1-1-2010

Grades 9-10 Algebra: Graphic Quadratics on the Coordinate Plane

Michelle Darcy
Pace University

Unit Map

Day	Topic
Day 1	Graphing Basic Quadratics – filling in T-charts, then graph the ordered pairs on a graph
Day 2	How does a quadratic function differ from a linear function? (Δ)
Day 3	Finding the Axis of Symmetry
Day 4	Using the Axis of Symmetry to find the point of maximum or minimum
Day 5	Finding the roots of a quadratic
Day 6	Working Backwards from the graph to find the max/min and roots, and equation
Day 7	Where are parabolas found in the real world? Word problems with real world examples
Day 8	Parabolas in the real world project (O)
Day 9	Quadratic projects (□)
Day 10	Quadratic projects (□)
Day 11	Quadratic projects (□)
Day 12	Unit Exam

Subject: Integrated Algebra

Topic: Graphing Quadratic Functions

Grade: 9

NYS Standards:
A.G.3: Determine when a relation is a function, by examining ordered pairs and inspecting graphs of relations
A.G.4: Identify and graph linear, quadratic (parabolic), absolute value, and exponential functions
A.G.5: Investigate and generalize how changing the coefficients of a function affects its graph
A.G.10: Determine the vertex and axis of symmetry of a parabola, given its graph (See A.A.41) *Note: The vertex will have an ordered pair of integers and the axis of symmetry will have an integral value.*
A.A.41: Determine the vertex and axis of symmetry of a parabola, given its equation
A.G.8: Find the roots of a parabolic function graphically *Note: Only quadratic equations with integral solutions.*

Hook:
Using math in the real world… does it really happen? Write down everywhere that you see math in the world, and at the end of the unit you can hopefully add to your list.

Essential Questions:
How do we graph quadratic functions?
How do quadratic functions differ from linear functions? How are they the same?
How do we find the point of maximum or minimum of the quadratic given the graph? Given the equation?
How do we find the roots of the quadratic function given the graph? Given the equation?
Where are parabolas found in the real world and what are their functions?

Understandings:
Students should understand how to graph a parabola.
Students should understand how a parabola is different from a line, by looking at the equation and the graph.
Students should be able to find the axis of symmetry by looking at the graph as well as using the formula.
Students should be able to find the point of maximum or minimum and state it as a coordinate.
Students should be able to find the roots of the quadratic using the equation or the graph.
Students should be able to solve real world problems dealing with parabolas.

**Rubrics done by Rubistar.4teachers.org
**Pre-assessment made by Michelle Darcy
**Post-assessment made by Steve Petrillo, edited and formatted by Michelle Darcy

Name_____
Date_____

Quiz – Graphing Linear Equations

For the following, fill in each T-chart given the x-values and the equation of each line:

