LESSON 5.7

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 299–305**

GOALS

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

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 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 (See also the assignment for Lesson 5.8.)

____ Block Schedule: 14–16, 18–46 even, 47–49, 51–53, 55–69 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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Available as a transparency

WARM-UP EXERCISES

For use before Lesson 5.7, pages 299–305

Solve and graph.

1. $2x - 7 \leq 11$
2. $3 - 6(x - 1) > 9$
3. Graph $y < 3x + 1$

   $y \geq -x$.

DAILY HOMEWORK QUIZ

For use after Lesson 5.6, pages 291–298

1. Solve $3x^2 + x - 8 = 0$.
2. Solve $8x^2 + 5x = -3x - 2$.
3. Solve $x^2 + 4x = -9$.
4. Find the discriminant of $x^2 - 4x + 7 = 0$ and give the number and type of solutions of the equation.

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Available as a transparency

Activity Lesson Opener

For use with pages 299–305

SET UP: Work in a group.

YOU WILL NEED: colored pencils

Use the inequality that is assigned to your group.

Group 1: $y < 2x^2 + 4x - 1$

Group 2: $y < 4x^2 - 8x - 1$

Group 3: $y \geq -2x^2 - 4x + 2$

Group 4: $y > -4x^2 + 8x + 1$

Group 5: $y < x^2 - 1$

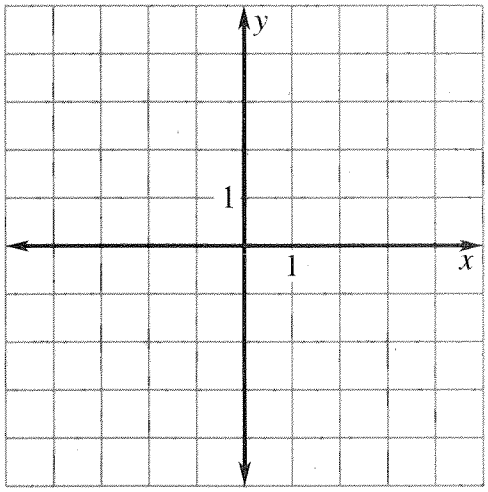
Group 6: $y \geq -x^2 + 2$

Group 7: $y \leq 2x^2 - 4x - 2$

Group 8: $y > -4x^2 - 8x + 1$

Group 9: $y > -2x^2 + 4x + 1$

Group 10: $y < 4x^2 + 8x - 1$



Your teacher will call out ordered pairs generated by flipping a coin and rolling a number cube twice. Heads indicates a positive number and tails indicates a negative number. A 6 on the number cube represents zero.

1. Decide if the ordered pair is a solution to the inequality. If it is, plot the point using a red pencil. Otherwise, plot it in blue. After ten points are called out, the group with the most red points wins.

2. The boundary of the solution region is a parabola. If this parabola is included in the region, graph it with a red pencil. If not, graph it with a blue pencil. Finish graphing the inequality by shading the entire solution region with a red pencil.

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Graphing Calculator Activity Keystrokes

For use with pages 299–305

TI-82

To solve, rewrite the equation as $0.125x^2 - 569x + 448{,}000$.

Insert function.

Y= 0.125 X,T,θ x^2 − 569 X,T,θ + 448,000 ENTER

Set the viewing window and graph.

WINDOW ENTER 400 ENTER 2200 ENTER 200 ENTER (-) 10 ENTER 10 ENTER 1 ENTER GRAPH

Find zero of the function.

2nd [CALC] 2

Use ◀ to move the trace cursor to select the lower bound at $x \approx 400$. Press ENTER.

Use ▶ to move the trace cursor to select the upper bound at $x \approx 2200$. Press ENTER.

Use ◀ to move the trace cursor to select the guess at $x \approx 1000$. Press ENTER.

TI-83

To solve, rewrite the equation as $0 = 0.125x^2 - 569x + 448{,}000$.

Insert function.

Y= 0.125 X,T,θ,n x^2 − 569 X,T,θ,n + 448,000 ENTER

Set the viewing window and graph.

WINDOW 400 ENTER 2200 ENTER 200 ENTER (-) 10 ENTER 10 ENTER 1 ENTER 1 ENTER GRAPH

Find zero of the function.

2nd [CALC] 2

Use the keypad to select the lower bound at $x \approx 400$. 400 ENTER

Use the keypad to select the upper bound at $x \approx 2200$. 2200 ENTER

Use the keypad to select the guess at $x \approx 1000$. 1000 ENTER

SHARP EL-9600c

To solve, rewrite equation as $0 = 0.125x^2 - 569x + 448{,}000$.

Y= 0.125 X/θ/T/n x^2 − 569 X/θ/T/n + 448,000 ENTER

Set the viewing window and graph.

WINDOW 400 ENTER 2200 ENTER 200 ENTER (-) 10 ENTER 10 ENTER 1 ENTER TRACE

Find zero of the function.

2ndF [CALC] 5

CASIO CFX-9850GA PLUS

To solve, rewrite equation as $0 = 0.125x^2 - 569x + 448{,}000$.

From the main menu, select GRAPH.

0.125 X,T,θ x^2 − 569 X,T,θ + 448,000 EXE

Set the viewing window and graph.

