



Program Information	<i>[Lesson Title]</i> Using the Quadratic Formula		TEACHER NAME Jessica Untch		PROGRAM NAME Parma City School District		
	<i>[Unit Title]</i> Advanced Algebra Topics		NRS EFL(s) 3 – 5		TIME FRAME 60 minutes		
Instruction	<u>ABE/ASE Standards – Mathematics</u>						
	Numbers (N)		Algebra (A)		Geometry (G)		Data (D)
	Numbers and Operation		Operations and Algebraic Thinking		Geometric Shapes and Figures		Measurement and Data
	The Number System		Expressions and Equations	A.3.9 A.5.3 A.5.10	Congruence		Statistics and Probability
	Ratios and Proportional Relationships		Functions		Similarity, Right Triangles. And Trigonometry		Benchmarks identified in RED are priority benchmarks. To view a complete list of priority benchmarks and related Ohio ABLE lesson plans, please see the Curriculum Alignments located on the Teacher Resource Center (TRC).
	Number and Quantity				Geometric Measurement and Dimensions		
					Modeling with Geometry		
	Mathematical Practices (MP)						
	<input checked="" type="checkbox"/>	Make sense of problems and persevere in solving them. (MP.1)			<input type="checkbox"/>	Use appropriate tools strategically. (MP.5)	
	<input checked="" type="checkbox"/>	Reason abstractly and quantitatively. (MP.2)			<input checked="" type="checkbox"/>	Attend to precision. (MP.6)	
<input type="checkbox"/>	Construct viable arguments and critique the reasoning of others.			<input checked="" type="checkbox"/>	Look for and make use of structure. (MP.7)		



(MP.3)	
<input type="checkbox"/> Model with mathematics. (MP.4)	<input checked="" type="checkbox"/> Look for and express regularity in repeated reasoning. (MP.8)
<p>LEARNER OUTCOME(S)</p> <ul style="list-style-type: none"> Students will be able to solve quadratic equations in one variable and demonstrate their skill by completing a worksheet with 80% accuracy. 	<p>ASSESSMENT TOOLS/METHODS</p> <ul style="list-style-type: none"> Formative: Walk around the room, checking in with student groups to see if they are finding answers to practice problems. Summative: Grade <i>The Quadratic Formula worksheet</i>. Students should achieve 80% accuracy.
<p>LEARNER PRIOR KNOWLEDGE</p> <ul style="list-style-type: none"> Understand and apply Integers rules in all operations. Demonstrate knowledge of order of operations and square roots. Ability to solving multi-step equations. 	
<p>INSTRUCTIONAL ACTIVITIES</p> <ol style="list-style-type: none"> Use the computer and projector to pull up the following web page: Quadratic Equations <ol style="list-style-type: none"> Use this page to introduce quadratic equations- what they are, their practical applications, how to solve them, etc. Take about 10 minutes for this and make sure that students take notes. Explain that while there are different ways to solve quadratic equations, the quadratic formula always works when equations are in $ax^2 + bx + c = 0$ format. This makes the formula a sound choice when faced with this type of problem. 	<p>RESOURCES</p> <p>Projector, ability to project</p> <p>Computer</p> <p>Internet access</p> <p>White board and markers</p> <p>Quadratic Equations. (n.d.). Retrieved from http://www.mathsisfun.com/algebra/quadratic-equation.html</p>



	<ol style="list-style-type: none">2. Write a sample problem on the board: $v^2 + 2v - 8 = 0$<ol style="list-style-type: none">a. Use the <i>Quadratic Equations Teacher Notes</i> (attached) to show the steps of solving this problem on the board.b. Make sure students write out every step and label appropriately.3. Do several more examples as a group. Examples are provided on <i>The Quadratic Formula – Sample Problems for Board</i> (attached). Gradually decrease the amount of support to allow students the opportunity to figure out answers on their own.<ol style="list-style-type: none">a. Put a few more practice problems on the board and ask students to work in groups to solve them.b. As students are working, move throughout the room to check for accuracy in applying signed numbers rules, using order of operations, and finding square roots.c. Students often make mistakes in these areas, so it pays to take the time to conduct an informal assessment. Answer students' questions as they arise.4. Take a 15 minute break, and then review the answers to the practice problems.5. As a final assessment, hand out student copies of <i>The Quadratic Formula worksheet</i> (attached) and give students time to work alone on them. Collect worksheets for later review.	<p>Teacher copy of <i>Quadratic Equations Teacher Notes</i> (attached)</p> <p>Teacher copy of <i>The Quadratic Formula – Sample Problems for Board</i> (attached)</p> <p>Student copies of <i>The Quadratic Formula worksheet</i> (attached)</p>
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	<p>DIFFERENTIATION</p> <ul style="list-style-type: none">• Walk students through several examples as a large group using explicit instruction.• Structure small groups to include low and high level students (allow higher level to help others solve problems).• Give extra assistance to students/groups who have difficulty solving problems.• Allow students to work one-on-one with a tutor, if needed.
<p>Reflection</p>	<p>TEACHER REFLECTION/LESSON EVALUATION</p>
	<p>ADDITIONAL INFORMATION</p>



