

Instructional Plan Template

Title: All that Grows Is Not Linear: A Study of Quadratic Functions

Grade Level: 12th

Timeframe: 10 90-minute periods

Prerequisite knowledge/skills:

- Successful completion of all previous units in postsecondary readiness course.

Essential Questions:

- What characteristics do non-linear functions have that set them apart from linear functions?
- How can non-linear functions be used to model real-world scenarios?
- How will knowledge of the characteristics of non-linear functions help individuals who are investigating patterns and their resulting relationships?

High School Readiness Indicators:

- Analyze problems and develop solution strategies
- Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context.
- Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts.
- Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation.
- Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.

State/Local Standards:

Assessments (Pre and Post):**Pre: Anticipation Guide—Non-linear Functions**

An **Anticipation Guide** prepares students for what they are about to read or discuss by having them react to a series of statements related to the new content. Teachers have found anticipation guides to be valuable because they prepare students to read and/or discuss by connecting them to the information ahead of time. Students tend to become interested in the topic because they have been asked their opinion. Steps for creating a good anticipation guide as defined in Reading to Learn in the Content Areas by Judy S. Richardson and Raymond F. Morgan:

- Read the content and decide on the major concepts. Decide which of those concepts is most important to stimulate student interests?
- Write statements based on the concepts. The statements should be thought provoking. The statements should be general enough to inspire discussion.
- After the students fill out the guide, a class discussion should occur. Students should have to argue their points in order to explain the decision they made.
- The teacher should present the material and then return to the guide to provide an opportunity for the students to change their answers.

Student Directions: Place a checkmark (✓) in front of those sentences that you believe to be true. During or after our discussion, cross through checkmarks you wish to change and place new checkmarks next to statements you now find to be true.

Post: Quad Cluster

Give students a cluster of four words from the unit of study.

Directions:

1. List the four words in the cluster at the top of your page.
2. Circle the one that is different from the other three.
3. Write two or three sentences explaining how the circled word is different.
4. Write two to three sentences explaining how the other three words are alike.

Post: Complete Frayer Model on Non-linear Functions

Daily Activities

Day 1 of 10

SREB's Readiness Indicator/s for daily activities

- Analyze problems and develop solution strategies
- Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context.
- Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts.
- Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation.
- Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.

State/District Standard/s for daily activities

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Literacy Strategies	Habits of Success
	1. <u>x</u> Create Relationships Team work/ responsible/communication 4. <u>x</u> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist												
<u>3</u> minutes	Opening Student Organizer: Give the students the following and ask them to evaluate and then graph the ordered pair solutions: $Y = x^2$ <table><tr><td>X</td><td>Y</td></tr><tr><td>-2</td><td></td></tr><tr><td>-1</td><td></td></tr><tr><td>0</td><td></td></tr><tr><td>1</td><td></td></tr><tr><td>2</td><td></td></tr></table>	X	Y	-2		-1		0		1		2		<u>x</u> Solve problems
X	Y													
-2														
-1														
0														
1														
2														
<u>5</u> minutes	Engage: Using the above example, explain some of the general characteristics of the graph $y = x^2 + bx + c$ such as U shaped, max or min value.	<u>x</u> Display object/picture												
<u>15</u> minutes	Explore: Ask the students to graph the following equations with a graphing calculator. $Y = x^2 + 4$ $Y = x^2 - 4$ $Y = x^2 + 9$	<u>x</u> Investigate												

