Name _____ Date _____ Class _____

LESSON 13-1

Reading Strategy

Understand Symbols

The square root of a real number can be positive or negative. The imaginary number i represents $\sqrt{-1}$. You can use i to find the square roots of imaginary numbers.

$$\begin{aligned}&\sqrt{-3}\\ &= \sqrt{(-1)3}\\ &= \sqrt{-1}\cdot\sqrt{3}\\ &= i\sqrt{3}\end{aligned}$$

You can also use i to solve quadratic equations that have no real solutions:

Solve

$$\begin{aligned}x^2 + 49 &= 0\\ x^2 &= -49\\ x &= \pm\sqrt{-49}\\ x &= \pm 7i\end{aligned}$$

Check the solution.

$$\begin{aligned}(7i)^2 &= 7^2 i^2\\ &= 49(-1)\\ &= -49\end{aligned}$$

$$\begin{aligned}(-7i)^2 &= (-7)^2 i^2\\ &= 49(-1)\\ &= -49\end{aligned}$$

Both $7i$ and $-7i$ are solutions of $x^2 + 49 = 0$.

Answer each question.

1. Circle the imaginary numbers.

   $-\sqrt{4}$ $\quad i\sqrt{9}$ $\quad 3i$ $\quad \sqrt{-8}$ $\quad -\sqrt{3}$ $\quad (-12)^2$

2. Use i to represent a number whose square is -9.

   _____

3. Consider the equation $x^2 + 1 = 0$.

   a. Find the solutions for the equation.

   _____

   b. Why doesn't this equation have real roots?

   _____

4. Show that $i\sqrt{5}$ and $-i\sqrt{5}$ are the solutions of $x^2 = -5$.

   _____

5. Is $(3i)(5i)$ a real or an imaginary number? Explain.

   _____

13. a. The beginning and end of the flight when the speed of the rocket is 0

b. $t = -3 \pm 5i$

c. No; possible answer: the zeros are imaginary because the graph never crosses the x-axis so the function never equals 0. The speed of the rocket must be 0 before takeoff and after landing.

Reteach

1. $6i\sqrt{2}$
2. $12i\sqrt{2}$
3. $10i$
4. $15i\sqrt{6}$
5. $16i$
6. $-7i\sqrt{2}$
7. $9i$
8. $1 - 4i$
9. $12 + i$
10. $x = \pm 3i\sqrt{2}$
11. $x = \pm\sqrt{-4}$

    $x = \pm 2i$
12. $x^2 = -49$

    $x = \pm\sqrt{-49}$

    $x = \pm 7i$
13. $x^2 = -100$

    $x = \pm\sqrt{-100}$

    $x = \pm 10i$
14. $x^2 = -36$

    $x = \pm\sqrt{-36}$

    $x = \pm 6i$
15. $x^2 = -12$

    $x = \pm\sqrt{(4)(3)(-1)}$

    $x = \pm 2i\sqrt{3}$

Challenge

1. $2i, -7i$
2. $-6i, -8i$
3. $9i, -12i$
4. $5i, 49i$
5. $-16i, -36i$
6. $-\frac{4}{3}i, -i$
7. $\frac{1}{5}i, 2i$
8. $-3i, -5i$
9. $-\frac{13}{4}i, 5i$
10. $\frac{5}{6}i, \frac{3}{2}i$

Problem Solving

1. a. $t = 1 \pm \frac{i}{2}$

   b. No; possible answer: the roots are imaginary numbers.

2. a.

b	Function	Roots
24	$d(t) = 16t^2 - 24t + 20$	$\frac{1}{4}\left(3 \pm i\sqrt{11}\right)$
32	$d(t) = 16t^2 - \_\_t + 20$	$1 \pm \frac{i}{2}$
40	$d(t) = 16t^2 - \_\_t + 20$	$\frac{1}{4}\left(5 \pm \sqrt{5}\right)$
48	$d(t) = 16t^2 - \_\_t + 20$	$\frac{3}{2} \pm \sqrt{1}$

   b. $b = 40$ and 48

   c. Possible answer: Real roots mean that ringing the bell is possible.

3. About 36 feet per second
4. C
5. D

Reading Strategies

1. $i\sqrt{9}$; $3i$; $\sqrt{-8}$
2. $3i$ or $-3i$
3. a. $x^2 = -1$, so $x = \pm\sqrt{-1}$, $x = i$ and $-i$

   b. Because the square of a real number cannot be a negative number

4. $\left(\sqrt{5}i\right)^2 = \left(\sqrt{5}\right)^2 (i)^2 = 5(-1) = -5; \left(-\sqrt{5}i\right)^2$
   $= \left(-\sqrt{5}\right)^2 (i)^2 = 5(-1) = -5$
5. Real number; $(3i)(5i) = 15i^2 = 15(-1)$
   $= -15$