LESSON 5-9

Success for English Language Learners

Operations with Complex Numbers

Steps for Success

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

- Draw a coordinate plane on the board, labeling the real and imaginary axes. Use a different color for each. Work with students to label each quadrant on the plane. (The upper right quadrant, for example, is a positive real number and a positive imaginary number.) Give students sticky notes with complex numbers and ask them to place the sticky notes in the correct positions on the complex plane.
- Students may confuse the complex plane with a "regular" coordinate plane. Work with students to compare and contrast the two and to create a mnemonic to remember the difference.

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

- Review the Commutative, Associative, and Distributive properties. Place students in learning groups of three and have each student become an "expert" on one of the properties, explaining it to the rest of the group. Give each group a problem to solve using the three properties.

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

- Point out that Examples 2A and 3D in the student textbook are supported by problems on the worksheet. Help students recognize that an imaginary number still has an absolute value. Review by showing the graph on page 382, tracing over the line in the graph that represents absolute value. For Example 3D, emphasize that real numbers and imaginary numbers need to be distributed and grouped before adding.
- Think and Discuss supports the problems on the worksheet.

Making Connections

- Discuss the meaning of *complex* ("made up of many parts"). Ask students to name things that are complex, such as an engine or the inside parts of a computer. Have students relate their knowledge of complex things to the mathematical meaning of *complex*. How can these associations help students remember the definitions of *complex plane* and *complex number*?

Name ______________________________ Date ___________ Class ___________

LESSON 5-9

Success for English Language Learners
Operations with Complex Numbers

Problem 1

Find the absolute value.

$|-9 + i|$

$|-9 + 1i|$

> Think: $|a + bi|$.
> $b = 1$

$\sqrt{a^2 + b^2} = \sqrt{(-9)^2 + 1^2}$

$\sqrt{81 + 1} = \sqrt{82}$

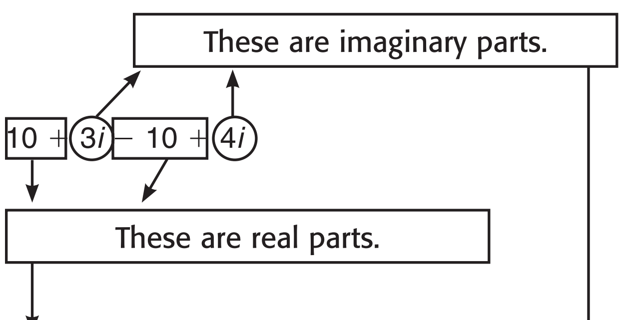
Problem 2

Subtract. Write the result in the form $a + bi$.

$(10 + 3i) - (10 - 4i)$

$(10 + 3i) - 10 - (-4i)$

> Multiply -1 times $(10 - 4i)$.



$(10 - 10) + (3i + 4i)$

$0 + 7i = 7i$

Think and Discuss

1. In which quadrant would the value in Problem 1 be found? Explain.

____

2. What additive inverses are found in Problem 2? How do you know?

____

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 $-4i$.