SHIFT F3 400 EXE 2200 EXE 200 EXE (-) 10 EXE 10 EXE 1 EXE EXIT F6

Find zero of the function.

SHIFT F5 F1

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Practice A

For use with pages 299–305

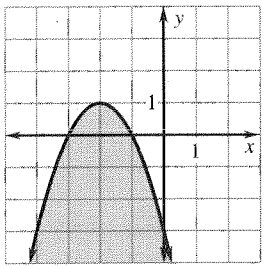
Determine whether the ordered pair is a solution of the inequality.

1. $y < x^2 - 2x + 4$, $(1, 2)$
2. $y > 2x^2 + x - 5$, $(-2, 1)$
3. $y \leq -2x^2 + 5x + 6$, $(4, -4)$
4. $y \geq -3x^2 - 4x + 1$, $(-3, -6)$
5. $y < 2x^2 + 3x - 4$, $(1, 1)$
6. $y \geq x^2 - 3x + 5$, $(2, 3)$

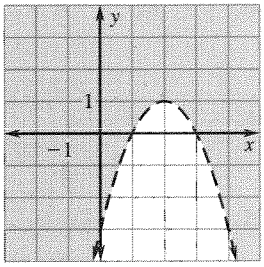
Match the inequality with its graph.

7. $y \geq -x^2 + 4x - 3$
8. $y \leq -x^2 - 4x - 3$
9. $y \leq x^2 + 2x - 3$
10. $y < x^2 - 4x + 3$
11. $y > -x^2 + 4x - 3$
12. $y > x^2 - 2x - 3$

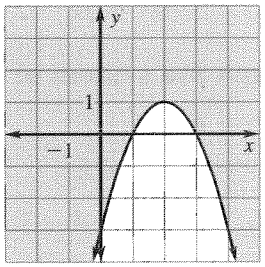
A.



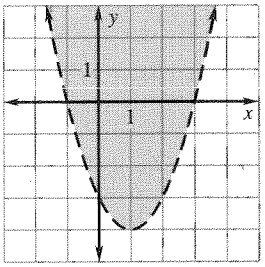
B.



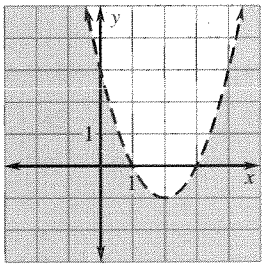
C.



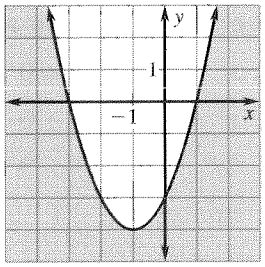
D.



E.



F.



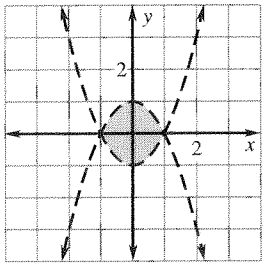
Sketch the graph of the inequality.

13. $y \leq 2x^2 + 1$
14. $y \geq x^2 + 2x$
15. $y < x^2 - 3$
16. $y > 3x^2 - 2$
17. $y < x^2 + 5x$
18. $y > x^2 - 2x$
19. $y \geq x^2 + 5x + 6$
20. $y \leq x^2 - 2x + 1$
21. $y \leq x^2 - 6x + 8$

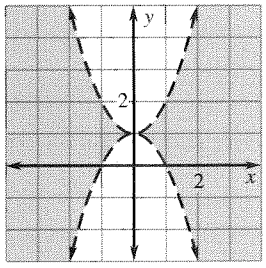
Match the system of inequalities with its graph.

22. $y < x^2 + 1$
    $y > -x^2 + 1$
23. $y < x^2 - 1$
    $y > -x^2 + 1$
24. $y > x^2 - 1$
    $y < -x^2 + 1$

A.



B.



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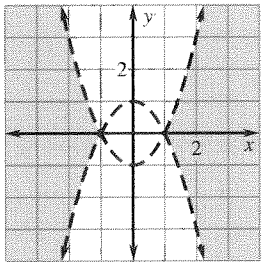

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Practice B

For use with pages 299–305

Determine whether the ordered pair is a solution of the inequality.

1. $y < 2x^2 + 2x - 5,\ (1, -1)$
2. $y > 5x^2 + 7x - 4,\ (-1, -6)$
3. $y \leq \frac{1}{2}x^2 + 3x - 1,\ (2, 7)$
4. $y \geq 3 - \frac{2}{3}x^2,\ (3, -3)$

Sketch the graph of the inequality.

5. $y < x^2 + 10x + 9$
6. $y > x^2 - 4x - 21$
7. $y > 3x^2 - 6x$
8. $y < x^2 - 2x + 1$
9. $y \leq -x^2 + 6x - 7$
10. $y \geq 3x^2 + 6x + 2$
11. $y > -x^2 - 6x - 9$
12. $y \geq 2x^2 + 4x - 2$
13. $y < -2x^2 - 8x - 5$
14. $y > 3x^2 - 5x - 2$
15. $y \leq 4x^2 - 16$
16. $y < 12 - 3x^2$

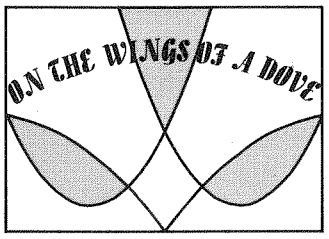
Graph the system of inequalities.

