.illustrativemathematics.org/content-standards/HSF/IF/B/4/tasks/1279

Suppose Brett and Andre each throw a baseball into the air.

The height of Brett's baseball is given by $h(t) = -16t^2 + 79t + 6$ where h is in feet and t is in seconds.

The height of Andre's baseball is given by the graph below:



Brett claims that his baseball went higher than Andre's, and Andre says that his baseball went higher.

Who is right?

How long is each baseball airborne?

Construct a graph of the height of Brett's throw as a function of time on the same set of axes a the graph of Andre's throw (if not done already), and explain how this can confirm your claims to parts (a) and (b).

Part 2: Understanding Quadratic Functions Graphically – work through this activity think like a student.

Introduction to Quadratic Functions

Name_____

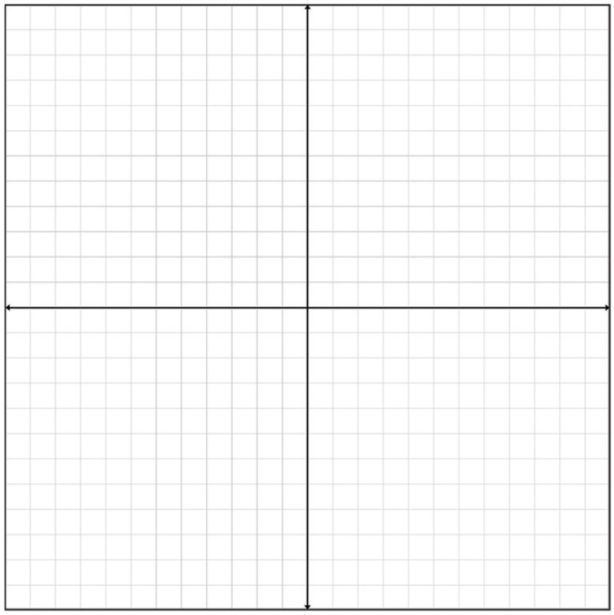
Date_____Period _____

Today's Lesson Goals:

- Understand and identify the vocabulary/parts of the graph of a quadratic function.
- Determine the real zeros of a quadratic function using a graph.
- Determine the number of real zeros of a quadratic function using a graph.

Part 1: Graph the following quadratic function: $f(x) = (x-3)^2 - 4.$

The name for the graph of quadratic function is a _____ .



Label the parts of a graph of a quadratic function:

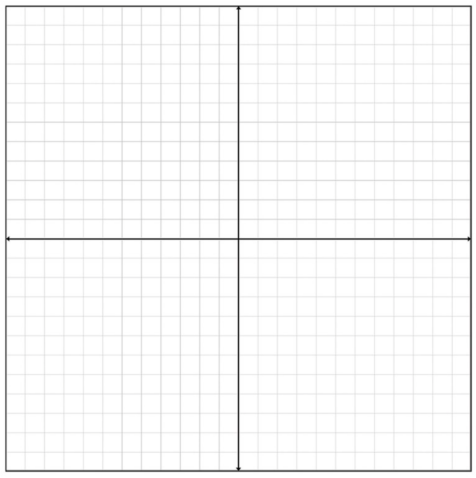
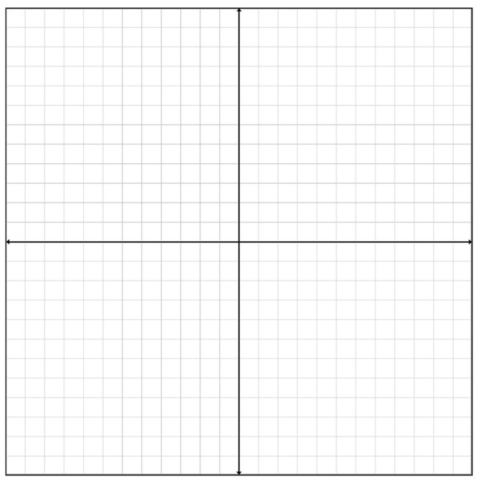
Vertex

Line/Axis of Symmetry

Real Zeros

Y-intercept

Try these!

$f(x) = (x+3)^2 - 1$	$f(x) = -2(x-3)^2 + 8$
Predict Vertex: Axis of Symmetry: Real Zeros:	Predict Vertex: Axis of Symmetry: Real Zeros:
Verify Graphically 	Verify Graphically 

Think about it!

