LESSON 5.5

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan

2-day lesson (See *Pacing the Chapter*, TE pages 246C–246D) **For use with pages 281–290**

GOALS

1. **Solve quadratic equations by completing the square.**
2. **Use completing the square to write quadratic functions in vertex form.**

State/Local Objectives _____

_____

✓ Check the items you wish to use for this lesson.

STARTING OPTIONS

____ Homework Check: TE page 277; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 282 and 280, CRB page 65, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 283
____ Concept Activity: SE page 281; CRB page 66 (Activity Support Master)
____ Lesson Opener (Application): CRB page 67 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 68
____ Examples: Day 1: 1–3, SE pages 282-283; Day 2: 4–7, SE pages 284-285
____ Extra Examples: Day 1: TE page 283 or Transp.; Day 2: TE pages 284–285 or Transp.; Internet
____ Technology Activity: SE page 290
____ Closure Question: TE page 285
____ Guided Practice: SE page 286 Day 1: Exs. 1, 2, 4–15; Day 2: Exs. 3, 16–22

APPLY/HOMEWORK

Homework Assignment

____ Basic Day 1: 24–28 even, 32–40 even, 48–52 even, 56–60 even, 64–74 even; Day 2: 29, 31, 43, 45, 53, 61, 82–92 even, 96–98, 101–117 odd
____ Average Day 1: 24–28 even, 32–40 even, 48–52 even, 56–60 even, 64–74 even; Day 2: 29, 31, 43, 45, 53, 61, 82–96 even, 101–117 odd
____ Advanced Day 1: 24–72; Day 2: 74–84 even, 85–88, 89–95 odd, 96–100, 101–117 odd

Reteaching the Lesson

____ Practice Masters: CRB pages 69–71 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 72–73 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Real-Life): CRB page 75
____ Challenge: SE page 289; CRB page 76 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: Day 1: TE page 283 or Transp.; Day 2: TE pages 284–285 or Transp.
____ Daily Homework Quiz (5.5): TE page 289, CRB page 79, or Transparencies
____ Standardized Test Practice: SE page 289; TE page 289; STP Workbook; Transparencies

Notes _____

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LESSON 5.5

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan for Block Scheduling

1-day lesson (See *Pacing the Chapter*, TE pages 246C–246D) **For use with pages 281–290**

GOALS

1. **Solve quadratic equations by completing the square.**
2. **Use completing the square to write quadratic functions in vertex form.**

State/Local Objectives _____

_____

_____

CHAPTER PACING GUIDE	
Day	**Lesson**
1	5.1 (all)
2	5.2 (all)
3	5.3 (all); 5.4 (begin)
4	5.4 (end); **5.5 (begin)**
5	**5.5 (end)**; 5.6 (all)
6	5.7 (all); 5.8 (all)
7	Review/Assess Ch. 5

✓ Check the items you wish to use for this lesson.

STARTING OPTIONS

____ Homework Check: TE page 277; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 282 and 280, CRB page 65, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 283
____ Concept Activity: SE page 281; CRB page 66 (Activity Support Master)
____ Lesson Opener (Application): CRB page 67 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 68
____ Examples: Day 4: 1–3, SE pages 282-283; Day 5: 4–7, SE pages 284-285
____ Extra Examples: Day 4: TE page 283 or Transparencies; Day 5: TE pages 284–285 or Transparencies; Internet
____ Technology Activity: SE page 290
____ Closure Question: TE page 285
____ Guided Practice: SE page 286 Day 4: Exs. 1, 2, 4–15; Day 5: Exs. 3, 16–22

APPLY/HOMEWORK

Homework Assignment (See also the assignments for Lessons 5.4 and 5.6.)

____ Block Schedule: Day 4: 24–28 even, 32–40 even, 48–52 even, 56–60 even, 64–74 even; Day 5: 29, 31, 43, 45, 53, 61, 82–96 even, 101–117 odd

Reteaching the Lesson

____ Practice Masters: CRB pages 69–71 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 72–73 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Real-Life): CRB page 75
____ Challenge: SE page 289; CRB page 76 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: Day 4: TE page 283 or Transparencies; Day 5: TE pages 284–285 or Transparencies
____ Daily Homework Quiz (5.5): TE page 289, CRB page 79, or Transparencies
____ Standardized Test Practice: SE page 289; TE page 289; STP Workbook; Transparencies

Notes _____

_____

LESSON 5.5

NAME _____ DATE _____

Available as a transparency

WARM-UP EXERCISES

For use before Lesson 5.5, pages 281–290

Solve the equation.