	$Y = x^2 - 9$ Ask the class to compare and contrast the graphs.	
<u>15</u> minutes	Explanation: Summarize the effect of adding or subtracting a constant to the x^2 term. Ask students to sketch the graphs of $y = x^2 + 3$ and $y = x^2 - 3$ without plotting points or making a table.	<u> x </u> Lecture with guided notes
<u>10</u> minutes	Practice Together: Have the students graph the following with a graphing calculator: $y = x^2 + 4x + 4$, $y = x^2 + 6x + 9$, $y = x^2 + 2x + 1$. Use the TRACE feature to find the x intercepts. Ask the class the significance of the x intercepts. Factor the quadratics with the aid of algebra tiles. Review the factoring patterns for $y = x^2 - a^2$ and $y = x^2 + 2ax + a^2$. Ask the students to graph $y = x^2 - 4$ and $y = (x + 2)(x - 2)$ using the graphing calculator. Compare the graphs. Ask the class why only one graph is visible. Continue by asking the students to graph $y = x^2 + 8x + 16$ and $y = (x + 4)^2$.	<u> x </u> Use manipulatives <u> x </u> Construct graphs
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Place the students in groups and have the groups generate equivalent quadratic pairs. Give each group a set of algebra tiles to use if needed.	<u> x </u> Solve similar questions/problems
<u>10</u> minutes	Practice Alone: Have the students practice factoring quadratics in the form $y = x^2 - a^2$ and $y = x^2 + 2ax + a^2$ and $y = x^2 - 2ax + a^2$. Allow the students to check their work with the graphing calculator and use algebra tiles.	<u> x </u> Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Without the aid of the graphing calculators, have students sketch the following graphs: $Y = x^2 - 16$, $y = x^2 + 4x + 2$, $y = x^2 - 10x + 25$	<u> x </u> Individual project/investigation
<u>5</u> minutes	Closing Activities: Ask students to begin to develop a graphic organizer for graphing quadratic equations. Assign extra equations for factoring practice. Have students find the x and y intercepts as well.	<u> X </u> Homework-assign and explain
	Resources/Materials Graphing calculators Algebra tiles	
	Enrichment/Extension/Reteaching	
Notes: Dale Seymour has some good resources on algebra tiles. Most algebra I textbooks also contain resources for algebra tiles.		

Daily Activities

Day 2 of 10

SREB's Readiness Indicator/s for daily activities
<ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation.
<ul style="list-style-type: none"> Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities
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Literacy Strategies	Habits of Success
<input checked="" type="checkbox"/> Other – Frayer Model	1. <input checked="" type="checkbox"/> Create Relationships Team work/responsible/communication 4. <input checked="" type="checkbox"/> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist
<u>3</u> minutes	Opening Student Organizer: Ask students to find the x and y intercepts for $y = x^2 + 5x + 6$	<input checked="" type="checkbox"/> Answer question
<u>5</u> minutes	Engage: Distribute algebra tiles and ask students to factor $y = x^2 + 5x + 6$. Ask the students how factoring relates to finding the x intercepts of a quadratic equation.	<input checked="" type="checkbox"/> Other
<u>15</u> minutes	Explore: Give the students several quadratics in the form: $y = x^2 + bx + c$. Factor the equations using algebra tiles. Also, have the class graph the equations and determine the factors, using the TRACE function.	<input checked="" type="checkbox"/> Investigate
<u>15</u> minutes	Explanation: Review the factoring patterns for $y = x^2 + bx + c$ and $y = ax^2 + bx + c$ after students have explored factoring with algebra tiles and the graphing calculators.	<input checked="" type="checkbox"/> Lecture with guided notes