17. $y \geq x^2$
    $y \leq -x^2 + 3$
18. $y \geq 2x^2 - 4$
    $y \leq -x^2 - 1$
19. $y \leq -x^2 + 4$
    $y \geq x^2 - 2x + 1$
20. $y \leq -x^2 + 4$
    $y \geq x^2 + 2x + 1$
21. $y > x^2 + 4x + 1$
    $y \leq -x^2 - 2x + 1$
22. $y \geq 2x^2 - 12x + 16$
    $y < -x^2 + 2x + 3$

Solve the inequality algebraically.

23. $x^2 - 2x - 15 < 0$
24. $x^2 - 6x - 16 > 0$
25. $x^2 + 5x + 4 \leq 0$
26. $x^2 + 7x + 12 \geq 0$
27. $x^2 - 11x + 28 < 0$
28. $x^2 - 9x + 18 \geq 0$
29. $2x^2 - 5x - 3 \leq 0$
30. $3x^2 \geq 10x + 8$
31. $x^2 - 4x \leq 21$
32. $2x^2 \geq -8x - 4$
33. $3x^2 + 4 < 7x$
34. $2x^2 > 5x$

Gift Shop Logo You are using a computer to create a logo for a gift shop called *On the Wings of a Dove*. The logo you have designed is shown at the right.



35. Sketch the intersections of the graphs of the inequalities.
    a. $y \geq 0.33x^2 - 2x + 4$
       $y \leq -0.09x^2 + 1.3x$
    b. $y \geq 0.33x^2 + 2x + 4$
       $y \leq -0.09x^2 - 1.3x$
36. Which region in Exercise 35 represents the dove's left wing?
37. Which region in Exercise 35 represents the dove's right wing?
38. Which two inequalities (when intersected) make up the dove's tail?

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Practice C

For use with pages 299–305

Sketch the graph of the inequality.

1. $y < x^2 - 2x - 35$
2. $y \geq x^2 - 12x + 27$
3. $y \leq 2x^2 + 19x + 35$
4. $y > 6x^2 - x - 2$
5. $y \geq x^2 + 3x - 1$
6. $y < -x^2 + 4x + 6$
7. $y \geq -2x^2 + 3x + 1$
8. $y > -2x^2 + 5x - 4$
9. $y \leq -4x^2 + x - 6$

Graph the system of inequalities.

10. $y \geq x^2 + 3x + 4$
    $y \leq -x^2 + 4x + 5$
11. $y > 2x^2 + 5x$
    $y < -x^2 - 2x - 3$
12. $y > x^2 + 3x + 1$
    $y < \frac{1}{2}x^2 + x + 2$

Solve the inequality algebraically.

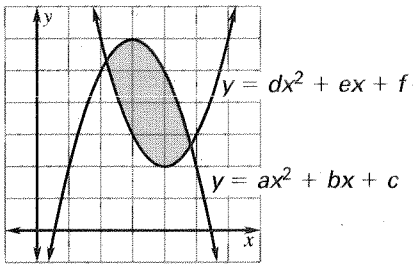
13. $x^2 + 3x - 70 \leq 0$
14. $x^2 + 15x + 36 \geq 0$
15. $2x^2 - x - 28 < 0$
16. $3x^2 - 26x + 48 > 0$
17. $12x^2 - 25x - 7 \leq 0$
18. $12x^2 + 12x - 9 \geq 0$
19. $-9x^2 + 30x - 25 < 0$
20. $2x^2 + 5x - 8 \geq 0$
21. $-x^2 + 2x - 6 \geq 0$
22. $-3x^2 + x + 1 < 0$
23. $-5x^2 + 4 > 0$
24. $2x^2 + x + 1 > 0$

Geometry **In Exercises 25–30, use the following information.**

The area of a region bounded by two parabolas, is given by

$$\text{Area} = \left(\frac{a-d}{3}\right)(B^3 - A^3) + \left(\frac{b-e}{2}\right)(B^2 - A^2) + (c-f)(B-A)$$

where $y = ax^2 + bx + c$ is the top parabola, $y = dx^2 + ex + f$ is the bottom parabola, and A and B are the x-coordinates of the intersection points of the parabolas with $A < B$.



25. To find the x-coordinates of the intersection points of two parabolas, set the two quadratic equations equal to each other and solve for x. Find the x-coordinates of the intersection points of $y = x^2 + 3x + 1$ and $y = -x^2 - 2x + 4$.
26. Graph the system of inequalities

    $y \geq x^2 + 3x + 1$

    $y \leq -x^2 - 2x + 4$
27. For the region in Exercise 26, which parabola is the top boundary?
28. For the region in Exercise 26, which parabola is the bottom boundary?
29. Find the area of the region from Exercise 26.
30. Find the area of the region.