1) $y = -3x + 7$

x	y
-2	
-1	
0	
1	
2	

2) $y = 8x - 20$

x	y
-4	
-2	
0	
2	
4	

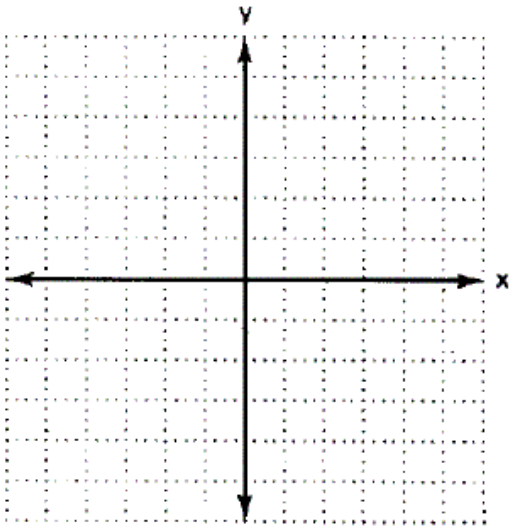
3) $2y = 4x + 6$

x	y
-8	
-4	
0	
4	
8	

Graph the following line on the given graph. *(Use of the T-chart is optional)*

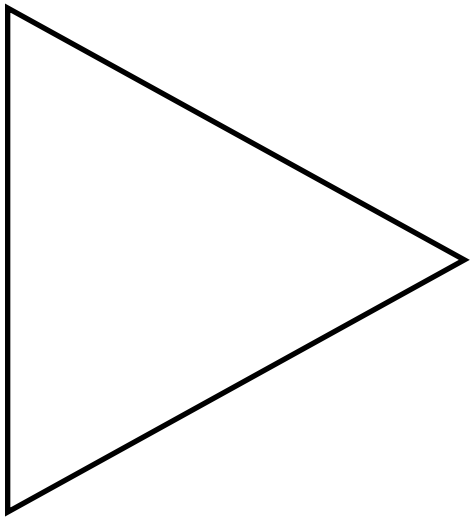
$y = \frac{5}{2}x - 6$

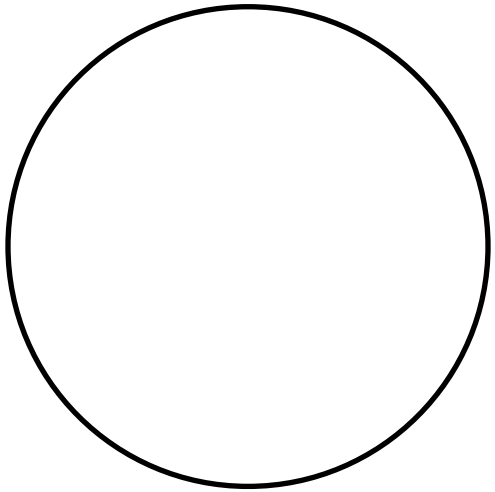
x	y



Shape Shifter

Directions: For each shape you are to choose which project to do (the square will be assigned). Each project that is chosen should be cut out and taped, or glued into these shapes. Once you choose which project to do, you will be given a task card for more specific instructions. Remember to follow the rubric for each of your projects.





Write a poem comparing and contrasting linear functions to quadratic functions. How can you tell the difference between them when looking at a graph?

In a comic strip, determine where parabolas can be found in the world, as well as the function that your example serves.

Create a board game that could teach this topic to an eighth grade student. Be sure to include the directions, and all pieces.

In a rap/song (lyrics must be included) compare and contrast linear equations to quadratic equations. How can you tell the difference between them when looking at the graph?

In an editorial, determine where parabolas can be found in the world and the function that they serve in your example.

In an essay, investigate something with parabolic shape. Use this shape and formulate the equation. Also, using the equation that you formulated, find the point of maximum or minimum. Be sure to state how your max or min point could be incorrect.

Make a skit on what a linear function does on a graph as compared to what a quadratic function does on a graph. Describe the differences and similarities between the two.

In a discussion, determine how you would use parabolas as a sports castor or an architect.

Lab: Take something that you know has a parabolic movement. Create the shape and measure the distance between the start and end point. Find the equation of the parabola, as well as the point of maximum or minimum using the equation found. Be sure to state how your max or min point could be incorrect.

Parabolic Motion

Teacher Name: **Ms. Darcy**

Student Name: _____

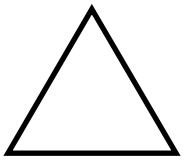
CATEGORY	4	3	2	1
Data	Professional looking and accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in written form, but no graphs or tables are presented.	Data are not shown OR are inaccurate.
Materials	All materials and setup used in the experiment are clearly and accurately described.	Almost all materials and the setup used in the experiment are clearly and accurately described.	Most of the materials and the setup used in the experiment are accurately described.	Many materials are described inaccurately OR are not described at all.
Analysis	The relationship between the variables is discussed and trends/patterns logically analyzed. Predictions are made about what might happen if part of the lab were changed or how the experimental design could be changed.	The relationship between the variables is discussed and trends/patterns logically analyzed.	The relationship between the variables is discussed but no patterns, trends or predictions are made based on the data.	The relationship between the variables is not discussed.
Error Analysis	Experimental errors, their possible effects, and ways to reduce errors are discussed.	Experimental errors and their possible effects are discussed.	Experimental errors are mentioned.	There is no discussion of errors.
Drawings/Diagrams	Clear, accurate diagrams are included and make the experiment easier to understand. Diagrams are labeled neatly and accurately.	Diagrams are included and are labeled neatly and accurately.	Diagrams are included and are labeled.	Needed diagrams are missing OR are missing important labels.
Conclusion	Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes what was learned from the experiment.	No conclusion was included in the report OR shows little effort and reflection.