<u>10</u> minutes	Practice Together: Practice factoring quadratics of these types with the class.	<u> </u> x Complete practice questions/problems
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Distribute the algebra tile and give each group a set of equations to factor, allow them to check their work using the graphing calculators. Have them plot both the quadratic and its factored form and check to see that they are the same graph.	<u> </u> x Solve similar questions/problems
<u>10</u> minutes	Practice Alone: Give each student 2 examples of each type and have them factor and graph. Allow students to use the algebra tiles, if needed.	<u> </u> x Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Ask students to do the following: 1. List the first 10 perfect squares. 2. Sketch the graphs of $y = x^2 - 16$, $y = x^2 - 8x + 16$, without a calculator. 3. Factor: $y = x^2 + 7x + 12$ and $y = 3x^2 - 10x + 21$	<u> </u> x Individual project/investigation
<u>5</u> minutes	Closing Activities: Add information on quadratics to the Frayer Model. Assign homework on graphing equations in the form: $y = x^2 - a^2$ and $y = x^2 \pm 2ax + a^2$ without a calculator and factoring problems in the form $y = x^2 - a^2$, $y = x^2 + 2ax + a^2$, $y = x^2 + bx + c$, $y = ax^2 \pm bx \pm c$.	<u> </u> X Homework-assign and explain
	Resources/Materials Equations to factor and graph Algebra tiles Graphing calculators	<u> </u> x Manipulatives
	Enrichment/Extension/Reteaching	
Notes:		

Daily Activities

Day 3__ of __10__

SREB's Readiness Indicator/s for daily activities
<ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation.
<ul style="list-style-type: none"> Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities
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Literacy Strategies	Habits of Success
	1. <u> x </u> Create Relationships Team work/responsible/communication 4. <u> x </u> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist
<u> 3 </u> minutes	Opening Student Organizer: Ask students where the vertex of the parabola was in these graphs: $y = x^2 - 4$ and $y = x^2 + 6x + 9$. Lead the discussion to discover that the vertex is located halfway between the x intercepts due to symmetry of the graph.	<u> x </u> Answer question
<u> </u> 5 minutes	Engage Ask if the vertex was the maximum or minimum value on the parabola. Explain how you would know from looking at the graph. Vertex is the highest (max) point on the graph or the lowest (min) point on the graph. Ask the class how they would determine the y coordinate of the vertex (Substitution).	<u> x </u> Discuss previous experiences
<u> 15 </u> minutes	Explore: Using the graphs from the previous lesson and the midpoint formula, determine the location of the vertex for several of the equations.	<u> x </u> Work problem
	Explanation: Explain to the class that there is an easier way to determine the vertex. Explain that the	<u> x </u> Lecture with guided notes

<u>15</u> minutes	x coordinate of the vertex is located at $x = -b/2a$ and that once the x coordinate is found, use substitution to find the y coordinate. Explain that the x – intercepts are often called the zeros of the quadratic. Remind students of how to find the y – intercepts.	
<u>10</u> minutes	Practice Together: Practice graphing several quadratics by finding the vertex, zeros, and y intercept as described above.	<u>x</u> Complete practice questions/problems
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Give the groups a set of quadratics to graph. Be sure all the quadratics are factorable.	<u>x</u> Solve similar questions/problems
<u>10</u> minutes	Practice Alone: Give each student some equations to graph.	<u>x</u> Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Ask students to interpret: Vertex Zeros Y-intercept Give the students several graphs and ask them to name the quadratic equation represented by the graph.	<u>x</u> Individual project/investigation
<u>5 minutes</u>	Closing Activities: Continue to add information to the Frayer Model. Assign additional graphing or factoring as needed.	X Homework-assign and explain
	Resources/Materials Sample factorable equations.	
	Enrichment/Extension/Reteaching	
Notes: Make algebra tiles available for factoring.		

Daily Activities

Day 4 of 10

SREB's Readiness Indicator/s for daily activities <ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities # _____ : _____ # _____ : _____ # _____ : _____

Literacy Strategies	Habits of Success
	1. <u> x </u> Create Relationships Team work/responsible/communication 4. <u> x </u> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist
<u> 3 </u> minutes	Opening Student Organizer: Ask students how they would find the x intercepts or zeros for a quadratic equation that does not factor. Congratulate the class if they mention using a graphing calculator and the TRACE or table feature.	<u> x </u> Answer question
<u> 5 </u> minutes	Engage: Demonstrate to the class how they can use the calculator to find the x-intercepts. Multiples of the ZOOMDECIMAL is the best window to use to get good solutions.	<u> x </u> Other
<u> 15 </u> minutes	Explore: As you write the quadratic formula, sing it or give the students a mnemonic device for remembering the formula. If your students can follow the derivation of the formula, derive it. This will be good practice for college.	<u> x </u> Investigate
<u> 15 </u> minutes	Explanation: Explain that the quadratic formula can be used to find the x-intercepts even if the quadratic equation factors and that some math	<u> x </u> Lecture with guided notes

