Name Key Date

3.1 Practice B

In Exercises 1–6, solve the equation by graphing.

1. $x^2 - 1 = 0$
2. $6x^2 = 4x + 2$
3. $x^2 - 14 = -5x$
4. $9x - 9 = -4x^2$
5. $\frac{1}{2}x^2 - 2x = 6$
6. $-3x = \frac{1}{3}x^2 + 6$

In Exercises 7–9, solve the equation using square roots.

7. $(x-3)^2 = 121$
8. $3(x+1)^2 - 4 = 5$
9. $\frac{4}{3}x^2 = \frac{2}{3}x^2 + 6$

10. Write an equation of the form $(x - a)^2 + b = d$ that has (a) two integer solutions, (b) two irrational solutions, and (c) no real solutions.

In Exercises 11–14, solve the equation by factoring.

11. $0 = x^2 - 121$
12. $3k^2 + 2k = 2k^2 + 11k$
13. $-w^2 - 3w - 7 = -2w^2 + 3$
14. $2y^2 = 6y$

In Exercises 15 and 16, solve the equation using any method. Explain your reasoning.

15. $x^2 - x + \frac{6}{25} = 0$
16. $n^2 - 1.5 = 0.19$

In Exercises 17–20, find the zero(s) of the function.

17. $h(x) = x^2 + 7x - 18$
18. $j(x) = x^2 - 16$
19. $g(x) = x^2 - 13x$
20. $f(x) = 9x^2 - 24x + 16$

21. A local kayak rental shop rents 28 kayaks per week when it charges $25 per day. For each $5 increase in price, the shop loses four kayak rentals per week. How much should the kayak rental shop charge to maximize weekly revenue? What is the maximum weekly revenue?

22. You drop a coin into a fountain from a height of 15 feet. Write an equation that models the height h (in feet) of the coin above the fountain t seconds after it has been dropped. How long is the coin in the air?

$i = \sqrt{-1}$ $i^2 = -1$

Name Key Date

3.2 Practice A

In Exercises 1–3, find the square root of the number.

1. $\sqrt{-25}$ $5i$
2. $\sqrt{-81}$ $9i$
3. $\sqrt{-32}$ $4i\sqrt{2}$

In Exercises 4–7, find the values of x and y that satisfy the equation.

4. $5x + 3i = 15 + yi$ $x = 3$, $y = 3$
5. $-6x + 10i = 12 + 2yi$ $x = -2$, $y = 5$
6. $x + 2yi = 13 + 8i$ $x = 13$, $y = 4$
7. $3x + 50i = 18 - 5yi$ $x = 6$, $y = 10$

In Exercises 8–11, add or subtract. Write the answer in standard form.

8. $(3 + 2i) + (5 + 7i)$ $8 + 9i$
9. $(4 - 3i) + (9 + 2i)$ $13 - i$
10. $(6 + 5i) - (4 + 3i)$ $2 + 2i$
11. $(7 - 4i) - (10 - 3i)$ $-3 - i$

12. Write each expression as a complex number in standard form.

a. $\sqrt{-25} - \sqrt{-9} + \sqrt{-81}$ $5i - 3i + 9i = 11i$

b. $\sqrt{-27} + \sqrt{-49} - \sqrt{-64}$ $3i\sqrt{3} + 7i - 8i = -i + 3i\sqrt{3}$

In Exercises 13–16, multiply. Write the answer in standard form.

13. $5i(-4 + 2i)$ $-20i + 10i^2$ $-10 - 20i$
14. $3i(8 - 3i)$ $24i - 9i^2 = 9 + 24i$
15. $(2 - i)(3 + i)$ $6 - i - i^2$ $7 - i$
16. $(4 + 6i)(9 - 2i)$ $36 - 8i + 54i - 12i^2$ $48 + 46i$
17. Justify each step in performing the operation.

$14 + (5 - 3i) - 4i$

$[(14 + 5) - 3i] - 4i$	associative
$(19 - 3i) - 4i$	add.
$19 + (-3i - 4i)$	associative
$19 - 7i$	add.

In Exercises 18 and 19, find the zeros of the function.

18. $f(x) = 5x^2 + 15$ $\frac{5x^2}{5} = \frac{-15}{5}$ $\sqrt{x^2} = \sqrt{-3}$ $x = \pm i\sqrt{3}$
19. $g(x) = 3x^2 + 21$ $3x^2 = -21$ $x^2 = -7$ $x = \pm i\sqrt{7}$

In Exercises 20 and 21, solve the equation. Check your solution(s).

20. $x^2 + 36 = 0$ $\sqrt{x^2} = \sqrt{-36}$ $x = \pm 6i$
21. $x^2 + 6 = -14$ $\sqrt{x^2} = \sqrt{-20}$ $x = \pm 2i\sqrt{5}$

Name Key Date

3.3 Practice B

In Exercises 1–4, solve the equation using square roots. Check your solution(s).

1. $w^2 - 22w + 121 = 81$
2. $k^2 - 16k + 64 = -8$
3. $t^2 - 30t + 225 = -24$
4. $9p^2 + 6p + 1 = 12$

In Exercises 5–8, find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

5. $x^2 + 18x + c$
6. $x^2 + 7x + c$
7. $y^2 - 3y + c$ $\left(\frac{-3}{2}\right)^2 = \frac{9}{4} = c$ $(y - \frac{3}{2})^2$
8. $y^2 + 20y + c$

In Exercises 9–14, solve the equation by completing the square.

