LESSON 5-4

Success for English Language Learners

Completing the Square

Steps for Success

Step I To begin, make sure all students understand the text in the lesson terminology by using the following procedures.

- Show students the examples of models using algebra tiles on page 342 of the lesson. Allow students to use algebra tiles in the classroom to model the trinomials in the lesson. Provide other trinomials for students to model with tiles. Allow them to work in groups and explain their work to other groups.
- Be sure to point out the Reading Math sidebar on page 341. Have students practice the mathematical language, inserting numbers in place of *a*.

Step II In order for students to grasp the important concepts of the lesson, use the following procedure.

- Lead students through the steps for completing the square on page 343. Students can work in pairs to create charts that show the steps, using numbers and simplified language. Ask them to practice showing and explaining the steps to other group members.

Step III Ask English Language Learners to complete the worksheet for this lesson.

- Point out that Example 3A in the student textbook is supported by Problem 1 on the worksheet. As necessary, go through the steps of solving the equation with students. Remind students that the variables all need to be collected on one side of the equation. Ask students to explain why there are two possible solutions rather than just one.
- Think and Discuss supports the problems on the worksheet.

Making Connections

- Help students make associations with actions for several of the words in the steps to solve quadratic equations. For example, point out the word *collect* and ask students to pantomime collecting. How does their pantomime relate to collecting in the process? (All of the variables need to be collected, or gathered on one side of the equation.) You can follow a similar process with the word *simplify*.

Name ______________________________ Date __________ Class __________

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Problem 1

Solve the equation by completing the square.

$x^2 = 27 - 6x$

$x^2 + 6x = 27 - 6x + 6x$

$x^2 + 6x = 27$ — All variables are on one side.

$x^2 + 6x + \quad = 27$ — $b = 6$

$x^2 + 6x + \left(\frac{6}{2}\right)^2 = 27 + \left(\frac{6}{2}\right)^2$ — Add $\left(\frac{b}{2}\right)^2$ to both sides.

$x^2 + 6x + \left(\frac{36}{4}\right) = 27 + \left(\frac{36}{4}\right)$ — $\left(\frac{6}{2}\right)^2 = \left(\frac{36}{4}\right)$

$x^2 + 6x + 9 = 27 + 9$ — $\left(\frac{36}{4}\right) = 9$

$x^2 + 6x + 9 = 36$

$(x + 3)^2 = 36$ — $x^2 + 6x + 9 = (x + 3)^2$

$\sqrt{(x + 3)^2} = \sqrt{36}$

$x + 3 = \pm 6$ — $\sqrt{36} = +6$ or $\sqrt{36} = -6$

$x + 3 = 6$ or $x + 3 = -6$

$x + 3 - 3 = 6 - 3$ or $x + 3 - 3 = -6 - 3$

$3 \qquad -9$

$x = 3$ or $x = -9$ — These are the two solutions to $x^2 = 27 - 6x$.

Think and Discuss

1. Why does the equation have two solutions?

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2. Describe why this method is called completing the square.

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Lesson 4-4

1. If A is a matrix it denotes determinant, if A is a number it denotes absolute value.
2. Using Cramer's Rule, the determinant can be used to solve systems of equations.

Lesson 4-5

1. If it is not square, then $AA^{-1} \neq A^{-1}A$.
2. There is no multiplicative inverse of the matrix.
3. It can be used to solve $A \cdot X = B$, where A is a coefficient matrix, X is a variable matrix, and B is a constant matrix.

Lesson 4-6

1. Because they are not coefficients of variables.
2. Answers may vary.

CHAPTER 5

Lesson 5-1

1. The graph moves right/left.
2. The graph moves up/down.
3. The y-coordinates of all points on the graph would change sign.

Lesson 5-2

1. Because $f(4) = 6$.
2. It opens up when $a > 0$.

Lesson 5-3

1. If a point on the graph is reflected across the axis of symmetry, the image is also on the graph.
2. Because a quadratic function can go up, then down; a linear function only goes up or down.

Lesson 5-4

1. Because the square root introduces the plus/minus sign.
2. Because you are changing the equation into a square plus a constant term.

Lesson 5-5

1. It is the square root of -1. It is used to work with negative square roots.
2. You could substitute the answer in the original equation.

Lesson 5-6

1. Because the square root is positive.
2. c would be 0 and the roots would be 0 and -10.

Lesson 5-7

1. The point $(0, 0)$ involves the least amount of calculation.
2. It is dotted because in the problem it is a less than sign, not a less than or equal to sign.

Lesson 5-8

1. The difference between the x-values is constant.
2. Between 4 and 6 the graph is at 9, goes down, and comes back up to 9. The vertex must be between 4 and 6.
3. It opens up because all the y-values are at least 9.

Lesson 5-9

1. Quadrant II, because it corresponds to the point $(-9, 1)$.
2. The additive inverses of 10 and $-4i$.