1. $(x - 2)^2 = 16$
2. $3(x + 5)^2 = 24$
3. $11(x - 7)^2 - 3 = 19$

DAILY HOMEWORK QUIZ

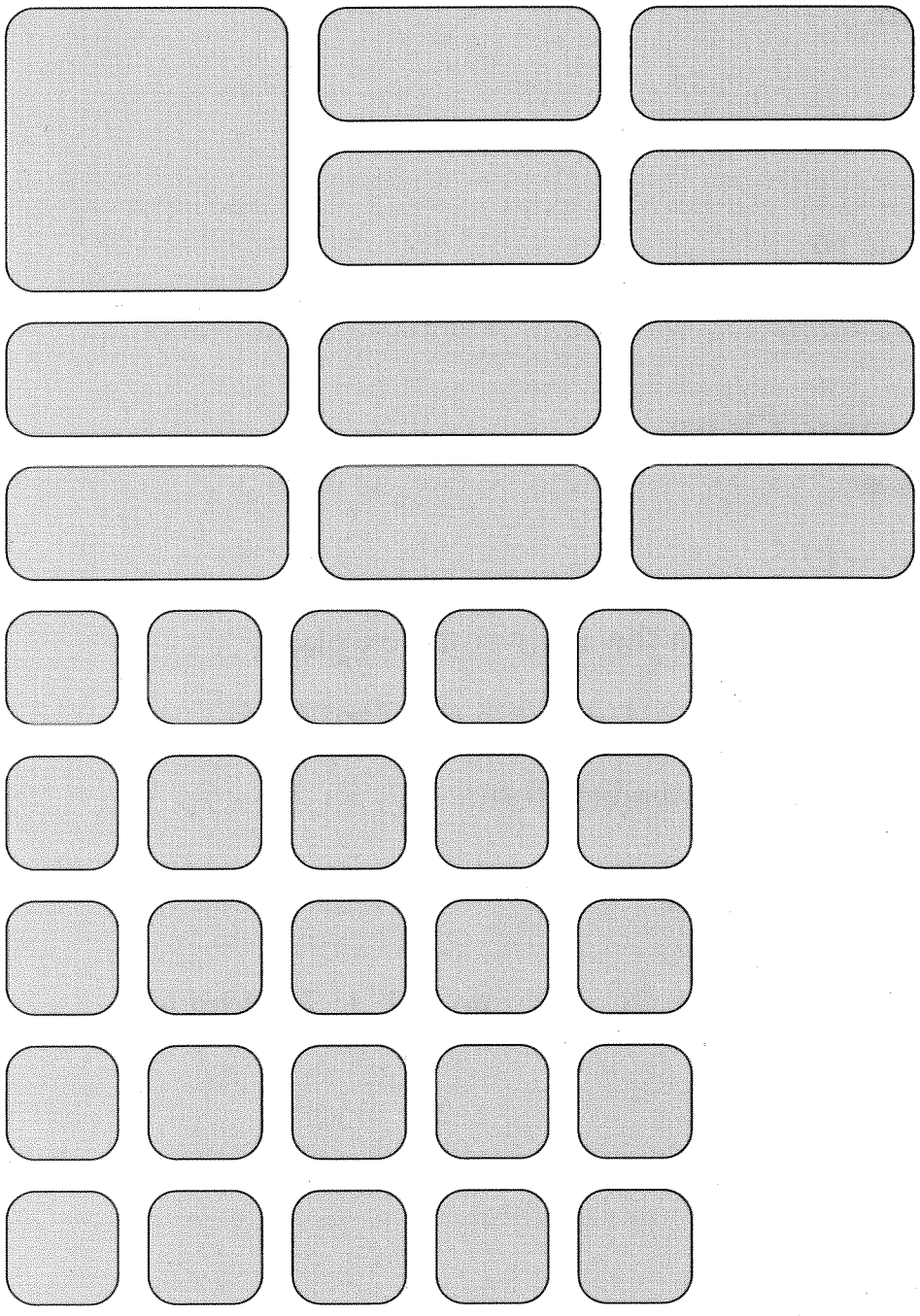
For use after Lesson 5.4, pages 272–280

1. Solve $4x^2 + 9 = -17$.
2. Plot $3 - 2i$, $-1 + i$, and $3i$ in the same complex plane.
3. Write $(8 - i) - (3 + 2i) + (-4 + 6i)$ in standard form.
4. Write $(2 - 3i)(-1 + 4i)$ in standard form.
5. Write $\dfrac{3 + 2i}{2 + i}$ in standard form.
6. Find the absolute value of $4 + 2i$, $-8i$, and $-3 + 7i$. Which is farthest from the origin?

NAME _____ DATE _____

Activity Support Master

For use with page 281



LESSON 5.5

NAME _____ DATE _____

Available as a transparency

Application Lesson Opener

For use with pages 282–289

Eliza wants to plant a rectangular garden. The length of the garden is to be 6 feet longer than the width, and the area is to be 35 square feet. To find the width x, she has written the equation $x(x + 6) = 35$.

1. Write the equation in standard form.
2. Try to solve the equation by factoring. Do you think the equation can be solved by factoring? Explain.
3. Try to solve the equation by using the square root method. Do you think the equation can be solved by using the square root method? Explain.
4. Simplify the expression $(x + 3)^2 - 44$. How does this expression relate to Eliza's situation?
5. Use the expression $(x + 3)^2 - 44$ and a calculator to find the width of Eliza's garden. Round to the nearest hundredth of a foot.
6. In this lesson, you will learn how to change a quadratic expression in the form $ax^2 + bx + c$ into the form $a\left(x + \frac{b}{2}\right)^2 + k$. Explain why this method is useful.

NAME _____ DATE _____

Graphing Calculator Activity Keystrokes

For use with page 290

TI-82

Enter the function.

Y= (-) X,T,θ x^2 − 7 X,T,θ − 6

Set the viewing window and graph.

ZOOM 6

Find maximum.

2nd [CALC] 4

Use the cursor keys, ◀ and ▶, to move the trace cursor to select the lower bound at $x \approx -5$. Press ENTER. Move the trace cursor to select the upper bound at $x \approx -2$. Press ENTER. Move the trace cursor to select the guess at $x \approx -3.5$.

Press ENTER.

TI-83

Enter the function.

Y= (-) X,T,θ,n x^2 − 7 X,T,θ,n − 6

Set the viewing window and graph.

ZOOM 6

Find maximum.

2nd [CALC] 4

Use the key pad to select the lower bound at $x \approx -5$. (-) 5 ENTER.

Use the keypad to select the upper bound at $x \approx -2$. (-) 2 ENTER.

Use the keypad to select the guess at $x \approx -3.5$.

(-) 3.5 ENTER.

SHARP EL-9600c

Enter the function.

Y= (-) X/θ/T/n x^2 − 7 X/θ/T/n − 6

Set the viewing window and graph:

ZOOM [A] 5

Find maximum:

2ndF [Calc] 4

CASIO CFX-9850GA PLUS

From the main menu, choose GRAPH.

Enter the function.

(-) X,θ,T x^2 − 7 X,θ,T − 6 EXE

Set the viewing window and graph.

SHIFT F3 F3 EXIT F6

Find the maximum.

SHIFT F5 F2

LESSON 5.5

NAME _____ DATE _____

Practice A

For use with pages 282–289

Write the expression as the square of a binomial.

1. $x^2 + 2x + 1$
2. $x^2 - 4x + 4$
3. $x^2 - 16x + 64$
4. $x^2 + 3x + \frac{9}{4}$
5. $x^2 - x + \frac{1}{4}$
6. $x^2 + 5x + \frac{25}{4}$

Find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

7. $x^2 + 6x + c$
8. $x^2 - 14x + c$
9. $x^2 + 8x + c$
10. $x^2 - x + c$
11. $x^2 - 22x + c$
12. $x^2 + 12x + c$
13. $x^2 - 20x + c$
14. $x^2 + 3x + c$
15. $x^2 + 7x + c$

Solve the equation by completing the square.

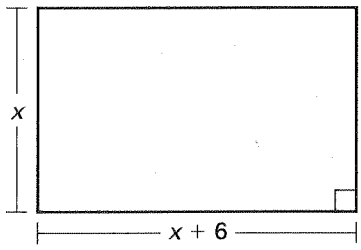
16. $x^2 - 2x - 2 = 0$
17. $x^2 - 4x - 1 = 0$
18. $x^2 - 6x + 2 = 0$
19. $x^2 + 12x + 3 = 0$
20. $x^2 + 2x - 2 = 0$
21. $x^2 + 8x - 1 = 0$
22. $x^2 - 16x + 15 = 0$
23. $x^2 + x - 2 = 0$
24. $x^2 - x - 1 = 0$

Write the quadratic function in vertex form and identify the vertex.

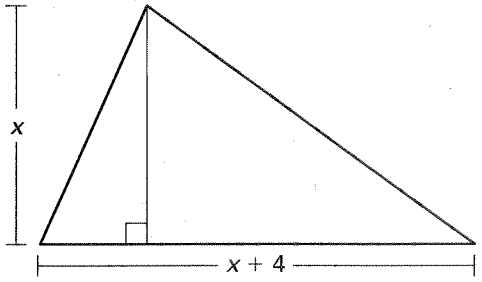
25. $y = x^2 + 8x + 5$
26. $y = x^2 - 10x + 7$
27. $y = x^2 + 2x - 3$

Find the dimensions of the figure. Round your answer to the nearest thousandth.

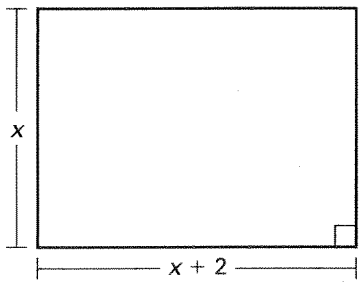
28. Area of rectangle = 178 square feet



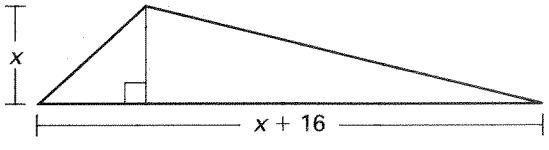
29. Area of triangle = 21 square feet



30. Area of rectangle = 48 square feet



31. Area of triangle = 36 square feet



NAME _____ DATE _____

Practice B

For use with pages 282–289

Write the expression as the square of a binomial.

1. $x^2 + 8x + 16$
2. $x^2 - 10x + 25$
3. $x^2 - \frac{1}{2}x + \frac{1}{16}$
4. $4x^2 + 12x + 9$
5. $9x^2 - 6x + 1$
6. $9x^2 - \frac{3}{2}x + \frac{1}{16}$

Find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

7. $x^2 + 24x + c$
8. $x^2 - 30x + c$
9. $x^2 + 5x + c$
10. $x^2 - 9x + c$
11. $4x^2 + 8x + c$
12. $9x^2 + 6x + c$

Solve the equation by completing the square.