    $y \geq x^2 + 4x + 3$

    $y \geq 2x^2 + 5x - 3$

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Reteaching with Practice

For use with pages 299–305

GOAL **Graph quadratic inequalities in two variables and solve quadratic inequalities in one variable**

VOCABULARY

A **quadratic inequality in two variables** can be written as follows:

$y < ax^2 + bx + c$ $\quad y \leq ax^2 + bx + c$

$y > ax^2 + bx + c$ $\quad y \geq ax^2 + bx + c$

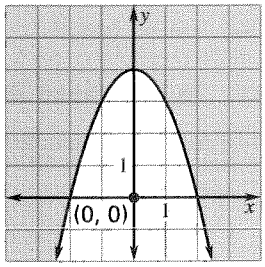
A **quadratic inequality in one variable** can be written as follows:

$ax^2 + bx + c < 0$ $\quad ax^2 + bx + c \leq 0$

$ax^2 + bx + c > 0$ $\quad ax^2 + bx + c \geq 0$

EXAMPLE 1 Graphing a Quadratic Inequality

Graph $y \geq -x^2 + 4$.



SOLUTION

1 Graph $-x^2 + 4$. Since the inequality symbol is $\geq$, make the parabola solid.

2 Test a point inside the parabola, such as (0, 0).

$y \geq -x^2 + 4$

$0 \geq -(0)^2 + 4$

$0 \not\geq 4$

So, (0, 0) is not a solution of the inequality.

3 Shade the region outside the parabola.

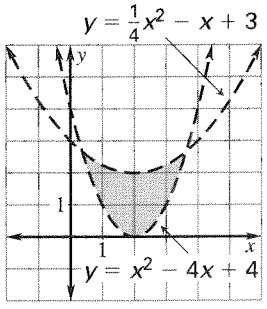
Exercises for Example 1

Graph the inequality.

1. $y \leq x^2 + 2$ **2.** $y > -x^2 + 2x$ **3.** $y \geq 2x^2$

EXAMPLE 2 Graphing a System of Quadratic Inequalities

Graph $y > x^2 - 4x + 4$ and $y < \frac{1}{4}x^2 - x + 3$.



SOLUTION

Graph $y > x^2 - 4x + 4$. The region inside the dashed parabola is shaded.

Graph $y < \frac{1}{4}x^2 - x + 3$. The region outside the dashed parabola is shaded.

The region where the two graphs overlap is the graph of the system.

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Reteaching with Practice

For use with pages 299–305

Exercises for Example 2

Graph the system of inequalities.

4. $y \leq -x^2$
$y \geq x^2 - 4$

5. $y \geq x^2$
$y \leq 4x - x^2$

EXAMPLE 3 Solving a Quadratic Inequality by Graphing

Solve $3x^2 + 2x - 1 \geq 0$.

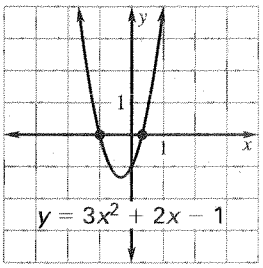
SOLUTION

Since the inequality symbol is $\geq$, the solution consists of the x-values for which the graph $y = 3x^2 + 2x - 1$ lies on or above the x-axis. Find the x-intercepts by letting $y = 0$ and solving for x.

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

$0 = (3x - 1)(x + 1)$

$x = \frac{1}{3}$ or -1



The graph lies on or above the x-axis when $x \leq -1$ or $x \geq \frac{1}{3}$.

Exercises for Example 3

Solve the inequality by graphing.

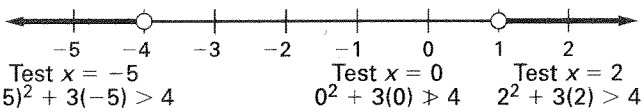
6. $y \geq 2x^2 + x - 3$ **7.** $y \leq -x^2 + 2x + 8$ **8.** $y > 2x^2 - 6x - 20$

EXAMPLE 4 Solving a Quadratic Inequality Algebraically

Solve $x^2 + 3x > 4$.

SOLUTION

The corresponding equation $x^2 + 3x - 4 = 0$ can be factored as $(x + 4)(x - 1) = 0$. The solutions -4 and 1 are the *critical x-values*. Since the inequality symbol is $>$, open circles appear at -4 and 1. Test an x-value in each interval.



The solution is $x < -4$ or $x > 1$.

Exercises for Example 4

Solve the inequality algebraically.

9. $x^2 - 3x - 10 < 0$ **10.** $x^2 + 3x \geq 18$ **11.** $2x^2 + 5x \leq 12$

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Quick Catch-Up for Absent Students

For use with pages 299–305

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

Lesson 5.7: Graphing and Solving Quadratic Inequalities

____ **Goal 1:** Graph quadratic inequalities in two variables. (pp. 299–300)

Material Covered:

____ Example 1: Graphing a Quadratic Inequality

____ Student Help: Look Back

____ Example 2: Using a Quadratic Inequality as a Model

____ Example 3: Graphing a System of Quadratic Inequalities

Vocabulary:

quadratic inequalities in two variables, p. 299

____ **Goal 2:** Solve quadratic inequalities in one variable. (pp. 301–302)

Material Covered:

____ Student Help: Look Back

____ Example 4: Solving a Quadratic Inequality by Graphing

____ Example 5: Solving a Quadratic Inequality by Graphing

____ Example 6: Solving a Quadratic Inequality Algebraically

____ Example 7: Using a Quadratic Inequality as a Model

Vocabulary:

quadratic inequalities in one variable, p. 301

____ Other (specify) _____

_____

Homework and Additional Learning Support

____ Textbook (specify) pp. 303–305

_____

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

____ *Personal Student Tutor* for Lesson 5.7

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

For use with pages 299–305

HEARING LOSS In October 1997, President Clinton was fitted for hearing aids in both ears as a result of listening to loud music when he was younger. The National Institute on Deafness and Other Communication Disorders reports that people who listened to loud music in their younger years now have some sort of hearing loss in their forties and fifties. When the inner ear is exposed to frequent loud noises, such as musical concerts, car stereos, movie theaters, NASCAR races, and even lawn mowers, the damage is cumulative and irreversible.