Making A Game : Graphing Quadratic Equations

Teacher Name: **Ms. Darcy**

Student Name: _____

CATEGORY	4	3	2	1
Accuracy of Content	All information cards made for the game are correct.	All but one of the information cards made for the game are correct.	All but two of the information cards made for the game are correct.	Several information cards made for the game are not accurate.
Rules	Rules were written clearly enough that all could easily participate.	Rules were written, but one part of the game needed slightly more explanation.	Rules were written, but people had some difficulty figuring out the game.	The rules were not written.
Knowledge Gained	All students in group could easily and correctly state several facts about the topic used for the game without looking at the game.	All students in the group could easily and correctly state 1-2 facts about the topic used for the game without looking at the game.	Most students in the group could easily and correctly state 1-2 facts about the topic used for the game without looking at the game.	Several students in the group could NOT correctly state facts about the topic used for the game without looking at the game.
Creativity	The group put a lot of thought into making the game interesting and fun to play as shown by creative questions, game pieces and/or game board.	The group put some thought into making the game interesting and fun to play by using textures, fancy writing, and/or interesting characters.	The group tried to make the game interesting and fun, but some of the things made it harder to understand/enjoy the game.	Little thought was put into making the game interesting or fun.

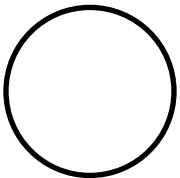


Compare and Contrast Linear vs. Quadratic

Teacher Name: **Ms. Darcy**

Student Name: _____

CATEGORY	4	3	2	1
Accuracy of Facts (Content)	All supportive facts are reported accurately.	Almost all supportive facts are reported accurately.	Most supportive facts are reported accurately.	NO facts are reported OR most are inaccurately reported.
Focus on Topic (Content)	There is one clear, well-focused topic. Main idea stands out and is supported by detailed information.	Main idea is clear but the supporting information is general.	Main idea is somewhat clear but there is a need for more supporting information.	The main idea is not clear. There is a seemingly random collection of information.
Support for Topic (Content)	Relevant, telling, quality details give the reader important information that goes beyond the obvious or predictable.	Supporting details and information are relevant, but one key issue or portion of the storyline is unsupported.	Supporting details and information are relevant, but several key issues or portions of the storyline are unsupported.	Supporting details and information are typically unclear or not related to the topic.
Sources (Content)	All sources used for quotes and facts are credible and cited correctly.	All sources used for quotes and facts are credible and most are cited correctly.	Most sources used for quotes and facts are credible and cited correctly.	Many sources used for quotes and facts are less than credible (suspect) and/or are not cited correctly.
Conclusion (Organization)	The conclusion is strong and leaves the reader with a feeling that they understand what the writer is "getting at."	The conclusion is recognizable and ties up almost all the loose ends.	The conclusion is recognizable, but does not tie up several loose ends.	There is no clear conclusion, the paper just ends.



Where are Quadratics found in the Real World?

