Name _____ Date _____ Class _____

LESSON 5-4

Practice B

Completing the Square

Solve each equation.

1. $2x^2 - 6 = 42$

2. $x^2 - 14x + 49 = 18$

Complete the square for each expression. Write the resulting expression as a binomial squared.

3. $x^2 - 4x + \_\_\_\_$

4. $x^2 + 12x + \_\_\_\_$

Solve each equation by completing the square.

5. $2d^2 = 8 + 10d$

6. $x^2 + 2x = 3$

7. $-3x^2 + 18x = -30$

8. $4x^2 = -12x + 4$

Write each function in vertex form, and identify its vertex.

9. $f(x) = x^2 - 6x - 2$

10. $f(x) = x^2 - 4x + 1$

11. $h(x) = 3x^2 - 6x - 15$

12. $f(x) = -2x^2 - 16x + 4$

Solve.

13. Nathan made a triangular pennant for the band booster club. The area of the pennant is 80 square feet. The base of the pennant is 12 feet shorter than the height.

a. What are the lengths of the base and height of the pennant?

b. What are the dimensions of the pennant if the base is only 6 feet shorter than the height?

LESSON 5-4

Practice A

Completing the Square

Solve each equation using square roots.

1. $(x + 1)^2 = 9$
   $x + 1 = \sqrt{9}$
   $x + 1 = \pm 3$, $x = -4$ or 2

2. $(x - 2)^2 = 16$
   $x - 2 = \sqrt{16}$
   $x - 2 = \pm 4$, $x = -2$ or 6

3. $(x + 3)^2 = 25$
   $x + 3 = \sqrt{25}$
   $x + 3 = \pm 5$, $x = -8$ or 2

To complete the square of $x^2 + bx$, add $\left(\frac{b}{2}\right)^2$ to the expression. Write the term needed to complete the square for each expression.

4. $x^2 + 4x$ — $\left(\frac{4}{2}\right)^2$
5. $x^2 + 2x$ — $\left(\frac{2}{2}\right)^2$
6. $x^2 - 8x$ — $\left(\frac{-8}{2}\right)^2$

Solve each equation by completing the square.

7. $x^2 + 10x = 20$
   a. Add $\left(\frac{b}{2}\right)^2$ to each side of the equation. $x^2 + 10x + \left(\frac{10}{2}\right)^2 = 20 + \left(\frac{10}{2}\right)^2$
   b. Simplify. $x^2 + 10x + 25 = 20 + 25$
   c. Factor the square. $(x + 5)(x + 5) = 45$
   d. Take square root of both sides. $x + 5 = \sqrt{45}$
   e. Solve for x. $x = -5 \pm 3\sqrt{5}$

8. $x^2 - 6x - 23 = 0$
   $x = 3 \pm 4\sqrt{2}$

9. $x^2 + 13 = -14x$
   $x = -13, -1$

Solve.

10. Ralph and Edie each solved the equation $(x - 7)^2 - 100 = 0$. Ralph says the correct answer is $x = 17$. Edie says the correct answer is $x = -3$. Who is correct? How do you know?

They are both correct. Possible answer: A quadratic can have two possible solutions; $x - 7 = \pm 10$, so $x = -3, 17$.

LESSON 5-4

Practice B

Completing the Square

Solve each equation.

1. $2x^2 - 6 = 42$
   $x = \pm 2\sqrt{6}$

2. $x^2 - 14x + 49 = 18$
   $x = 7 \pm 3\sqrt{2}$

Complete the square for each expression. Write the resulting expression as a binomial squared.

3. $x^2 - 4x + \underline{4}$
   $(x - 2)^2$

4. $x^2 + 12x + \underline{36}$
   $(x + 6)^2$

Solve each equation by completing the square.

5. $2d^2 = 8 + 10d$
   $d = \frac{5}{2} \pm \frac{\sqrt{41}}{2}$

6. $x^2 + 2x = 3$
   $x = -3, 1$

7. $-3x^2 + 18x = -30$
   $x = 3 \pm \sqrt{19}$

8. $4x^2 = -12x + 4$
   $x = -\frac{3}{2} \pm \frac{\sqrt{13}}{2}$

Write each function in vertex form, and identify its vertex.

9. $f(x) = x^2 - 6x - 2$
   $f(x) = (x - 3)^2 - 11$; $(3, -11)$

10. $f(x) = x^2 - 4x + 1$
    $g(x) = (x - 2)^2 - 3$; $(2, -3)$

11. $h(x) = 3x^2 - 6x - 15$
    $h(x) = 3(x - 1)^2 - 18$; $(1, -18)$

12. $f(x) = -2x^2 - 16x + 4$
    $f(x) = -2(x+4)^2 + 36$; $(-4, 36)$

Solve.