Hearing Education and Awareness for Rockers (H.E.A.R.) is a non-profit organization to prevent hearing loss among musicians and music fans. H.E.A.R. was formed in 1988 with support from Pete Townshend of The Who, Lars Ulrich of Metallica, MTV, The American Academy of Audiology, and The Recording Academy, along with many other supporters from the medical fields and recording industries. The goals of H.E.A.R. are to provide information and resources on hearing loss and to promote hearing protection at concerts. This organization also provides school programs and public service announcements about hearing loss and hearing protection.

In Exercises 1–6, use the following information.

The percentage of hearing loss experienced by people throughout their adult years can be modeled by the equation

$$y = 0.0086x^2 - 0.4267x + 6.6434, \text{ with } 18 \leq x \leq 84,$$

where y represents the percentage of hearing loss and x is the age of a person.

1. By the age of 18, what percent of hearing loss can a person experience?
2. Find the percent range of hearing loss for the 30–60 year age group.
3. Find the percent range of hearing loss for the 60–90 year age group.
4. Find the age group where the percent of hearing loss is less than 5%.
5. Find the age group where the percent of hearing loss is greater than 25%.
6. Find the age group where the percent of hearing loss is greater than 15%, but less than 30%.
7. Sketch a graph of this equation. Use your graph to check your answers for Exercises 1–6.

LESSON 5.7

NAME _____ DATE _____

Challenge: Skills and Applications

For use with pages 299–305

Solve each system of inequalities algebraically.

Example: $-2 \le x^2 + 3x \le 10$

Solution: $-2 \le x^2 + 3x \implies 0 \le x^2 + 3x + 2$

The solution of this inequality is $x \le -2$ or $x \ge -1$.

$x^2 + 3x \le 10 \implies x^2 + 3x - 10 \le 0$

The solution of this inequality is $-5 \le x \le 2$.

The solution of the system is therefore $-5 \le x \le -2$ or $-1 \le x \le 2$.

1. $2 \le x^2 + x \le 12$

2. $-4 < x^2 - 5x < 14$

3. $x \le x^2 \le 2x + 15$

4. $-7 < -x^2 + 6x < 8$

5. a. Use the graph of $y = x^2 - 3x$ to solve the inequality $x^2 - 3x > 10$.

b. Solve the inequality in part (a) using the following method: Write the inequality as $x^2 - 3x - 10 > 0$. Factor the expression $x^2 - 3x - 10$ and find the intervals on which each of the factors is positive and each is negative. To solve the inequality, use the fact that a product is positive if and only if both factors are positive or both are negative. Does your answer agree with the answer to part (a)?

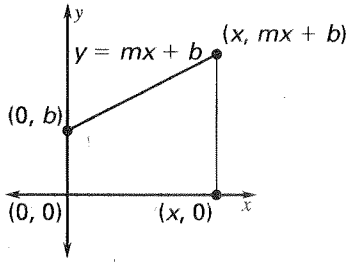
6. Let $f(x) = 2x^2 + x - 3$.

a. Find the x-intercepts of the graph of $y = f(x)$, and write a system of two inequalities in one variable, x, specifying the set of points between the x-intercepts.

b. Find a system of inequalities in one variable, y, specifying the y-values that correspond to the points between the x-intercepts.

7. a. Express the area of the trapezoid shown in terms of m, x, and b.

b. Let $m = 3$ and $b = 4$. Find the positive values of x so that the area of the trapezoid will be less than $\frac{35}{2}$.



Lesson 5.7

LESSON 5.8

TEACHER'S NAME _____ CLASS _____ ROOM _____ DATE _____

Lesson Plan

1-day lesson (See *Pacing the Chapter,* TE pages 246C–246D) **For use with pages 306–312**

GOALS

1. **Write quadratic functions given characteristics of their graphs.**
2. **Use technology to find quadratic models for real-life data.**

State/Local Objectives _____

_____

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

STARTING OPTIONS

____ Homework Check: TE page 303; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 306 and 305, CRB page 107, or Transparencies

TEACHING OPTIONS

____ Lesson Opener (Application): CRB page 108 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 109
____ Examples 1–4: SE pages 306–308
____ Extra Examples: TE pages 307–308 or Transparencies
____ Closure Question: TE page 308
____ Guided Practice Exercises: SE page 309

APPLY/HOMEWORK

Homework Assignment

____ Basic 7–12, 16–21, 25–28, 34, 36, 39, 41–47 odd; Quiz 3: 1–10
____ Average 8–30 even, 34–36, 39, 42–48 even; Quiz 3: 1–10
____ Advanced 8–38 even, 39, 40, 42–48 even; Quiz 3: 1–10