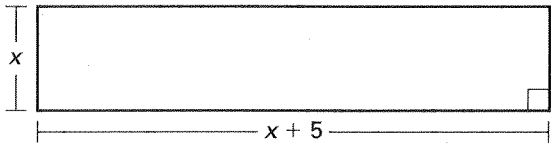
13. $x^2 + 6x - 7 = 0$
14. $x^2 - 14x + 1 = 0$
15. $x^2 - 3x - 4 = 0$
16. $x^2 + 9x + 6 = 0$
17. $2x^2 - 2x - 4 = 0$
18. $3x^2 + 9x - 12 = 0$
19. $2x^2 - 4x - 10 = 0$
20. $-5x^2 + 10x + 20 = 0$
21. $4x^2 - 4x - 2 = 0$
22. $3x^2 - 12x + 1 = 0$
23. $-2x^2 + 8x + 10 = 0$
24. $-x^2 - 4x + 3 = 0$

Write the quadratic function in vertex form and identify the vertex.

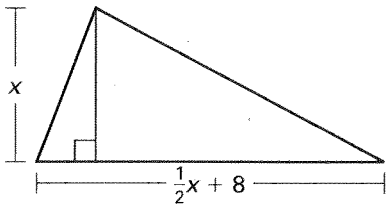
25. $y = x^2 - 8x + 11$
26. $y = 2x^2 + 4x - 7$
27. $y = -3x^2 + 6x - 8$

Find the dimensions of the figure. Round your answer to the nearest thousandth.

28. Area of rectangle = 8 square feet

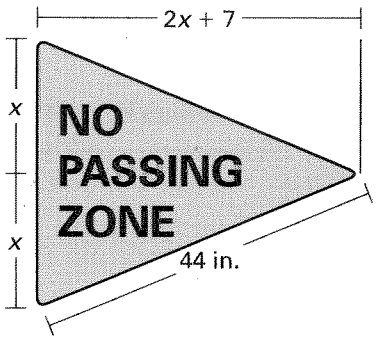


29. Area of triangle = 23 square feet



No Passing Zone A "No Passing Zone" sign has the shape of an isosceles triangle. The width of the sign is 7 inches greater than its height. The top and bottom edges of the sign are 44 inches.

30. Use the Pythagorean theorem to write an equation that relates x, $2x + 7$, and 44.
31. Solve the equation in Exercise 30 by completing the square. (*Hint*: Use decimal representations and a calculator to simplify your work.)
32. What is the height of the sign?



LESSON 5.5

NAME _____ DATE _____

Practice C

For use with pages 282–289

Write the expression as the square of a binomial.

1. $x^2 + \frac{2}{3}x + \frac{1}{9}$
2. $4x^2 + 20x + 25$
3. $4x^2 - \frac{4}{5}x + \frac{1}{25}$
4. $9x^2 + 3x + \frac{1}{4}$
5. $x^2 + 1.6x + 0.64$
6. $0.09x^2 - 2.4x + 0.16$

Solve the equation by completing the square.

7. $x^2 + 8x - 3 = 0$
8. $x^2 - 10x + 6 = 0$
9. $x^2 - 5x + 1 = 0$
10. $x^2 + 7x - 4 = 0$
11. $2x^2 + 5x - 3 = x^2 + 5$
12. $4x^2 + 2x + 1 = 3x^2 + 4x + 5$
13. $2x^2 + 8x - 10 = 0$
14. $3x^2 + 9x - 4 = 5$
15. $5x^2 + 2x + 3 = 10 - 8x$
16. $x^2 + 3x - 6 = 0$
17. $2x^2 + 6x + 4 = 0$
18. $2x^2 + 10x = -17$
19. $3x^2 + 4x + 2 = x^2 + 6x$
20. $x^2 + 3x + 7 = 8x + 2$
21. $3x^2 + 2x + 1 = x^2 - 6x - 3$

Write the quadratic function in vertex form and identify the vertex.

22. $y = x^2 - 16x + 2$
23. $y = 2x^2 + 12x - 5$
24. $y = 3x^2 - 15x + 1$
25. $y = 2x^2 + 3x + 1$
26. $y = -x^2 + 4x - 1$
27. $y = -4x^2 - 2x - 3$

28. ***Biology*** The impala is the most powerful jumper of the antelope family. When an impala jumps, its path through the air can be modeled by $y = -0.0444x^2 + 1.3333x$ where x is the impala's horizontal distance traveled (in feet) and y is its corresponding height (in feet). How high can an impala jump? How far can it jump?

29. ***Falling Object*** An object is propelled upward from the top of a 500-foot building. The path that the object takes as it falls to the ground can be modeled by $y = -16t^2 + 100t + 500$ where t is time (in seconds) and y is the corresponding height (in feet) of the object. The velocity of the object can be modeled by $v = -32t + 100$ where t is time (in seconds) and v is the corresponding velocity of the object. With what velocity does the object hit the ground?

LESSON 5.5

NAME _____ DATE _____

Reteaching with Practice

For use with pages 282–289

GOAL **Solve quadratic equations by completing the square, and use completing the square to write quadratic functions in vertex form**

VOCABULARY

Completing the square is the process of rewriting an expression of the form $x^2 + bx$ as the square of the binomial. To complete the square for $x^2 + bx$, you need to add $\left(\frac{b}{2}\right)^2$. This leads to the rule

$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$.

EXAMPLE 1 Completing the Square

Find the value of c that makes $x^2 + 1.6x + c$ a perfect square trinomial. Then write the expression as the square of a binomial.

SOLUTION

Use the form $x^2 + bx + \left(\frac{b}{2}\right)^2$ and that $b = 1.6$.

$$c = \left(\frac{b}{2}\right)^2 = \left(\frac{1.6}{2}\right)^2 = (0.8)^2 = 0.64$$

$x^2 + 1.6x + c = x^2 + 1.6x + 0.64$ Perfect square trinomial

$= (x + 0.8)^2$ Square of a binomial: $\left(x + \frac{b}{2}\right)^2$

Exercises for Example 1

Find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

1. $x^2 + 6x + c$ **2.** $x^2 - 12x + c$ **3.** $x^2 + 2x + c$

EXAMPLE 2 Solving a Quadratic Equation if the Coefficient of x^2 is 1

Solve $x^2 - 2x - 2 = 0$ by completing the square.

SOLUTION

$x^2 - 2x - 2 = 0$	Write original equation.
$x^2 - 2x = 2$	To isolate the terms containing x, add 2 to each side.
$x^2 - 2x + (-1)^2 = 2 + 1$	Add $\left(\frac{-2}{2}\right)^2 = (-1)^2 = 1$ to each side.
$(x - 1)^2 = 3$	Write the left side as a binomial squared.
$x - 1 = \pm\sqrt{3}$	Take sqare roots of each side.
$x = 1 \pm \sqrt{3}$	To solve for x, add 1 to each side.

The solutions are $1 + \sqrt{3}$ and $1 - \sqrt{3}$.

NAME _____ DATE _____

Reteaching with Practice

For use with pages 282–289

Exercises for Example 2

Solve the equation by completing the square.

4. $x^2 - x = 1$ **5.** $x^2 + 6x + 5 = 0$ **6.** $x^2 = 4x - 13$

EXAMPLE 3 Solving a Quadratic Equation if the Coefficient of x^2 is Not 1

Solve $4x^2 - 6x + 1 = 0$ by completing the square.