	students prefer to use it over factoring. Explain the prerequisite skills needed to be able to work with the formula. Review simplifying radicals as needed, with and without a calculator. Do not forget to consider imaginary numbers.	
<u>10</u> minutes	Practice Together: Practice simplifying radicals with the class.	<u> x </u> Complete practice questions/problems
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Place the students in pairs and have them simplify radicals.	<u> x </u> Solve similar questions/problems
<u>10</u> minutes	Practice Alone: After working together, give the students some problems to simplify individually.	<u> x </u> Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Have students write in their journals how to recognize if a radical is in simplest form.	<u> x </u> Other
<u>5</u> minutes	Closing Activities: Assign homework on simplifying radicals.	<u> X </u> Homework-assign and explain
	Resources/Materials	
	Enrichment/Extension/Reteaching	
Notes:		

Daily Activities

Day 5 of 10

SREB's Readiness Indicator/s for daily activities <ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities # _____ : _____ # _____ : _____ # _____ : _____

Literacy Strategies	Habits of Success
<u> x </u> Exit slips	1. <u> x </u> Create Relationships Team work/responsible/communication 4. <u> x </u> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist
<u> 3 </u> minutes	Opening Student Organizer: Ask the students how many x – intercepts are possible for a quadratic equation.	<u> x </u> Answer question
<u> 5 </u> minutes	Engage: Write the quadratic formula on the board and ask the students how they can tell if they will have 0, 1, or 2 x-intercepts or zeros. After the discussion, explain that the determinant determines the number of solutions.	<u> x </u> Display object/picture
<u> 15 </u> minutes	Explore: Use the quadratic formula to find the x-intercepts or zeros of these equations: $Y = x^2 + 5x + 6$ $Y = 4x^2 - 9$ $Y = x^2 + 7x + 1$ $Y = x^2 + 2x - 7$ $Y = 16 - x^2$ $Y = 3x^2 + 5x - 1$	<u> x </u> Investigate
	Explanation: Using the above equations practice finding the y intercepts, vertex, and determine	<u> x </u> Interactive Discussion

<u>15</u> minutes	whether the vertex is a max or min. pt. on the graph. Graph each equation.	
<u>10</u> minutes	Practice Together Use this time for the explanation or add to the team practice.	<u>x</u> Complete practice questions/problems
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Have the students work to graph quadratic equations without a calculator, be sure that some of the quadratics do not factor. Allow them to check their work with a calculator. Explain to the students that the graphs can also be made using calculus.	<u>x</u> Solve similar questions/problems
<u>10</u> minutes	Practice Alone: After the group activity, have the students complete two graphs on their own. Make sure one of the equations does not factor.	<u>x</u> Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Ask the students to explain the terms: Determinant Zeros Quadratic	<u>x</u> Discussion
<u>5 minutes</u>	Closing Activities: Have students turn in their individual graphs as a ticket out the door.	<u>X</u> Homework-assign and explain
	Resources/Materials	
	Enrichment/Extension/Reteaching	
Notes:		

Daily Activities

Day 6 of 10

SREB's Readiness Indicator/s for daily activities
<ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities
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Literacy Strategies	Habits of Success
	3. <u>x</u> Improve reading/writing skills Revise/write/use reading & writing strategies