Teacher Name: **Ms. Darcy**

Student Name: _____

CATEGORY	4	3	2	1
Content Accuracy	Contains at least 5 accurate facts about the topic.	Contains 3-4 accurate facts about the topic.	Contains 1-2 accurate facts about the topic.	Contains no accurate facts about the topic.
Neatness	Typed, clean, not wrinkled, and is easy to read with no distracting error corrections. It was done with pride.	Neatly hand-written, clean, not wrinkled, and is easy to read with no distracting error corrections. It was done with care.	Typed and is crumpled or slightly stained. It may have 1-2 distracting error corrections. It was done with some care.	Typed and looks like it had been shoved in a pocket or locker. It may have several distracting error corrections. It looks like it was done in a hurry or stored improperly.
Ideas	Ideas were expressed in a clear and organized fashion. It was easy to figure out what the letter was about.	Ideas were expressed in a pretty clear manner, but the organization could have been better.	Ideas were somewhat organized, but were not very clear. It took more than one reading to figure out what the letter was about.	The letter seemed to be a collection of unrelated sentences. It was very difficult to figure out what the letter was about.
Grammar & spelling (conventions)	Writer makes no errors in grammar or spelling.	Writer makes 1-2 errors in grammar and/or spelling.	Writer makes 3-4 errors in grammar and/or spelling	Writer makes more than 4 errors in grammar and/or spelling.
Salutation and Closing	Closing has no errors in capitalization and punctuation.	Closing has 1-2 errors in capitalization and punctuation.	Closing has 3 or more errors in capitalization and punctuation.	Closing is missing.

Name _____ Date_____

Unit 8: Quadratic Functions

PART I. Circle the correct answer. Each question is worth 3 points. No partial credit will be allowed.

1. Which quadratic function $y = ax^2 + bx + c$ has a graph that opens downward?

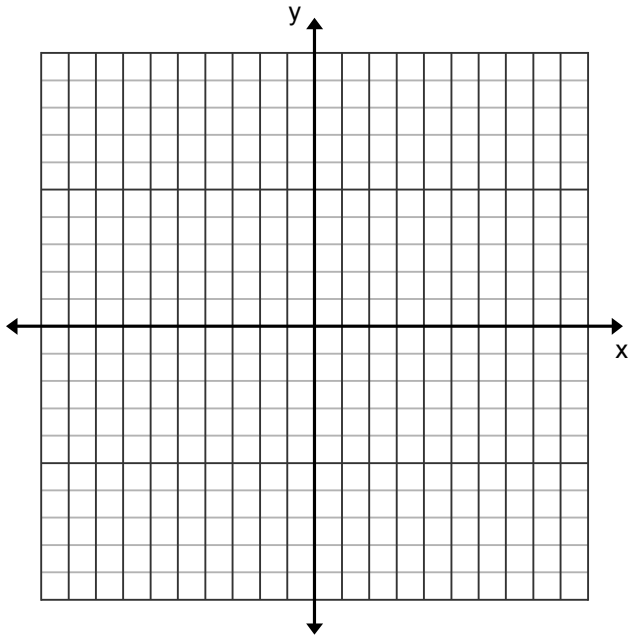
   a. the a coefficient is positive
   b. the a coefficient is negative
   c. the c term is positive
   d. the c term is negative

2. What is the y-intercept of $y = -2x^2 + 8x - 11$?

   a. –2
   b. 8
   c. –11
   d. There is none.

Part II. Each question in this part is worth 5 points. Show all work and clearly indicate your answer.