SOLUTION

$4x^2 - 6x + 1 = 0$	Write original equation.
$x^2 - \frac{3}{2}x + \frac{1}{4} = 0$	Divide by 4 to make the coefficient of x^2 be 1.
$x^2 - \frac{3}{2}x = -\frac{1}{4}$	Write the left side in the form $x^2 + bx$.
$x^2 - \frac{3}{2}x + \left(-\frac{3}{4}\right)^2 = -\frac{1}{4} + \frac{9}{16}$	Add $\left(\frac{-3}{4}\right)^2 = \frac{9}{16}$ to each side.
$\left(x - \frac{3}{4}\right)^2 = \frac{5}{16}$	Write the left side as the square of a binomial.
$x - \frac{3}{4} = \pm\frac{\sqrt{5}}{4}$	Take square roots of each side.
$x = \frac{3}{4} \pm \frac{\sqrt{5}}{4}$	To solve for x, add $\frac{3}{4}$ to each side.

The solutions are $\frac{3}{4} + \frac{\sqrt{5}}{4}$ and $\frac{3}{4} - \frac{\sqrt{5}}{4}$.

Exercises for Example 3

Solve the equation by completing the square.

7. $4x^2 + 24x - 8 = 0$ **8.** $3x^2 + 12x - 9 = 0$

EXAMPLE 4 Writing a Quadratic Function in Vertex Form

Write $y = -2x^2 - 4x - 7$ in vertex form.

SOLUTION

$y = -2x^2 - 4x - 7$	Write original function.
$y + \underline{?} = -2(x^2 - 2x + \underline{?}) - 7$	Prepare to complete the square for $x^2 - 2x$.
$y - 2 = -2(x^2 - 2x + 1) - 7$	Add $-2\left(\frac{-2}{2}\right)^2 = -2$ to each side.
$y - 2 = -2(x - 1)^2 - 7$	Write $x^2 - 2x + 1$ as a binomial squared.
$y = -2(x - 1)^2 - 5$	Solve for y.

The vertex form is $y = -2(x - 1)^2 - 5$. The vertex is $(1, -5)$.

Exercises for Example 4

Write the function in vertex form.

9. $y = x^2 + 8x + 2$ **10.** $y = x^2 - 4x + 10$ **11.** $y = x^2 - 2x - 5$

LESSON 5.5

NAME _____ DATE _____

Quick Catch-Up for Absent Students

For use with pages 281–290

The items checked below were covered in class on (date missed) _____

Activity 5.5: Using Algebra Tiles to Complete the Square (p. 281)

____ **Goal:** Given b, find the value of c that makes $x^2 + bx + c$ a perfect square trinomial.

Lesson 5.5: Completing the Square

____ **Goal 1:** Solve quadratic equations by completing the square. (pp. 282–284)

Material Covered:

____ Example 1: Completing the Square

____ Student Help: Study Tip

____ Example 2: Solving a Quadratic Equation if the Coefficient of x^2 Is 1

____ Example 3: Solving a Quadratic Equation if the Coefficient of x^2 Is Not 1

____ Example 4: Using a Quadratic Equation to Model Distance

____ Example 5: Using a Quadratic Equation to Model Area

Vocabulary:

completing the square, p. 282

____ **Goal 2:** Use completing the square to write quadratic functions in vertex form. (p. 285)

Material Covered:

____ Example 6: Writing a Quadratic Function in Vertex Form

____ Example 7: Finding the Maximum Value of a Quadratic Function

Activity 5.5: Finding Maximums and Minimums (p. 290)

____ **Goal:** Find maximum and minimum values of quadratic functions using a graphing calculator.

____ Student Help: Keystroke Help

____ Student Help: Study Tip

____ Other (specify) _____

_____

Homework and Additional Learning Support

____ Textbook (specify) pp. 286–289

_____

____ Internet: Extra Examples at www.mcdougallittell.com

____ *Reteaching with Practice* worksheet (specify exercises) _____

____ *Personal Student Tutor* for Lesson 5.5

LESSON 5.5

NAME _____ DATE _____

Real-Life Application: When Will I Ever Use This:

For use with pages 282–289

Television

Early in the 1800s, experiments were being performed which eventually led to the invention of television. Philo T. Farnsworth is credited with developing the world's first all-electric system of television in 1927. As new advances in technology were made, changes and improvements were added to the television. Television screens became larger and the picture became clearer. In 1954, color television was introduced. Since then, the cost of owning a television has decreased, making it one of the most common household items. In the 1970s, projection television systems were introduced with screens as large as 7 feet (diagonally).

Because the industry has made all possible technological advances regarding size, new developments are now being made in the picture quality. The Federal Communications Commission (FCC) has ordered that digital television (or HDTV) must be available to every home in the United States by 2002. The FCC's goal is to eliminate analog television transmission by the broadcasting stations by 2006. This means that the 250 million televisions in the United States will have to be replaced with a digital television system.

1. Find the dimensions of a television screen that has a 20-inch diagonal. The height of the screen is 2 inches less than the width.
2. You want to buy an oversized television. The model you are looking at has a 56-inch diagonal. The screen is 10 inches wider than it is high. Find the dimensions of the screen.
3. You are constructing a TV stand for your 28-inch TV. You want the stand to enclose the TV and have 2 more inches on both sides and top of the TV. The height of the TV is 2 inches less than the width. Find the dimensions of the stand.

LESSON 5.5

NAME _____ DATE _____

Challenge: Skills and Applications

For use with pages 282–289

1. Use completing the square to show that the solutions of the quadratic equation $x^2 + bx + c = 0$ are given by

$$x = -\frac{b}{2} \pm \frac{\sqrt{b^2 - 4c}}{2}.$$

2. In this problem, you will factor the expression $x^4 + 64$.

   a. Rewrite $x^4 + 64$ in the form $x^4 + rx^2 + 64 - rx^2$, so that the first 3 terms form a perfect-square trinomial.

   b. Factor the expression you found in part (a) as a difference of two squares. Factor the result into two factors, whose product therefore equals $x^4 + 64$.

3. Given a complex number $a + bi$, how can you find a square root of $a + bi$? That is, how can you find a complex number $p + qi$ such that $(p + qi)^2 = a + bi$?

   a. To answer this question let $a + bi = 3 + 4i$. By squaring $p + qi$, and equating the real and imaginary parts of the result with the real and imaginary parts of $3 + 4i$, find two equations that must be satisfied by $p + qi$.

   b. Solve the second equation you found in part (a) for q and substitute the expression you get into the first equation, to get a single equation with p as the only variable.

   c. Simplify the equation you found in part (b) to get a quadratic equation *in the variable* p^2.

   d. Factor the equation completely to find the possible *real* values of p.

   e. List two possible pairs (p, q) such that $(p + qi)^2 = a + bi$.

4. In this problem, you will investigate the effect on the graph of $y = ax^2 + bx + c$ that is achieved by increasing b.

   a. Suppose b is replaced by $(b + r)$ in the equation above. By factoring out a from all three terms, express the equation in the form

$$y = a\left(x^2 + kx + \frac{c}{a}\right).$$

   b. By completing the square, express the equation in vertex form.

   c. What are the coordinates of the vertex of the new graph, in terms of a, b, c, and r?

LESSON 5.6

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan

1-day lesson (See *Pacing the Chapter*, TE pages 246C–246D) **For use with pages 291–298**

GOALS

1. **Solve quadratic equations using the quadratic formula.**
2. **Use the quadratic formula in real-life situations.**

State/Local Objectives _____

_____

✓ Check the items you wish to use for this lesson.