13. Nathan made a triangular pennant for the band booster club. The area of the pennant is 80 square feet. The base of the pennant is 12 feet shorter than the height.
    a. What are the lengths of the base and height of the pennant?
    Base = 8 ft, height = 20 ft
    b. What are the dimensions of the pennant if the base is only 6 feet shorter than the height?
    Base = 10 ft, height = 16 ft

LESSON 5-4

Practice C

Completing the Square

Complete the square for each expression. Write the resulting expression as a binomial squared.

1. $x^2 - 22x + \underline{121}$
   $(x - 11)^2$

2. $x^2 + 9x + \underline{\frac{81}{4}}$
   $\left(x + \frac{9}{2}\right)^2$

Solve each equation by completing the square.

3. $14x + x^2 = 24$
   $x = -7 \pm \sqrt{73}$

4. $2x^2 - 8x = -2$
   $x = 2 \pm \sqrt{3}$

5. $x^2 = 3x + 4$
   $x = -1, 4$

6. $4x^2 + 32x + 16 = 0$
   $x = -4 \pm 2\sqrt{3}$

Write each function in vertex form, and identify its vertex.

7. $f(x) = x^2 - 4x - 17$
   $f(x) = (x - 2)^2 - 21$, $(2, -21)$

8. $g(x) = x^2 - \frac{1}{2}x + 1$
   $g(x) = \left(x - \frac{1}{4}\right)^2 + \frac{15}{16}$; $\left(\frac{1}{4}, \frac{15}{16}\right)$

9. $h(x) = 3x^2 - 24x + 15$
   $h(x) = 3(x - 4)^2 - 33$; $(4, -33)$

10. $f(x) = -x^2 - 3x + 12$
    $f(x) = -\left(x + \frac{3}{2}\right)^2 + \frac{57}{4}$; $\left(-\frac{3}{2}, \frac{57}{4}\right)$

Solve.

11. Write a quadratic equation with the vertex $(3, 1)$ and $a = 1$ in standard form.
    $f(x) = x^2 - 6x + 10$

12. What is the y-intercept for the graph of the function $f(x) = 2(x + 2)^2 + 9$?
    y-intercept = 17

13. The value of a stock is given by $S(t) = t^2 - 6t + 13$, where t is the number of days after the purchase.
    a. Complete the square and write the function in vertex form.
    $S(t) = (t - 3)^2 + 4$
    b. What is the value of the stock at $t = 0$? At what other time will the stock have this same value?
    13; $t = 6$
    c. What is the vertex? What does the vertex represent in terms of the stock price?
    $(3, 4)$; the minimum price

LESSON 5-4

Reteach

Completing the Square

You can use the **square root property** to solve some quadratic equations.

Square Root Property	
To solve $x^2 = a$, take the square root of both sides of the equation.	$x^2 = a$ $\sqrt{x^2} = \pm\sqrt{a}$ $x = \pm\sqrt{a}$

Remember: $2^2 = 4$, and $(-2)^2 = 4$.

Solve $4x^2 - 5 = 43$.

$4x^2 = 48$	*Add 5 to both sides.*
$x^2 = 12$	*Divide both sides by 4.*
$\sqrt{x^2} = \pm\sqrt{12}$	*Take the square root of both sides.*
$x = \pm\sqrt{12}$	*Simplify.*
$x = \pm 2\sqrt{3}$	

The coefficient of x^2 should be 1 to use the square root property.

Think: $\sqrt{12} = \sqrt{4 \cdot 3} = \sqrt{4}\sqrt{3} = 2\sqrt{3}$

Solve $x^2 + 12x + 36 = 50$.

$(x + 6)^2 = 50$	*Factor the perfect square trinomial.*
$\sqrt{(x + 6)^2} = \pm\sqrt{50}$	*Take the square root of both sides.*
$x + 6 = \pm\sqrt{50}$	*Subtract 6 from both sides.*
$x = -6 \pm \sqrt{50}$	*Simplify.*
$x = -6 \pm 5\sqrt{2}$	

Think: $\sqrt{50} = \sqrt{25 \cdot 2} = \sqrt{25}\sqrt{2} = 5\sqrt{2}$

Solve each equation.

1. $3x^2 + 7 = 31$
   $3x^2 = \underline{24}$
   $x^2 = 8$
   $x = \pm 2\sqrt{2}$

2. $x^2 - 8x + 16 = 18$
   $(x - \underline{4})^2 = 18$
   $x - 4 = \pm\sqrt{18}$
   $x = 4 \pm 3\sqrt{2}$

3. $6x^2 - 4 = 38$
   $6x^2 = 42$
   $x^2 = 7$
   $x = \pm\sqrt{7}$

4. $x^2 - 2x + 1 = 10$
   $(x - 1)^2 = 10$
   $x - 1 = \pm\sqrt{10}$
   $x = 1 \pm \sqrt{10}$