Anticipated Time	Sequence of instruction	Checklist
<u>3</u> minutes	Opening Student Organizer: Ask students to predict which ball has more bounce (resiliency) super ball, golf ball, or tennis ball. Keep a record of their predictions. Ask to explain why those choose a particular type of ball. Resiliency = height of bounce divided by height of drop.	<u> x </u> Answer question
<u> 5 </u> minutes	Engage: Ask students to think of other types of balls that could be compared to those above.	<u> x </u> Display object/picture
<u> 15 </u> minutes	Explore Using a CBL/CBR collect and analyze ball bounce data with a motion detector. Measure data for super ball, golf ball and tennis ball. (Another that you can consider using is the ping-pong ball). You will need the BOUNCE program for the graphing calculator for this activity. This activity can also be completed without the equipment. See attached file.	<u> x </u> Perform lab activity
<u> 15 </u> minutes	Explanation: Use the data collected to calculate the percent of decrease of each bounce, to determine the resiliency of each type of ball, and to predict heights on additional bounces.	<u> x </u> Other- make predictions

<u>10</u> minutes	Practice Together: Test the predictions.	<u> </u> x Conduct Laboratory activity
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: If possible, give each group a different type of ball and have them complete the activity working together. (Use a handball if possible.)	<u> </u> x Solve similar questions/problems
<u>10</u> minutes	Practice Alone: Add this time to one of the activities.	
<u>15</u> minutes	Evaluate understanding: Ask students to respond to the following questions in their journals: 1. Does the resiliency change from measurement to measurement on the same ball? Why might this happen? 2. Does the resiliency change from ball to ball? Why?	<u> </u> x Other- journals
<u>5 minutes</u>	Closing Activities: Assign additional factoring, quadratic formula, or simplifying radical homework.	<u> </u> X Homework-assign and explain <u> </u> x Review major points <u> </u> x Answer questions
	Resources/Materials CBL/motion detector or/and Ball Bounce Activity Meter, Yardsticks or Tape Measures – doing activity without technology BOUNCE program for calculators	
	Enrichment/Extension/ Reteaching <u>Entire day is enrichment, can be omitted if time is needed for additional skill practice.</u>	
Notes:		

Daily Activities

Day 7 of 10

SREB's Readiness Indicator/s for daily activities <ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities # _____ : _____ # _____ : _____ # _____ : _____

Literacy Strategies	Habits of Success
<input checked="" type="checkbox"/> KWL Chart	1. <input checked="" type="checkbox"/> Create Relationships Team work/responsible/communication 4. <input checked="" type="checkbox"/> Improve Mathematics skills Solve/estimate/predict/synthesize/compute 5. <input checked="" type="checkbox"/> Set goals/plan Accountable/plan/set goals/connections

Anticipated Time	Sequence of instruction	Checklist
<u>3</u> minutes	Opening Student Organizer: Ask students to calculate the area of circle with diameter 2 ft. Use 3.14 for pi.	<input checked="" type="checkbox"/> Solve problems
<u>5</u> minutes	Engage: Ask students to explain how the area of the light beam on a flashlight changes as the distance between the wall and the flashlight increases or decreases.	<input checked="" type="checkbox"/> Discuss previous experiences
<u>15</u> minutes	Explore: Using a flashlight, test out the predictions.	<input checked="" type="checkbox"/> Investigate
<u>15</u> minutes	Explanation: Explain the spread of the light beam to the class.	
<u>10</u> minutes	Practice Together: Using the flashlight, practice finding the area of the beam from various distances. Record the data.	
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs: Have students complete the Shedding Light	

	Activity.	
<u>10</u> minutes	Practice Alone Add time to the Shedding Light Activity.	
<u>15</u> minutes	Evaluate understanding: Ask the class to explain how the experiments conducted over the last two days of class helped to increase their understanding of quadratics and mathematics in general.	
<u>5</u> minutes	Closing Activities: Have students add information on quadratics to the KWL. Assign homework on graphing quadratics.	<u>X</u> Homework-assign and explain
	Resources/Materials: Shedding Light Activity Flashlights Measuring tapes	<u>X</u> Manipulatives
	Enrichment/Extension/Reteaching:	
Notes:		