STARTING OPTIONS

____ Homework Check: TE page 286; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 291 and 289, CRB page 79, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 292
____ Lesson Opener (Visual Approach): CRB page 80 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB pages 81–82
____ Examples 1–5: SE pages 291–294
____ Extra Examples: TE pages 292–294 or Transparencies; Internet
____ Closure Question: TE page 294
____ Guided Practice Exercises: SE page 295

APPLY/HOMEWORK

Homework Assignment

____ Basic 18–40 even, 46–60 even, 65–68, 75, 77, 81–83, 85–101 odd; Quiz 2: 1–22
____ Average 18–40 even, 46–64 even, 65–69, 75–79 odd, 81–83, 85–101 odd; Quiz 2: 1–22
____ Advanced 18–40 even, 46–64 even, 65–69, 74, 75–79 odd, 81–84, 85–101 odd; Quiz 2: 1–22

Reteaching the Lesson

____ Practice Masters: CRB pages 83–85 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 86–87 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Interdisciplinary): CRB page 89
____ Challenge: SE page 297; CRB page 90 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 292–294 or Transparencies
____ Daily Homework Quiz (5.6): TE page 297, CRB page 94, or Transparencies
____ Standardized Test Practice: SE page 297; TE page 297; STP Workbook; Transparencies
____ Quiz (5.4–5.6): SE page 298; CRB page 91

Notes _____

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LESSON 5.6

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan for Block Scheduling

Half-day lesson (See *Pacing the Chapter*, TE pages 246C–246D) **For use with pages 291–298**

GOALS

1. **Solve quadratic equations using the quadratic formula.**
2. **Use the quadratic formula in real-life situations.**

State/Local Objectives _____

_____

_____

CHAPTER PACING GUIDE	
Day	**Lesson**
1	5.1 (all)
2	5.2 (all)
3	5.3 (all); 5.4 (begin)
4	5.4 (end); 5.5 (begin)
5	5.5 (end); **5.6 (all)**
6	5.7 (all); 5.8 (all)
7	Review/Assess Ch. 5

✓ Check the items you wish to use for this lesson.

STARTING OPTIONS

____ Homework Check: TE page 286; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 291 and 289, CRB page 79, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 292
____ Lesson Opener (Visual Approach): CRB page 80 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB pages 81–82
____ Examples 1–5: SE pages 291–294
____ Extra Examples: TE pages 292–294 or Transparencies; Internet
____ Closure Question: TE page 294
____ Guided Practice Exercises: SE page 295

APPLY/HOMEWORK

Homework Assignment (See also the assignment for Lesson 5.5.)

____ Block Schedule: 18–40 even, 46–64 even, 65–69, 75–79 odd, 81–83, 85–101 odd; Quiz 2: 1–22

Reteaching the Lesson

____ Practice Masters: CRB pages 83–85 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 86–87 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Interdisciplinary): CRB page 89
____ Challenge: SE page 297; CRB page 90 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 292–294 or Transparencies
____ Daily Homework Quiz (5.6): TE page 297, CRB page 94, or Transparencies
____ Standardized Test Practice: SE page 297; TE page 297; STP Workbook; Transparencies
____ Quiz (5.4–5.6): SE page 298; CRB page 91

Notes _____

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LESSON 5.6

NAME _____ DATE _____

Available as a transparency

WARM-UP EXERCISES

For use before Lesson 5.6, pages 291–298

Evaluate the expression $b^2 - 4ac$ for the given values of a, b, and c.

1. $a = 1, b = 3, c = -1$
2. $a = 2, b = -2, c = 0$
3. $a = -1, b = 0, c = 5$
4. $a = -2, b = 2, c = -3$

DAILY HOMEWORK QUIZ

For use after Lesson 5.5, pages 281–290

1. Find the value of c that makes $x^2 - 8x + c$ a perfect square trinomial. Then write the expression as the square of a binomial.
2. Solve $x^2 - 12x + 4 = 0$ by completing the square.
3. Solve $2x^2 + 8x - 1 = 0$.
4. Write $y = x^2 - 4x + 4$ in vertex form. What is the vertex of the function's graph?

LESSON 5.6

NAME _____ DATE _____

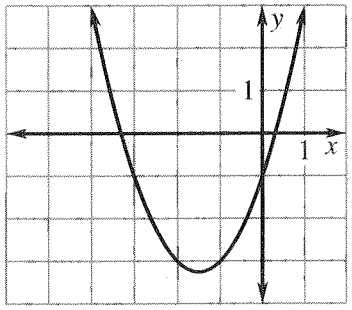
Available as a transparency

Visual Approach Lesson Opener

For use with pages 291–298

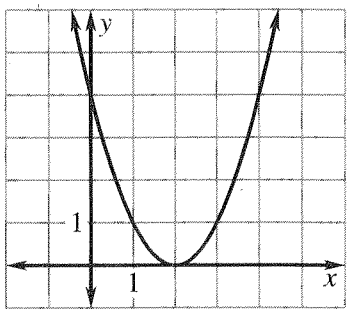
For each equation, compute $b^2 - 4ac$. Then use the graph to determine the number of solutions.

1. $x^2 + 3x - 1 = 0$



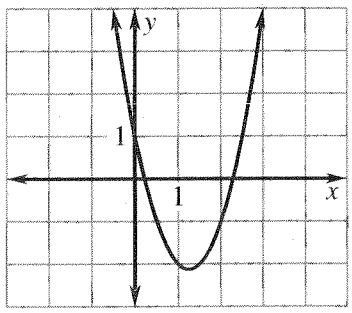
$y = x^2 + 3x - 1$

2. $x^2 - 4x + 4 = 0$



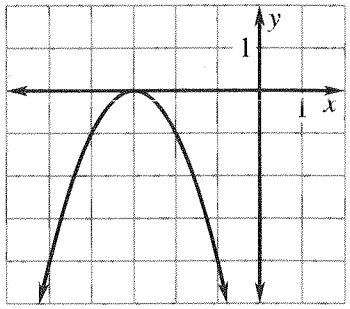
$y = x^2 - 4x + 4$

3. $2x^2 - 5x + 1 = 0$



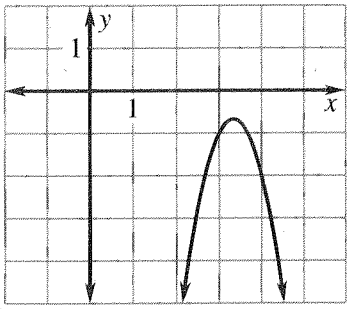
$y = 2x^2 - 5x + 1$

4. $-x^2 - 6x - 9 = 0$



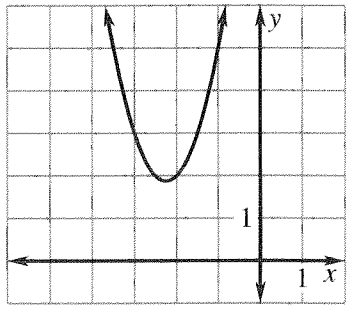
$y = -x^2 - 6x - 9$

5. $-3x^2 + 20x - 34 = 0$



$y = -3x^2 + 20x - 34$

6. $2x^2 + 9x + 12 = 0$



$y = 2x^2 + 9x + 12$

7. What do you notice about the relationship between the sign of $b^2 - 4ac$ and the number of solutions?

LESSON 5.6

NAME _____ DATE _____

Graphing Calculator Activity

For use with pages 291-298

GOAL **To determine the number of real solutions of a quadratic equation**

For the quadratic equation $ax^2 + bx + c = 0$, you can predict the equation's number of real solutions by finding the value of $b^2 - 4ac$.

Activity

1. For the following equations, calculate $b^2 - 4ac$.
   $2x^2 + x + 1 = 0$
   $2x^2 - 6x + 3 = 0$
   $x^2 + 4x + 4 = 0$
2. Use a graphing calculator to graph the three equations in Step 1.
3. Each x-intercept on the graph is a real solution of the related equation. Using your results from Step 1, make a conjecture as to the number of real solutions of an equation $ax^2 + bx + c = 0$ if
   a. $b^2 - 4ac$ is zero. **b.** $b^2 - 4ac$ is positive. **c.** $b^2 - 4ac$ is negative.