9. $q(q + 6) = 1$
10. $5h^2 - 5h - 15 = 0$
11. $3x^2 + 24x + 15 = 0$
12. $3y(y - 8) = -36$
13. $7t^2 - 18t = 14 + 10t$
14. $2s^2 + 4s = -6s + 3$

In Exercises 15–18, determine whether you would use factoring, square roots, or completing the square to solve the equation. Explain your reasoning. Then solve the equation.

15. $(x + 9)^2 = 49$
16. $3x^2 + 6x - 4 = 0$
17. $x^2 - 144 = 0$
18. $5x^2 - 45 = 0$ $5(x^2 - 9) = 0$ $5(x+3)(x-3) = 0$

In Exercises 19–22, write the quadratic function in vertex form. Then identify the vertex.

19. $f(x) = x^2 + 18x + 100$
20. $g(x) = x^2 - 2x - 26$
21. $h(x) = x^2 + 22x + 96$
22. $f(x) = x^2 - x + 2$

23. The height y (in feet) of a basketball t seconds after it is thrown can be modeled by the function $y = -16t^2 + 32t + 2$.

a. Find the maximum height of the basketball. A.O.S. $x = \frac{-32}{2(-16)} = 1$ $y = -16(1)^2 + 32(1) + 2 = 18$

b. The basketball is caught in its descent when it is 7 feet above the ground. How long is the basketball in the air?

$-16t^2 + 32t + 2 = 7$, $-16t^2 + 32t - 5 = 0$, $t = \frac{-32 \pm \sqrt{32^2 - (4 \cdot 16 \cdot -5)}}{2(-16)} = \frac{-32 \pm \sqrt{704}}{-32}$

$1.8 - .17 = 1.63$

(10) $h^2 - h - 3 = 0$, $h^2 - h + \frac{1}{4} = 3 + \frac{1}{4}$, $(h - \frac{1}{2})^2 = \frac{13}{4}$, $h = \frac{1 \pm \sqrt{13}}{2}$

(11) $x^2 + 8x = -5$, $x^2 + 8x + 16 = -5 + 16$, $(x+4)^2 = \sqrt{11}$, $x = -4 \pm \sqrt{11}$

C.T.S. (19) $x^2 + 18x + 81 = y + 100 + 81$, $(x+9)^2 = y + 19$, $y = (x+9)^2 + 19$, $V: (-9, 19)$

Name Key Date

3.4 Practice A

In Exercises 1–8, solve the equation using the Quadratic Formula. Use a graphing calculator to check your solution(s).

1. $x^2 + 9x + 4 = 0$
2. $2x^2 - 2x - 4 = 0$
3. $2x^2 + 12x + 18 = 0$
4. $-4x^2 = 3x - 1$ $4x^2+3x-1=0$
5. $-3x^2 + 5x = 4$ $3x^2-5x+4=0$ $25-4(3)(4)$ $25-48=-23$
6. $x^2 + 144 = 24x$
7. $-7x \cdot 2x^2 + 9$
8. $6x^2 = 4x - 9$ $6x^2-4x+9=0$ $16-4\cdot6\cdot9=-200$

① $x = \frac{-9 \pm \sqrt{81-(4\cdot1\cdot4)}}{2}$

$x = \frac{-9 \pm \sqrt{65}}{2}$

In Exercises 9–12, find the discriminant of the quadratic equation and describe the number and type of solutions of the equation.

9. $x^2 - 4x + 1 = 0$ b^2-4ac $(-4)^2-4(1)(1)=12$ 2 real, rational roots
10. $x^2 + 10x + 25 = 0$
11. $3t^2 - 3t + 18 = 0$
12. $-x^2 - 2x + 3 = 0$

④ $x = \frac{-3 \pm \sqrt{9-(4\cdot4\cdot-1)}}{8}$

$x = \frac{-3 \pm \sqrt{25}}{8} = \frac{-3 \pm 5}{8}$

13. What are the complex solutions of the equation $2x^2 - 32x + 178 = 0$?

A. $8 + 20i, 8 - 20i$ B. $8 + 5i, 8 - 5i$

C. $32 + 5i, 32 - 5i$ D. $32 + 20i, 32 - 20i$

In Exercises 14 and 15, find a possible pair of integer values for a and c so that the quadratic equation has the given solution(s). Then write the equation.

14. $ax^2 + 8x + c = 0$; one real solution $(-5)^2-4ac<0$ $25-4ac<0$ $25<4ac$ $\frac{25}{4}<\frac{4ac}{4}$ $6.25<ac$ $a=5$ $c=10$ $5x^2-5x+10=0$
15. $ax^2 - 5x + c = 0$; two imaginary solutions Neg. disc.

$\frac{-3+5}{8}=\frac{2}{8}=\frac{1}{4}$ $\frac{-3-5}{8}=\frac{-8}{8}=-1$

In Exercises 16 and 17, use the Quadratic Formula to write a quadratic equation that has the given solutions.

16. $x = \frac{9 \pm \sqrt{-79}}{8}$
17. $x = \frac{-11 \pm \sqrt{97}}{-6}$

In Exercises 18–21, solve the quadratic equation using the Quadratic Formula. Then solve the equation using another method. Which method do you prefer? Explain.

18. $9x^2 + 4 = 12x$
19. $4x^2 - 13x + 3 = 0$ $ac=12$ -12 $b=-13$ -1 $4x^2-12x-1x+3=0$ $4x(x-3)-1(x-3)=0$ $(4x-1)(x-3)=0$ $\frac{1}{4}$ 3
20. $x^2 - 12x + 9 = 0$
21. $x^2 - 4x = 12$

22. Suppose a quadratic equation has the form $x^2 + x + c = 0$. Show that the constant c must be less than $\frac{1}{4}$ in order for the equation to have two real solutions.