Teacher Notes

$$x^2 + 2x - 8 = 0$$

(Note: 'a' is above the first x, 'b' is above the '+ 2', and 'c' is above the '- 8' in the original image)

Step 1: label the coefficients
a, b, c

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Step 2: Write the quadratic formula

$$\frac{-2 \pm \sqrt{2^2 - 4(1)(-8)}}{2(1)}$$

(Note: '2' in the square root is circled and has an arrow pointing to the text "tells # of answers")

Step 3: substitute numbers for
a, b, c

$$\frac{-2 \pm \sqrt{4 + 32}}{2}$$

Step 4: Follow Order of Operations



$$\frac{-2 \pm \sqrt{36}}{2}$$

Step 5: Take the square root of 36

$$\frac{-2 \pm 6}{2}$$

Step 6: Find 2 solutions

$$\frac{-2 + 6}{2} = \frac{4}{2} = 2$$

$$\frac{-2 - 6}{2} = \frac{-8}{2} = -4$$

Sample problems for board

Name : _____

Score : _____

Teacher : _____

Date : _____

The Quadratic Formula

Solve each equation with the quadratic formula.

1) $q^2 - 7q - 18 = 0$

6) $h^2 - 3h - 40 = 0$

2) $12q^2 + 32q - 12 = 0$

7) $18g^2 + 21g - 9 = 0$

3) $30r^2 + 85r + 50 = 0$

8) $b^2 + 9b - 10 = 0$

4) $w^2 - 2w - 120 = 0$

9) $6r^2 + 3r - 3 = 0$

5) $10z^2 + 9z - 40 = 0$

10) $p^2 - 7p - 44 = 0$



Name : _____

Score : _____

Teacher : _____

Date : _____

The Quadratic Formula

Solve each equation with the quadratic formula.

1) $q^2 - 7q - 18 = 0$

$$q = \{ 9, -2 \}$$

6) $h^2 - 3h - 40 = 0$

$$h = \{ -5, 8 \}$$

2) $12q^2 + 32q - 12 = 0$

$$q = \left\{ \frac{1}{3}, -3 \right\}$$

7) $18g^2 + 21g - 9 = 0$

$$g = \left\{ \frac{1}{3}, \frac{-3}{2} \right\}$$

3) $30r^2 + 85r + 50 = 0$

$$r = \left\{ -2, \frac{-5}{6} \right\}$$

8) $b^2 + 9b - 10 = 0$

$$b = \{ -10, 1 \}$$

4) $w^2 - 2w - 120 = 0$

$$w = \{ -10, 12 \}$$

9) $6r^2 + 3r - 3 = 0$

$$r = \left\{ \frac{1}{2}, -1 \right\}$$

5) $10z^2 + 9z - 40 = 0$

$$z = \left\{ \frac{8}{5}, \frac{-5}{2} \right\}$$

10) $p^2 - 7p - 44 = 0$

$$p = \{ 11, -4 \}$$



Name : _____

Score : _____

Teacher : _____

Date : _____

The Quadratic Formula

Solve each equation with the quadratic formula.

1) $z^2 - 7z + 12 = 0$

6) $10n^2 + 14n - 48 = 0$

2) $12p^2 + 16p - 3 = 0$

7) $8q^2 + 54q + 70 = 0$

3) $y^2 + 3y - 108 = 0$

8) $q^2 - 4q - 5 = 0$

4) $6s^2 + 54s + 108 = 0$

9) $w^2 - 21w + 110 = 0$

5) $24d^2 - 58d + 30 = 0$

10) $m^2 + 15m + 36 = 0$



Name : _____

Score : _____

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The Quadratic Formula

Solve each equation with the quadratic formula.

1) $z^2 - 7z + 12 = 0$

$$z = \{ 3, 4 \}$$

6) $10n^2 + 14n - 48 = 0$

$$n = \left\{ \frac{8}{5}, -3 \right\}$$

2) $12p^2 + 16p - 3 = 0$

$$p = \left\{ \frac{-3}{2}, \frac{1}{6} \right\}$$

7) $8q^2 + 54q + 70 = 0$

$$q = \left\{ -5, \frac{-7}{4} \right\}$$

3) $y^2 + 3y - 108 = 0$

$$y = \{ 9, -12 \}$$

8) $q^2 - 4q - 5 = 0$

$$q = \{ 5, -1 \}$$

4) $6s^2 + 54s + 108 = 0$

$$s = \{ -6, -3 \}$$

9) $w^2 - 21w + 110 = 0$

$$w = \{ 11, 10 \}$$

5) $24d^2 - 58d + 30 = 0$

$$d = \left\{ \frac{3}{4}, \frac{5}{3} \right\}$$

10) $m^2 + 15m + 36 = 0$

$$m = \{ -12, -3 \}$$