Exercises

1. By calculating $b^2 - 4ac$, predict the number of real solutions of the following equations.
   a. $x^2 - 5x - 14 = 0$ **b.** $x^2 - 2x - 4 = 0$
   c. $7x^2 + 2x + 9 = 0$ **d.** $3x^2 + 6x + 3 = 0$
2. Check your answer to Exercise 1 with a graphing calculator.
3. By calculating $b^2 - 4ac$, predict the number of real solutions of the following equations.
   a. $x^2 - 3x = 15$ **b.** $x^2 = 6x + 9$
   c. $5x^2 = -2x - 7$ **d.** $6x^2 = -5x - 1$
4. Check your answer to Exercise 3 with a graphing calculator.

NAME _____ DATE _____

Graphing Calculator Activity

For use with pages 291–298

TI-82

Step 1

In the first equation, $a = 2$, $b = 1$, and $c = 1$.

1 x^2 − (4 × 2 × 1) ENTER

In the second equation, $a = 2$, $b = -6$, and $c = 3$.

((-) 6) x^2 − (4 × 2 ×

3) ENTER

In the third equation, $a = 1$, $b = 4$, and $c = 4$.

Step 2

Y= 2 X,T,θ x^2 + X,T,θ + 1 ENTER

Y= 2 X,T,θ x^2 − 6 X,T,θ + 3 ENTER

Y= X,T,θ x^2 + 4 X,T,θ + 4 ENTER

ZOOM 6

TI-83

Step 1

In the first equation, $a = 2$, $b = 1$, and $c = 1$.

1 x^2 − (4 × 2 × 1) ENTER

In the second equation, $a = 2$, $b = -6$, and $c = 3$.

((-) 6) x^2 − (4 × 2 × 3

) ENTER

In the third equation, $a = 1$, $b = 4$, and $c = 4$.

4 x^2 − (4 × 1 × 4) ENTER

Step 2

Y= 2 X,T,θ,n x^2 + X,T,θ,n + 1 ENTER

Y= 2 X,T,θ,n x^2 − 6 X,T,θ,n + 3 ENTER

Y= X,T,θ,n x^2 + 4 X,T,θ,n + 4 ENTER

ZOOM 6

SHARP EL-9600c

Step 1

In the first equation, $a = 2$, $b = 1$, and $c = 1$.

1 x^2 − (4 × 2 × 1) ENTER

In the second equation, $a = 2$, $b = -6$, and $c = 3$.

((-) 6) x^2 − (4 × 2 ×

3) ENTER

In the third equation, $a = 1$, $b = 4$, and $c = 4$.

4 x^2 − (4 × 1 × 4) ENTER

Step 2

Y= 2 X/θ/T/n x^2 + X/θ/T/n + 1 ENTER

Y= 2 X/θ/T/n x^2 − 6 X/θ/T/n + 3 ENTER

Y= X/θ/T/n x^2 + 4 X/θ/T/n + 4 ENTER

ENTER ZOOM [A] 5

CASIO CFX-9850GA PLUS

Step 1

From the main menu, choose RUN.

In the first equation, $a = 2$, $b = 1$, and $c = 1$.

1 x^2 − (4 × 2 × 1) EXE

In the second equation, $a = 2$, $b = -6$, and $c = 3$.

((-) 6) x^2 − (4 × 2 × 3

) EXE

In the third equation, $a = 1$, $b = 4$, and $c = 4$.

4 x^2 − (4 × 1 × 4) EXE

Step 2

From the main menu, choose GRAPH.

2 X,T,θ x^2 + X,T,θ + 1 EXE

2 X,T,θ x^2 − 6 X,T,θ + 3 EXE

X,T,θ x^2 + 4 X,T,θ + 4 EXE

SHIFT F3 F3 EXIT F6

LESSON 5.6

NAME _____ DATE _____

Practice A

For use with pages 291–298

Write the equation in standard form. Identify *a*, *b*, and *c*.

1. $3x^2 - 4x + 3 = 0$
2. $x^2 = 3x - 2$
3. $3x = 4 - 3x^2$
4. $3x^2 + 5 = x^2 - 4x$
5. $2 - x = 8x - x^2$
6. $-5x^2 + 2 = x^2 - 1$

Find the discriminant of the quadratic equation.

7. $x^2 - x + 3 = 0$
8. $-x^2 + 2x - 1 = 0$
9. $x^2 + 2x - 6 = 0$
10. $x^2 - 5x + 1 = 0$
11. $x^2 - 2x + 7 = 0$
12. $x^2 + 6x + 9 = 0$

Find the discriminant and use it to determine the number of real solutions of the equation.

13. $x^2 - 2x - 3 = 0$
14. $x^2 + 5x + 2 = 0$
15. $-x^2 + 3x - 5 = 0$
16. $x^2 - 5x + 6 = 0$
17. $2x^2 - x + 4 = 0$
18. $2x^2 - x - 5 = 0$
19. $x^2 + 18x + 81 = 0$
20. $x^2 - 4x + 4 = 0$
21. $-x^2 - 3x - 5 = 0$
22. $x^2 + 3 = 0$
23. $x^2 - 21 = 0$
24. $-5x^2 = 0$

Use the quadratic formula to solve the equation.

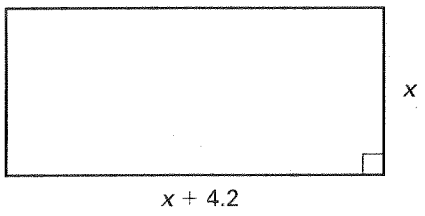
25. $x^2 - x - 1 = 0$
26. $x^2 + 3x - 1 = 0$
27. $x^2 - 6x + 2 = 0$
28. $x^2 - 7x = 0$
29. $x^2 + 3x = 0$
30. $x^2 + 6 = 0$
31. $x^2 - 36 = 0$
32. $x^2 + 3x + 5 = 0$
33. $x^2 + x + 14 = 0$

Write the equation in standard form. Use the quadratic formula to solve the equation.

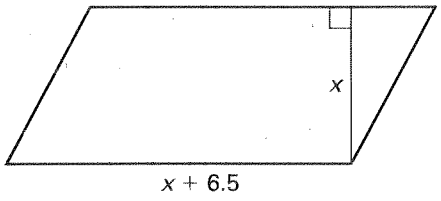
34. $x^2 - 5 = 2x - 1$
35. $3x^2 + 2x = 2x^2 - 1$
36. $x^2 + 2x = 15$
37. $x^2 + 11 = 6x$
38. $x^2 + 1 = x + \frac{3}{4}$
39. $x^2 - 3x = 2x^2$

Find the dimensions of the figure. Round your answer to the nearest thousandth.

40. Area of rectangle = 24.5 square inches



41. Area of parallelogram = 63.9 square inches



Lesson 5.6

LESSON 5.6

NAME _____ DATE _____

Practice B

For use with pages 291–298

Find the discriminant of the quadratic equation.

1. $x^2 - 3x + 5 = 0$
2. $3x^2 + x - 2 = 0$
3. $4x^2 - 12x + 9 = 0$
4. $5x^2 - 2x + 4 = 0$
5. $-2x^2 + 3x + 5 = 0$
6. $-3x^2 - 2x + 8 = 0$

Find the discriminant and use it to determine the number of real solutions of the equation.