3. Find the vertex of $y = x^2 - 6x + 9$ algebraically or graphically.

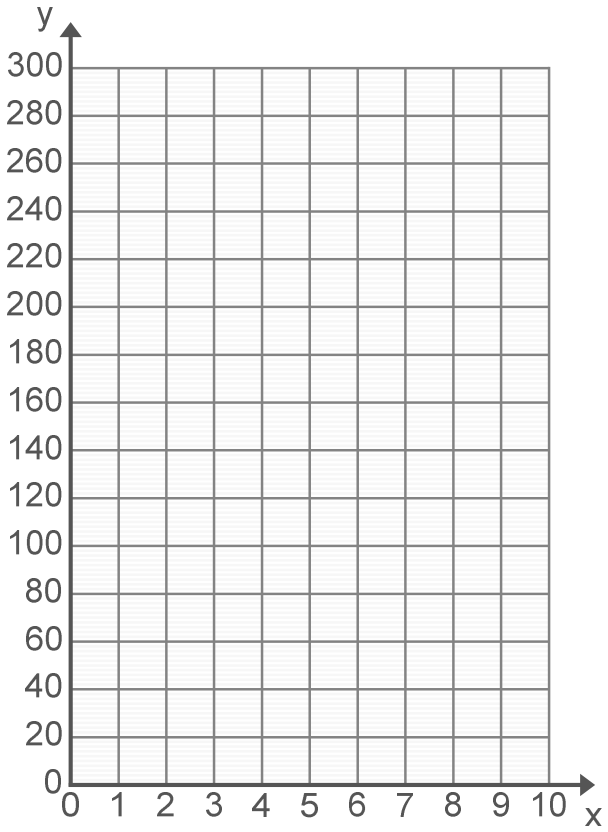


Part III. Each question in this

part is worth 10 points. Show all work and clearly indicate your answer.

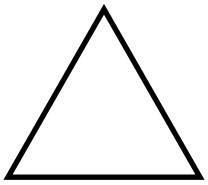
4. The height of a golf ball that is hit into the air is given by the equation $h = -16t^2 + 128t$ where t is the time in seconds that the ball has been in the air.

a. Graph the path of the golf ball on the grid below. Label three points and the parabola.



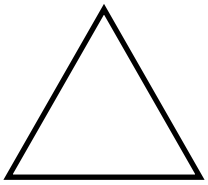
b. After how many seconds is the ball at its maximum height?

c. After how many seconds will it hit the ground?



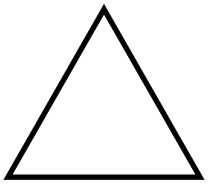
Pythagoras –

Compare and contrast the linear function to the quadratic function by looking at their graphs. Be sure to be specific about what the differences and similarities are.



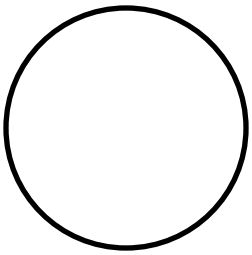
Pascal –

Compare and contrast the linear function to the quadratic function by looking at their equations. Be sure to be specific about what the differences and similarities are.



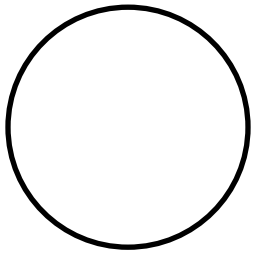
Euclid –

Compare and contrast the linear function to the quadratic function by looking at their graphs and their equations. Be sure to be specific about what the differences and similarities are. Then predict what you think might happen with the graph of $y = x^3$.



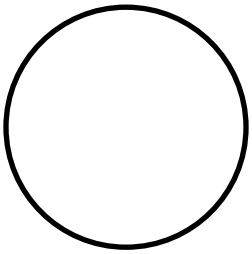
Pythagoras –

Name three different places you would find a parabola in the world. Describe the parabolic shape. What is the purpose of the parabola that you have found? Which of the three parabolas in the real world are significant in your life and why?



Pascal –

Name three different places you would find a parabola in the world. Describe the parabolic shape. What is the purpose of the parabola that you have found? How do these parabolas help people in the world/why are they significant?



Euclid –

Name three different places you would find a parabola in the world. Describe the parabolic shape. What is the purpose of the parabolas that you have found? Think of a parabolic shape that could be used in the future. Describe the purpose of this new parabolic shape.

Anchor Activity:

Students will get to read a math novel of their choice.

Options:
Kiss My Math by: Danica McKellar
Math Doesn't Suck by: Danica McKellar
The Number Devil by: Hans Magnus Enzensberger
Fermat's Enigma by: Simon Singh
Algebra Unplugged by: Kenn Amdahl and Jim Loats

Assignment:
Using the reading that you are doing, relate the math in the book to the real world, outside of the math classroom. Can you answer the age old questions math teachers hear on an almost daily basis, "When will I ever use this?"

Note:
The three levels in this unit are Pythagoras (low level), Pascal (medium level), and Euclid (high level). These levels are determined by the pre-assessment. Each different level has a task card. For the third assignment (the square), this will be assigned to the students. Pythagoras should get the game assignment, Pascal should get the investigative essay assignment, and Euclid should get the lab assignment.