Reteaching the Lesson

____ Practice Masters: CRB pages 110–112 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 113–114 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Interdisciplinary): CRB page 116
____ Challenge: SE page 312; CRB page 117 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 307–308 or Transparencies
____ Daily Homework Quiz (5.8): TE page 311 or Transparencies
____ Standardized Test Practice: SE page 311; TE page 311; STP Workbook; Transparencies
____ Quiz (5.7–5.8): SE page 312

Notes _____

_____

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LESSON 5.8

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 306–312**

GOALS

1. **Write quadratic functions given characteristics of their graphs.**
2. **Use technology to find quadratic models for real-life data.**

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 303; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 306 and 305, CRB page 107, or Transparencies

TEACHING OPTIONS

____ Lesson Opener (Application): CRB page 108 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 109
____ Examples 1–4: SE pages 306–308
____ Extra Examples: TE pages 307–308 or Transparencies
____ Closure Question: TE page 308
____ Guided Practice Exercises: SE page 309

APPLY/HOMEWORK

Homework Assignment (See also the assignment for Lesson 5.7.)

____ Block Schedule: 8–30 even, 34–36, 39, 42–48 even; Quiz 3: 1–10

Reteaching the Lesson

____ Practice Masters: CRB pages 110–112 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 113–114 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Interdisciplinary): CRB page 116
____ Challenge: SE page 312; CRB page 117 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 307–308 or Transparencies
____ Daily Homework Quiz (5.8): TE page 311 or Transparencies
____ Standardized Test Practice: SE page 311; TE page 311; STP Workbook; Transparencies
____ Quiz (5.7–5.8): SE page 312

Notes _____

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LESSON 5.8

NAME _____ DATE _____

Available as a transparency

WARM-UP EXERCISES

For use before Lesson 5.8, pages 306–312

Solve the system of linear equations.

1. $2x - y + z = 2$

   $x + y + z = 3$

   $-3x - 2y + z = -4$

2. $-x + y = -2$

   $x + 3y - z = -5$

   $2x - y + z = 6$

DAILY HOMEWORK QUIZ

For use after Lesson 5.7, pages 299–305

1. Graph $y > x^2 - 4x + 3$.

2. Graph the system of quadratic inequalities.

   $y \geq x^2 - 9$

   $y < -x^2 - x + 3$

3. Solve $x^2 - 5x + 6 > 0$.

LESSON 5.8

NAME _____ DATE _____

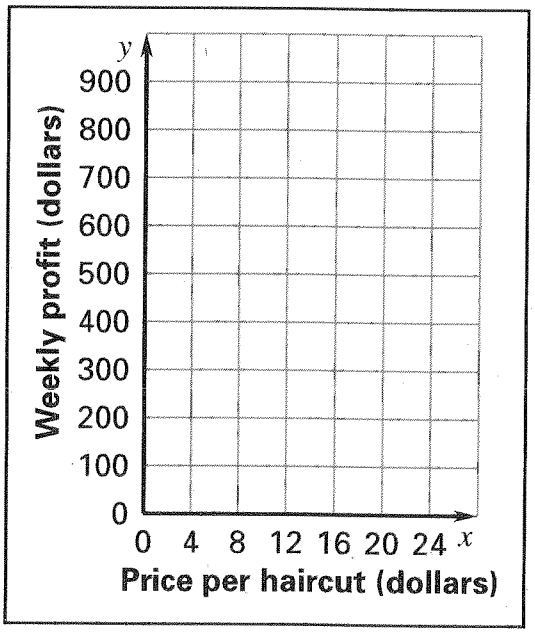
Available as a transparency

Application Lesson Opener

For use with pages 306–312

The table shows how a hair stylist's weekly profit is related to the price per haircut.

Price per haircut (dollars)	*Weekly profit (dollars)*
8	210
10	540
12	750
14	840
16	810
18	660
20	390



1. Make a scatter plot by plotting the data pairs (x, y). Your scatter plot should have a parabolic shape. Draw a parabola that fits the scatter plot.
2. Observe that if the stylist charges too much for a haircut, the profits decrease. Explain why this occurs.
3. Use your graph to estimate the weekly profit if the stylist charges \$17 per haircut.
4. Use your scatter plot to give two different haircut prices for which the weekly profit would be \$540.
5. Use your graph to estimate the maximum possible weekly profit. To achieve the maximum profit, how much should the hair stylist charge per haircut?

Lesson 5.8

LESSON 5.8

NAME _____ DATE _____

Graphing Calculator Activity Keystrokes

For use with pages 306–312

TI-82

STAT 1

Enter the x-values into L1 and the y-values into L2.

2nd [STAT PLOT] 1

Choose the following.

On; Type: ⋰; Xlist: L1; Ylist: L2; Mark: ▫

Set the viewing window

WINDOW ENTER 10 ENTER 75 ENTER 5 ENTER 20 ENTER 35 ENTER 5 ENTER

Graph and find maximum.

GRAPH STAT ▶ 6 2nd [L1] , 2nd [L2] ENTER

Y= VARS 5 ▶ ▶ 7 GRAPH 2nd [CALC] 4

Use the cursor keys, ◀ and ▶, to move the trace cursor to select the lower bound at $x \approx 36$. Press ENTER.