7. $x^2 + 3x + 2 = 0$
8. $-4x^2 + 20x - 25 = 0$
9. $3x^2 - 2x + 1 = 0$
10. $-3x^2 + x - 4 = 0$
11. $x^2 - 3x + 4 = 2x^2 - 3$
12. $4x^2 + 3x = 0$

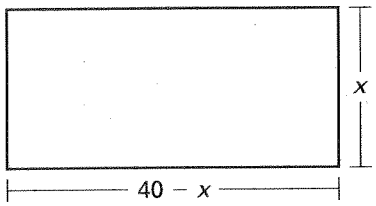
Use the quadratic formula to solve the equation.

13. $x^2 - x - 20 = 0$
14. $-2x^2 + 3x + 2 = 0$
15. $2x^2 + x - 4 = 0$
16. $4x^2 - 9x + 2 = 0$
17. $10x^2 + 2x - 5 = 0$
18. $-8x^2 + 7x + 2 = 0$

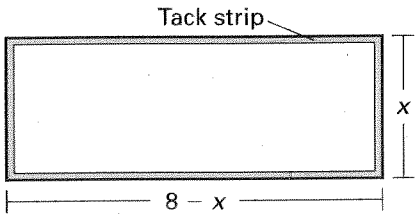
Write the equation in standard from. Use the quadratic formula to solve the equation.

19. $3x^2 - 4x = 2x^2 + 2$
20. $x^2 - 5 = 3x - 1$
21. $4 - 2x^2 = x - 3$
22. $x^2 - 3x + 2 = 4x^2 - 3$
23. $9x - x^2 = x^2 + 4x - 1$
24. $6x^2 + 5 = 2x^2 - 3x + 7$
25. $2(x - 3)^2 = 3x + 1$
26. $2.4x^2 - 3.5x = 2.2$
27. $6.8x - 2 = 4.2x^2$

28. ***Fencing Your Garden*** It takes 80 feet of fencing to enclose your garden. According to your calculations, you will need 350 square feet to plant everything you want. Is your garden big enough? Explain your answer.



29. ***New Carpeting*** You have new carpeting installed in a rectangular room. You are charged for 20 square yards of carpeting and 48 feet (16 yards) of tack strip. Do you think these figures are correct? Explain your answer.



Throwing an Object on the Moon An astronaut standing on the surface of the moon throws a rock into the air with an initial velocity of 27 feet per second. The astronaut's hand is 6 feet above the surface of the moon. The height of the rock is given by $h = -2.7t^2 + 27t + 6$.

30. How many seconds is the rock in the air?
31. Suppose the astronaut had been standing on the earth's surface. Write a vertical motion model for the height of the rock after it is thrown.
32. Use the model in Exercise 31 to determine how many seconds the rock remains in the air when thrown from the earth's surface.

LESSON 5.6

NAME _____ DATE _____

Practice C

For use with pages 291–298

Find the discriminant of the quadratic equation.

1. $x^2 + 3x - 1 = 0$
2. $3x^2 + 7x + 2 = 0$
3. $-8x^2 + 3x + 5 = 0$
4. $2x + x^2 - 5 = 0$
5. $10 - 3x + x^2 = 0$
6. $6x + 3 + 5x^2 = 0$

Use the quadratic formula to solve the equation.

7. $x^2 + 5x - 3 = 0$
8. $2x^2 + 3x - 1 = 0$
9. $\frac{1}{3}x^2 + 4x + 3 = 0$
10. $3x^2 + 2x = x^2 + 5x - 1$
11. $x^2 + 3 = 2x^2 - 5x$
12. $\frac{1}{2}x^2 + 2x + 5 = 2 - 3x$
13. $5x^2 + 9 = -x + 8$
14. $\frac{1}{16}x^2 + \frac{5}{2}x = -25$
15. $2.3x^2 + 4.1x = 2.1x^2 - 5.3$
16. $4.5x^2 + 1.2x = 2.1 - 1.3x^2$
17. $7.3x^2 + 2.1 = -1.1x$
18. $\frac{1}{5}(x + 1)^2 = \frac{1}{5}x - \frac{1}{3}$

Find all values of *b* for which the equation has one real solution.

19. $x^2 + bx + 4 = 0$
20. $2x^2 + bx + 3 = 0$
21. $3x^2 + bx - 5 = 0$

Give two examples of values of *b* for which the equation has two imaginary solutions.

22. $x^2 + bx + 5 = 0$
23. $2x^2 + bx + 1 = 0$
24. $\frac{2}{5}x^2 + bx + 10 = 0$

Vertical Motion **In Exercises 25–29, use the following information.**

Three objects are launched from the top of a 100-foot building. The first object is launched upward with an initial velocity of 10 feet per second. The second object is dropped. The third object is launched downward with an initial velocity of 10 feet per second.

25. Without doing any calculations, which object do you think will hit the ground first?
26. Write a height model for the object launched upward.
27. Write a height model for the dropped object.
28. Write a height model for the object launched downward.
29. Use the quadratic formula to verify your answer in Exercise 25.

LESSON 5.6

NAME _____ DATE _____

Reteaching with Practice

For use with pages 291–298

GOAL **Solve quadratic equations using the quadratic formula**

VOCABULARY

The **quadratic formula,**

$$x = -\frac{b \pm \sqrt{b^2 - 4ac}}{2a},$$

is used to find the solutions of the quadratic equation $ax^2 + bx + c = 0$, when $a \neq 0$.

The expression $b^2 - 4ac$, where a, b, and c are coefficients of the quadratic equation $ax^2 + bx + c = 0$, is called the **discriminant.**

If $b^2 - 4ac > 0$, then the equation has two real solutions.
If $b^2 - 4ac = 0$, then the equation has one real solution.
If $b^2 - 4ac < 0$, then the equation has two imaginary solutions.

EXAMPLE 1 Solving a Quadratic Equation with Two Real Solutions

Solve $-8x^2 - 5x = -x^2 - 1$.

SOLUTION

$-8x^2 - 5x = -x^2 - 1$ Write original equation.

$-7x^2 - 5x + 1 = 0$ Write in standard form.

$x = \frac{5 \pm \sqrt{(-5)^2 - 4(-7)(1)}}{2(-7)}$ Quadratic formula with $a = -7$, $b = -5$, and $c = 1$.

$x = \frac{5 \pm \sqrt{53}}{-14}$ Simplify.

The solutions are

$$x = \frac{5 + \sqrt{53}}{-14} \approx -0.88 \text{ and } x = \frac{5 - \sqrt{53}}{-14} \approx 0.16.$$

Exercises for Example 1

Use the quadratic formula to solve the equation.

1. $x^2 - 9x + 5 = 0$ **2.** $5x^2 + 3x - 1 = 0$ **3.** $-x^2 + 2x + 4 = 0$

NAME _____ DATE _____

Reteaching with Practice

For use with pages 291–298

EXAMPLE 2 Solving a Quadratic Equation with One Real Solution

Solve $2x^2 - 5x + 7 = x^2 - 3x + 6$.

SOLUTION

$2x^2 - 5x + 7 = x^2 - 3x + 6$ — Write original equation.

$x^2 - 2x + 1 = 0$ — Write in standard form.

$x = \dfrac{2 \pm \sqrt{(-2)^2 - 4(1)(1)}}{2(1)}$ — Quadratic formula with $a = 1$, $b = -2$, and $c = 1$.

$x = \dfrac{2 \pm \sqrt{0}}{2}$ — Simplify.

$x = 1$ — Simplify.

The solution is 1.

Exercises for Example 2

Use the quadratic formula to solve the equation.

4. $x^2 - 6x + 9 = 0$ **5.** $x^2 + 4x + 4 = 0$ **6.** $x^2 + 10x + 25 = 0$

EXAMPLE 3 Solving a Quadratic Equation with Two Imaginary Solutions

Solve $3x^2 - 3x + 5 = 0$.

SOLUTION

$3x^2 - 3x + 5 = 0$ — Write original equation.