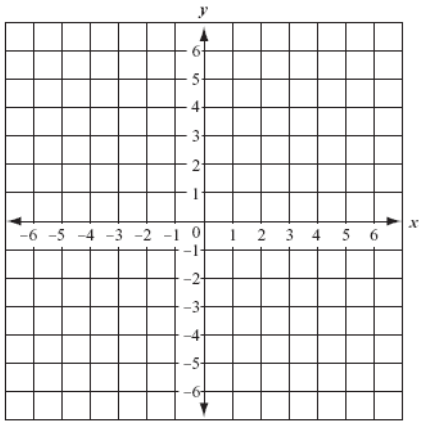
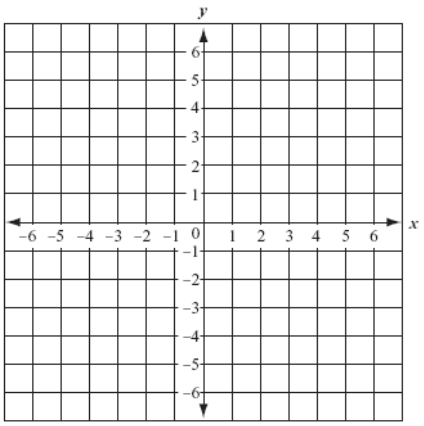
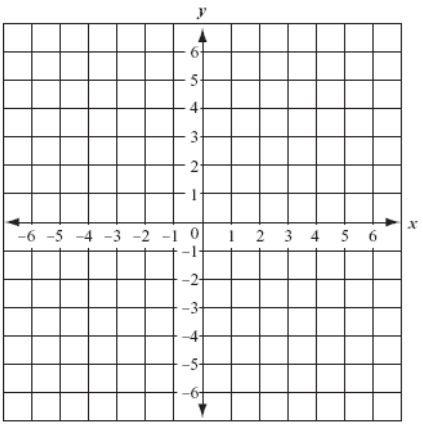
1. What relationships do you see between the following:

Vertex and the Line of Symmetry

Vertex and the Real Zeros

Line of Symmetry and the Real Zeros

Part 2: Graph the following quadratic functions

$f(x) = -\frac{1}{2}(x+1)^2 - 2$	$f(x) = (x+1)^2$	$f(x) = (x-2)^2 - 4$
		
# of real zeros:	# of real zeros:	# of real zeros:

Think about it!

1. How can you predict the number of real zeros from the equation?

Homework (complete on a separate piece of paper)

Factor the following polynomials.

1. $3x^2 + 18x + 27$
2. $3x^3 - 75x$
3. $x^2 + 2x - 24$
4. $5x^2 + 20x + 10$
5. $6x^2 - x - 15$
6. $4x^2 - 10x - 24$

Predict the line of symmetry, vertex, and number of zeros. Graph to verify

7. $f(x) = x^2 - 9$
8. $f(x) = x^2 - 5$
9. $f(x) = (x+1)^2 - 4$
10. $f(x) = (x-1)^2 + 2$

Part 3: Connect Graphing Quadratic Functions to Solving Quadratic Equations *(HSA.REI.D.11)*
http://achievethecore.org/page/976/quadratic-equations-mini-assessment

The table below contains single equations in a single variable. Using graphs to solve the equations, check the appropriate box to show whether there is no real solutions, exactly 1 real solution, or exactly 2 real solutions

		No Real Solutions	Exactly 1 Real Solution	Exactly 2 Real Solutions
a.	$(a+5)^2 = 25$			
b.	$(n-5)^2 = 25$			
c.	$(z+5)^2 = -25$			
d.	$(x-5)^2 = 0$			
e.	$16-(l+5)^2 = 25$			
f.	$(f+1)^2 = (f+2)^2$			
g.	$5b^2 = 5b^2+1$			

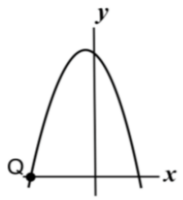
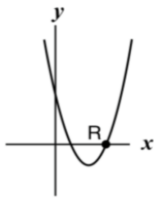
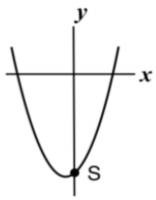
Part 4: The "In between" (notes area ☺)

Part 5: Bringing it all together. http://map.mathshell.org/lessons.php?unit=9245&collection=8

Quadratic Functions

1. Here are 4 equations of quadratic functions and 4 sketches of the graphs of quadratic functions.

A. $y = x^2 - 6x + 8$	B. $y = (x-6)(x+8)$	C. $y = (x-6)^2 + 8$	D. $y = -(x+8)(x-6)$

1.	2.	3.	4.
			

a. Match the equation to its graph and explain your decision.

Equation A ***matches*** Graph ....., because

.....

Equation B ***matches*** Graph ....., because

.....

Equation C ***matches*** Graph ....., because

.....

Equation D ***matches*** Graph ....., because

.....

b. Write the co ordinates of the points: P (....,....) Q(....,....) R (....,....) S (....,....)