Use the cursor keys, ◀ and ▶, to move the trace cursor to select the upper bound at $x \approx 56$. Press ENTER.

Use the cursor keys, ◀ and ▶, to move the trace cursor to select the guess at $x \approx 46$. Press ENTER.

TI-83

STAT 1

Enter the x-values into L1 and the y-values into L2.

2nd [STAT PLOT] 1

Choose the following.

On; Type: ⋰; Xlist: L1; Ylist: L2; Mark: ▫

Set the viewing window

WINDOW 10 ENTER 75 ENTER 5 ENTER 20 ENTER 35 ENTER 5 ENTER

Graph and find maximum.

GRAPH STAT ▶ 5 2nd [L1] , 2nd [L2] ENTER

Y= VARS 5 ▶ ▶ 1

GRAPH 2nd [CALC] 4

Use the keypad to select the lower bound at $x \approx 36$. 36 ENTER

Use the keypad to select the upper bound at $x \approx 56$. 56 ENTER

Use the keypad to select the guess at $x \approx 46$.

46 ENTER

SHARP EL-9600c

STAT [A] ENTER

Enter the x-values into L1 and the y-values into L2.

2ndF [STAT PLOT] [A] ENTER

Choose the following.

On; DATA XY; List X: L1; List Y: L2

2ndF [STAT PLOT] [G] 3

Graph and find maximum.

ZOOM [A][9] +− ×÷ CL STAT [D] 0 4 (2ndF [L1] , 2ndF [L2] , VARS A ENTER 1) ENTER

GRAPH 2ndF [CALC] 4

CASIO CFX-9850GA PLUS

From the main menu, select STAT.

Enter the x-values into L1 and the y-values into L2.

Adjust Window

SHIFT F3 10 EXE 75 EXE 5 EXE 20 EXE 35 EXE 5 EXE EXIT

SHIFT [Set Up] F2 EXIT F1 F6

Choose the following.

Graph Type: Scatter; XList: List 1; YList: List 2; Frequency: 1; Mark Type: ▫

Graph and find maximum.

EXIT F1 F3 F5 EXE F6

MENU 5 F6 SHIFT F5 F2

Lesson 5.8

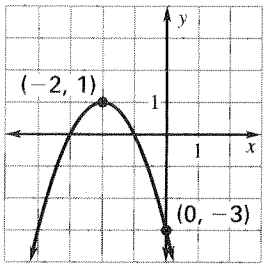
LESSON 5.8

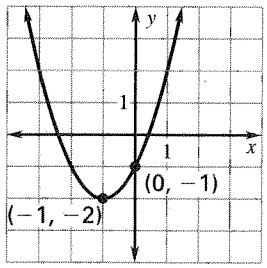
NAME _____ DATE _____

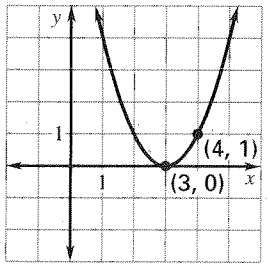
Practice A

For use with pages 306–312

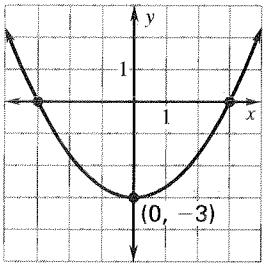
Write a quadratic function in vertex form for the parabola shown.

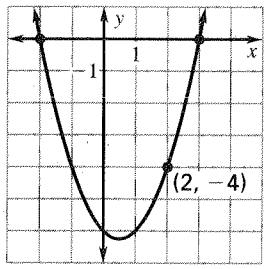
1. 

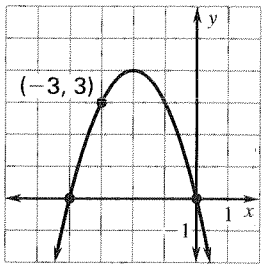
2. 

3. 

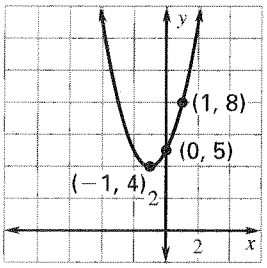
Write a quadratic function in intercept form for the parabola shown.

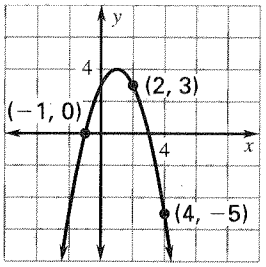
4. 

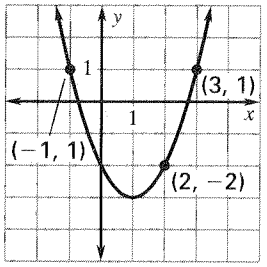
5. 

6. 

Write a quadratic function in standard form for the parabola shown.

7. 

8. 

9. 

Australia's Unemployment Rate The following table shows the number of people (in thousands) that were unemployed in Australia from 1990 to 1995. Assume that t is the number of years since 1990.