Daily Activities

Day 8 of 10

SREB's Readiness Indicator/s for daily activities <ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.
State/District Standard/s for daily activities # _____ : _____ # _____ : _____ # _____ : _____

Literacy Strategies	Habits of Success

Anticipated Time	Sequence of instruction	Checklist
<u>3</u> minutes	Opening Student Organizer: Ask students to describe their experiences working retail or fundraising.	<u> x </u> Answer question
<u> 5 </u> minutes	Engage: Write the words, profit, revenue, and cost. Ask the class why these words are important to business owners, managers, and employees.	<u> x </u> Discuss previous experiences
<u> 15 </u> minutes	Explore: If possible, give students a list of items, their cost, their retail-selling price, and a list of items ordered by a customer. Have them find the cost of the items, total of the order, and the profit on the order.	<u> x </u> Investigate
<u> 15 </u> minutes	Explanation: Explain that these functions can be modeled by quadratic functions.	<u> x </u> Lecture with guided notes
<u> 10 </u> minutes	Practice Together: Work through the Department Store example with the class (File attached). May need to add some time to this section.	<u> x </u> Complete practice questions/problems
	Practice in Teams/groups/buddy-pairs:	<u> x </u> Solve similar

<u>10</u> minutes	Place the class in teams and assign the Application of Polynomial Functions Activity (File attached).	questions/problems
<u>10</u> minutes	Practice Alone: Continue with Team Activity.	<u> x </u> Solve additional questions/problems
<u>15</u> minutes	Evaluate understanding: Ask groups to report the results of the activity.	<u> x </u> Discussion
<u>5 minutes</u>	Closing Activities Assign a quiz on quadratics for Day 10.	<u> X </u> Homework-assign and explain
	Resources/Materials Department Store file Applications of Polynomial file	
	Enrichment/Extension/Reteaching See department store activity for enrichment ideas Invite a buyer for a department store to speak to the class.	
Notes:		

Daily Activities

Day 9 of 10

SREB's Readiness Indicator/s for daily activities

- Analyze problems and develop solution strategies
- Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context.
- Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts.
- Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation.
- Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphically.

State/District Standard/s for daily activities

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Literacy Strategies	Habits of Success

Anticipated Time	Sequence of instruction	Checklist
<u>3</u> minutes	Opening Student Organizer: Ask students to define profit.	<u> </u> x Answer question
<u> </u> 5 minutes	Engage: Discuss with the student their prior experiences with fundraising, through the discussion help students to understand the terms, cost, revenue, and profit. Explain that cost refers to cost to the seller and consist of fixed cost and the cost of producing each item. Revenue is the selling price X number of units sold, and profit is the difference in the revenue and the cost.	<u> </u> x Discuss previous experiences
<u> </u> 15 minutes	Explore: Remind the class of the relationship between the vertex and the maximum or minimum value of a quadratic equation. Give the students a revenue equation like $R(x) = 250x - x^2$ and ask them to determine the number of units required to maximize the revenue and to determine the maximum revenue. Next, give the students a total cost function $C(x) = 250 + 6x + 0.1x^2$ and ask them to find the minimum total cost. (250.00, minimum would equal the fixed costs, in this	<u> </u> x Work problem