$x = \dfrac{3 \pm \sqrt{(-3)^2 - 4(3)(5)}}{2(3)}$ — Quadratic formula with $a = 3$, $b = -3$, and $c = 5$.

$x = \dfrac{3 \pm \sqrt{-51}}{6}$ — Simplify.

$x = \dfrac{3 \pm i\sqrt{51}}{6}$ — Write using the imaginary unit i.

The solutions are $\dfrac{1}{2} + \dfrac{\sqrt{51}}{6}i$ and $\dfrac{1}{2} - \dfrac{\sqrt{51}}{6}i$.

Exercises for Example 3

Use the quadratic formula to solve the equation.

7. $x^2 - 6x = -10$ **8.** $x^2 = -x - 1$ **9.** $x^2 - 2x + 3 = 0$

LESSON 5.6

NAME _____ DATE _____

Quick Catch-Up for Absent Students

For use with pages 291–298

The items checked below were covered in class on (date missed) _____

Lesson 5.6: The Quadratic Formula and the Discriminant

____ **Goal 1:** Solve quadratic equations using the quadratic formula. (pp. 291–293)

Material Covered:

____ Example 1: Solving a Quadratic Equation with Two Real Solutions

____ Example 2: Solving a Quadratic Equation with One Real Solution

____ Example 3: Solving a Quadratic Equation with Two Imaginary Solutions

____ Example 4: Using the Discriminant

Vocabulary:

quadratic formula, p. 291 discriminant, p. 293

____ **Goal 2:** Use the quadratic formula in real-life situations. (p. 294)

Material Covered:

____ Example 5: Solving a Vertical Motion Problem

____ Other (specify) _____

_____

Homework and Additional Learning Support

____ Textbook (specify) pp. 295–298

_____

____ Internet: Extra Examples at www.mcdougallittell.com

____ *Reteaching with Practice* worksheet (specify exercises) _____

____ *Personal Student Tutor* for Lesson 5.6

LESSON 5.6

NAME _____ DATE _____

Interdisciplinary Application

For use with pages 291–298

Geysers

EARTH SCIENCE A geyser is a deep, narrow hole filled with water. The water near the bottom of the hole is heated by the hot rocks found in the Earth. Gradually the heat at the bottom reaches far above the boiling point of water, causing steam to form. The steam begins to build up pressure because it cannot escape into the air. More water turns to steam and the pressure continues to grow until the steam pushs up with a tremendous force. This force causes the water near the top of the hole to be thrown into the air.

Geysers are sometimes compared to volcanoes. They are similar in that the inner heat of the Earth causes them to erupt. They are different in that volcanoes erupt with molten lava while geysers shoot forth hot water containing dissolved mineral matter.

In Exercises 1–3, use the following information.

A geyser sends a blast of boiling water high into the air. During the eruption, the height h (in feet) of the water t seconds after being forced out from the ground could be modeled by $h = -16t^2 + 70t$.

1. What is the initial velocity of the boiling water?
2. What is the maximum height of the boiling water?
3. How long is the boiling water in the air?

In Exercises 4–6, use the following information.

Old Faithful in Yellowstone Park is probably the world's most famous geyser. Old Faithful sends a stream of boiling water into the air. During the eruption, the height h (in feet) of the water t seconds after being forced out from the ground could be modeled by $h = -16t^2 + 150t$.

4. What is the initial velocity of the boiling water?
5. What is the maximum height of the boiling water?
6. How long is the boiling water in the air?

LESSON 5.6

NAME _____ DATE _____

Challenge: Skills and Applications

For use with pages 291–298

Use the quadratic formula to solve each equation.

1. $3x^2 - ix - 4 = 0$

2. $ix^2 - 5x + 2i = 0$

3. Find the values of the discriminants of the equations in Problems 1 and 2. Both discriminants are positive, yet neither equation has two distinct real roots. Can you explain this apparent contradiction?

4. One form of *Schwarz's Inequality* states that for any 4 real numbers p, q, r, and s,

   $$pr + qs \leq \sqrt{p^2 + q^2} \cdot \sqrt{r^2 + s^2}.$$

   Prove Schwarz's Inequality using the following steps.

   a. Let $f(x) = (px + r)^2 + (qx + s)^2$. Explain why, for any real number x, $f(x) \geq 0$.

   b. Expand $f(x)$, and express the discriminant of $f(x) = 0$ in terms of p, q, r, and s. (Leave your answer in factored form.)

   c. What does the fact that $f(x) \geq 0$ tell you about where the graph of $y = f(x)$ is situated in relation to the x-axis? What does this tell you about the roots of the equation $f(x) = 0$? What does it therefore tell you about the discriminant of the equation $f(x) = 0$?

   d. Use your answer to the last question of part (c) to prove Schwarz's Inequality.

5. The positive solution of the equation $x^2 + x - 1 = 0$ is often called the *Golden Ratio.*

   a. Use the quadratic formula to find the Golden Ratio in simplest form.

   b. Divide both sides of the equation above by x^2 and simplify the resulting equation. Your new equation can be expressed in terms of the variable

   $$w = \frac{1}{x}.$$

   Solve this equation for the positive value of w to get an expression for the reciprocal of the Golden Ratio.

   c. Use your answer to part (b) to show that if the reciprocal of the Golden Ratio is increased by 1, the result is the Golden Ratio.

LESSON 5.6

NAME _____ DATE _____

Quiz 2

For use after Lessons 5.4–5.6

1. Write the expression $(6 + 3i) + (-4 + 10i)$ as a complex number in standard form. *(Lesson 5.4)*

2. Write the expression $(-2 + 6i) - (2 - 3i)$ as a complex number in standard form. *(Lesson 5.4)*

3. Write the expression $(2 + 5i)(5 - i)$ as a complex number in standard form. *(Lesson 5.4)*

4. Write the expression $\frac{2 - 3i}{6 + i}$ as a complex number in standard form. *(Lesson 5.4)*

5. Solve the equation $x^2 - 4x + 10 = 0$ by completing the square. *(Lesson 5.5)*

6. Write $y = x^2 + 8x + 1$ in vertex form. *(Lesson 5.5)*

7. Use the quadratic formula to solve the equation $x^2 - 14x + 53 = 0$. *(Lesson 5.6)*

8. Use the quadratic formula to solve the equation $2p^2 + 16p = -2p^2 + 3$. *(Lesson 5.6)*

Answers

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

LESSON 5.7

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan

1-day lesson (See *Pacing the Chapter*, TE pages 246C–246D) **For use with pages 299–305**

GOALS

1. **Graph quadratic inequalities in two variables.**
2. **Solve quadratic inequalities in one variable.**

State/Local Objectives _____

_____

✓ Check the items you wish to use for this lesson.

STARTING OPTIONS

____ Homework Check: TE page 295; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 299 and 297, CRB page 94, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 300
____ Lesson Opener (Activity): CRB page 95 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 96
____ Examples 1–7: SE pages 299–302
____ Extra Examples: TE pages 300–302 or Transparencies
____ Closure Question: TE page 302
____ Guided Practice Exercises: SE page 303

APPLY/HOMEWORK

Homework Assignment

____ Basic 14–16, 18–24 even, 30–46 even, 47–48, 52, 55–65 odd
____ Average 14–16, 18–46 even, 47–49, 52, 55–69 odd
____ Advanced 14–16, 18–46 even, 47–49, 52, 53–69 odd

Reteaching the Lesson

____ Practice Masters: CRB pages 97–99 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 100–101 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Real-Life): CRB page 103
____ Challenge: SE page 305; CRB page 104 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 301–302 or Transparencies
____ Daily Homework Quiz (5.7): TE page 305, CRB page 107, or Transparencies
____ Standardized Test Practice: SE page 305; TE page 305; STP Workbook; Transparencies

Notes _____

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