

## 3.7 Perfecting My Quads

### *A Practice Understanding Task*



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Carlos and Clarita, Tia and Tehani, and their best friend Zac are all discussing their favorite methods for solving quadratic equations of the form  $ax^2 + bx + c = 0$ . Each student thinks about the related quadratic function  $y = ax^2 + bx + c$  as part of his or her strategy.

Carlos: “I like to make a table of values for  $x$  and find the solutions by inspecting the table.”

Clarita: “I like to write the equation in factored form, and then use the factors to find the solutions.”

Tia: “I like to treat it like a quadratic function that I am trying to put in vertex form by completing the square. I can then use a square root to undo the squared expression.”

Tehani: “I also like to treat it like a quadratic function, but I use the quadratic formula to find the solutions.”

Zac: “I like to graph the related quadratic function and use my graph to find the solutions.”

Demonstrate how each student might solve each of the following quadratic equations.

Solve:  $x^2 - 2x - 15 = 0$	<u>Carlos' Strategy</u>	<u>Zac's Strategy</u>
<u>Clarita's Strategy</u>	<u>Tia's Strategy</u>	<u>Tehani's Strategy</u>



<p>Solve:</p> $2x^2 + 5x - 12 = 0$	<p><u>Carlos' Strategy</u></p>	<p><u>Zac's Strategy</u></p>
<p><u>Clarita's Strategy</u></p>	<p><u>Tia's Strategy</u></p>	<p><u>Tehani's Strategy</u></p>

<p>Solve:</p> $x^2 + 4x - 8 = 0$	<p><u>Carlos' Strategy</u></p>	<p><u>Zac's Strategy</u></p>
<p><u>Clarita's Strategy</u></p>	<p><u>Tia's Strategy</u></p>	<p><u>Tehani's Strategy</u></p>



<p>Solve:</p> $8x^2 + 2x = 3$	<p><u>Carlos' Strategy</u></p>	<p><u>Zac's Strategy</u></p>
<p><u>Clarita's Strategy</u></p>	<p><u>Tia's Strategy</u></p>	<p><u>Tehani's Strategy</u></p>

Describe why each strategy works.

As the students continue to try out their strategies, they notice that sometimes one strategy works better than another. Explain how you would decide when to use each strategy.



Here is an extra challenge. How might each student solve the following system of equations?

<p>Solve the system:</p> $y_1 = x^2 - 4x + 1$ $y_2 = x - 3$	<p><u>Carlos' Strategy</u></p>	<p><u>Zac's Strategy</u></p>
<p><u>Clarita's Strategy</u></p>	<p><u>Tia's Strategy</u></p>	<p><u>Tehani's Strategy</u></p>



## 3.7 Perfecting My Quads – Teacher Notes

### *A Solidify Understanding Task*

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**Purpose:** In this task students use their techniques for changing the forms of quadratic expressions (i.e., factoring, completing the square to put the quadratic in vertex form, or using the quadratic formula to find the x-intercepts) as strategies for solving quadratic equations.

**Core Standards Focus:**

**A.REI.4** Solve quadratic equations in one variable.

- Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

**Note for Mathematics II A.REI.4a, A.REI.4b**

*Extend to solving any quadratic equation with real coefficients, including those with complex solutions.*

**A.REI.7** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .

**Note for Mathematics II A.REI.7**

*Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions.*

**A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

**Related Standards: A.SSE.1**

**Launch (Whole Class):**

Remind students that in the previous task, *Curbside Rivalry*, they used various strategies to solve quadratic equations that arose from various problem situations that Carlos and Clarita were trying to resolve. In this task the focus is again on solving quadratic equations, but no contexts are provided. Instead, students are to try out several different strategies and procedures for solving the equations and to focus on the strengths and weaknesses of each method.



Read through the first part of the task handout with the class, and make sure they understand the basic strategy each of the characters in the story plan to use. Then set students to work trying out each of the strategies on a variety of problems.

**Explore (Small Group):**

As students work through the task they should notice that some strategies, such as factoring or making a table, do not work as consistently as some other strategies, although they are effective and easy to do when they do yield solutions. Encourage students to focus on the types of solutions that seem to support each method. For example, making a table works better when the solutions are integers, or at least rational numbers.

**Discuss (Whole Class):**

Focus the discussion on the questions “describe why each strategy works” and “explain how you would decide when to use each strategy.”

Illustrate the value of the graphical and numerical strategies by working through the last problem, which involves a system of equations where one equation is quadratic and one equation is linear. Point out how the graph and table give us a sense of what a solution to this system would mean. Students may wonder about how to start an algebraic approach for these problems. Remind students that with systems of equations we can sometimes set the equations equal to each other. Doing so will lead to an equation that can be solved by rearranging the terms to get a quadratic expression equal to 0.

**Aligned Ready, Set, Go: Solving Quadratic and Other Equations 3.7**