	case). Explain this to the class.	
<u>15</u> minutes	<p>Explanation: Use this example to teach students to maximize profit: A travel agency will plan a tour for groups of size 25 or larger. If the group contains exactly 25 people, the cost is \$500 per person. However, each person's cost is reduced by \$10 for each additional person above the 25. If the travel agency incurs a cost of \$125 per person for the tour, what size group will give the agency the maximum profit?</p> <p>Steps:</p> <ol style="list-style-type: none"> 1. Write the cost, revenue, and profit function. 2. $P = R - C$ 3. Then find the number of people that will maximize the profit 4. Next, find the maximum profit. <p>Explain to the students that this problem will be solved in college using calculus.</p>	<u> </u> x Lecture with guided notes
<u>10</u> minutes	<p>Practice Together</p> <p>Solve this problem with the class: A company handles an apartment building with 50 units. Experience has shown that if the rent for each of the units is \$720 per month, all of the units will be filled, but 1 unit will become vacant for each \$20 increase in this monthly rate. If the monthly cost of maintaining the apartment building is \$12 per rented unit, what rent should be charged per month to maximize the profit?</p>	<u> </u> x Complete practice questions/problems
<u>10</u> minutes	<p>Practice in Teams/groups/buddy-pairs: Give the class a set of word problems requiring them to find maximum or minimum values.</p>	<u> </u> x Solve similar questions/problems
<u>10</u> minutes	<p>Practice Alone: After the students work in groups, have them solve a similar problem working alone.</p>	<u> </u> x Solve additional questions/problems
<u>15</u> minutes	<p>Evaluate understanding: Ask the students to define the following in their journals: Maximum, Minimum, Cost, Revenue, Profit, Break-even, Loss, Gain</p>	<u> </u> x Other- journal
<u>5</u> minutes	<p>Closing Activities: Assign review homework on quadratics to prepare for the mini-unit quiz.</p>	<u> </u> X Homework-assign and explain
	Resources/Materials	
	Enrichment/Extension/Reteaching	
Notes		

Daily Activities

Day 10 of 10

SREB's Readiness Indicator/s for daily activities <ul style="list-style-type: none"> Analyze problems and develop solution strategies Read and interpret mathematics problems. Utilize the language of mathematics to explain thinking processes and communicate solutions within a context. Use technology (including software and graphing calculators) to enhance understanding of mathematical ideas and concepts. Read, write, compare, order, and represent in a variety of forms: integers, fractions, decimals, percents, and numbers written in scientific and exponential notation. Analyze, interpret, and translate (advanced) non-linear relations (quadratic, absolute value, square root, exponential and step functions) numerically, algebraically, and graphical.
State/District Standard/s for daily activities # _____ : _____ # _____ : _____ # _____ : _____

Literacy Strategies	Habits of Success
	2. <u> x </u> Study, Manage time, organize Time/materials/study skills 4. <u> x </u> Improve Mathematics skills Solve/estimate/predict/synthesize/compute

Anticipated Time	Sequence of instruction	Checklist
<u> 3 </u> minutes	Opening Student Organizer: Ask students to graph $y = x $ and $y = x^2$.	<u> x </u> Answer question
<u> 5 </u> minutes	Engage: Ask the students to brainstorm how the graphs are similar and how they are different. To review some concepts of quadratics, read the story of Mr. Norm Parabola from the Mathematics Teacher (file attached).	<u> x </u> Discuss previous experiences
<u> 15 </u> minutes	Explore: Continue to explore the similarities and differences between other pairs of graphs. Examples $Y = x + 1$ and $y = x^2 + 1$ $Y = x - 1 $ and $y = (x - 1)^2$ $Y = 2 x $ and $y = 2x^2$	<u> x </u> Investigate
<u> 15 </u> minutes	Explanation: Take student questions about quadratic equations.	<u> x </u> Interactive Discussion
<u> 10 </u> minutes	Practice Together Have the class use the remaining time to complete the assessment	<u> x </u> Other

	on quadratic equations.	
<u>10</u> minutes	Practice in Teams/groups/buddy-pairs	
<u>10</u> minutes	Practice Alone	
<u>15</u> minutes	Evaluate understanding	
<u>5</u> minutes	Closing Activities: Collect papers and dismiss.	<u>X</u> Homework-assign and explain
	Resources/Materials	
	Enrichment/Extension/Reteaching Have students create a story similar to Mr. Norm Parabola for another function.	
Notes:		