Year, t	0	1	2	3	4	5
Percentage of people unemployed, y	6.9	9.6	10.8	10.9	9.7	8.5

10. Use a graphing calculator to make a scatter plot of the data.

11. Use a graphing calculator to find the best fitting quadratic model for the data.

12. Use a graphing calculator to check how well the data fits the model.

LESSON 5.8

NAME _____ DATE _____

Practice B

For use with pages 306–312

Write a quadratic function in vertex form whose graph has the given vertex and passes through the given point.

1. vertex: (2, 3)
   point: (0, 7)
2. vertex: (−1, 4)
   point: (1, 8)
3. vertex: (−2, 1)
   point: (1, 10)
4. vertex: (4, 2)
   point: (3, 3)
5. vertex: (−3, −1)
   point: (−2, 0)
6. vertex: (−1, −5)
   point: (1, −1)
7. vertex: (3, −1)
   point: (2, 0)
8. vertex: (4, −5)
   point: (1, 4)
9. vertex: (−6, 0)
   point: (−3, 9)

Write a quadratic function in intercept form whose graph has the given *x*-intercepts and passes through the given point.

10. *x*-intercepts: 2, 4
    point: (1, 3)
11. *x*-intercepts: 3, 5
    point: (2, 3)
12. *x*-intercepts: −4, −1
    point: (3, 28)
13. *x*-intercepts: −6, −2
    point: (−3, −3)
14. *x*-intercepts: −5, 4
    point: (3, −8)
15. *x*-intercepts: −1, 7
    point: (5, −12)
16. *x*-intercepts: −5, 0
    point: (1, 12)
17. *x*-intercepts: 0, 3
    point: (1, −8)
18. *x*-intercepts: −8, 2
    point: (4, 12)

Write a quadratic function in standard form whose graph passes through the given points.

19. (1, 1), (0, −2), (2, 8)
20. (−1, −7), (1, −5), (2, −1)
21. (−1 −2), (0, −3), (1, 0)
22. (−1, 4), (1, 6), (2, 10)
23. (0, 1), (1, 3), (2, 11)
24. (−2, 11), (−1, 1), (1, −7)
25. (−1, 7), (1, 3), (2, 4)
26. (−1, 2), (1, −4), (2, −4)
27. (1, 2), (2, −1), (3, −6)

28. ***Population Model*** The table shows the population of a town from 1990 through 1998. Find a quadratic model in standard form for the data. Assume that t is the number of years since 1990 and that P is measured in thousands of people.

Year, t	0	1	2	3	4	5	6	7	8
Population, P	23.2	24	26.5	27.2	27.1	27.3	26.8	25.9	24.4

29. ***Voter Turn-out*** The table shows the percentage of eligible voters that participated in presidential elections from 1964 through 1992. Find a quadratic model in standard form for the data. Assume that t is the number of years since 1964.

Year, t	0	4	8	12	16	20	24	28
Percent voted, V	69.3	67.8	63.0	59.2	59.2	59.9	57.4	61.3

LESSON 5.8

NAME _____ DATE _____

Practice C

For use with pages 306–312

Write a quadratic function in vertex form whose graph has the given vertex and passes through the given point.

1. vertex: $(1, 3)$
   point: $(2, 5)$
2. vertex: $(-6, -2)$
   point: $(-4, -14)$
3. vertex: $(2, -5)$
   point: $(5, -2)$
4. vertex: $\left(-3, \frac{1}{2}\right)$
   point: $\left(-2, \frac{9}{10}\right)$
5. vertex: $\left(\frac{1}{3}, 5\right)$
   point: $\left(1, \frac{41}{9}\right)$
6. vertex: $\left(-\frac{1}{2}, \frac{3}{2}\right)$
   point: $(1, 3)$

Write a quadratic function in intercept form whose graph has the given *x*-intercepts and passes through the given point.

7. x-intercepts: $-6, 7$
   point: $(2, -80)$
8. x-intercepts: $2, 4$
   point: $(5, -1)$
9. x-intercepts: $-3, -\frac{1}{2}$
   point: $(5, 11)$
10. x-intercepts: $-\frac{1}{2}, \frac{3}{4}$
    point: $\left(\frac{1}{2}, \frac{3}{10}\right)$
11. x-intercepts: $\frac{5}{8}, \frac{3}{5}$
    point: $\left(2, \frac{77}{10}\right)$
12. x-intercepts: $-\frac{2}{7}, 0$
    point: $\left(\frac{5}{7}, -\frac{5}{3}\right)$

Write a quadratic function in standard form whose graph passes through the given points.

13. $(2, 13), (3, 27), (4, 55)$
14. $(-2, -9), (0, 1), (1, 3)$
15. $(-2, 3), (2, 11), (4, 21)$
16. $\left(-2, -\frac{21}{4}\right), \left(\frac{1}{2}, \frac{1}{16}\right), (1, 0)$
17. $(-3, -13), (0, 6), (3, -11)$
18. $\left(-\frac{1}{8}, \frac{67}{64}\right), \left(1, -\frac{13}{8}\right), \left(\frac{5}{4}, -\frac{19}{16}\right)$
19. $\left(\frac{1}{2}, -\frac{23}{4}\right), (1, -2), \left(\frac{3}{2}, \frac{9}{4}\right)$
20. $\left(-1, \frac{11}{3}\right), \left(-\frac{1}{3}, 1\right), \left(\frac{2}{3}, 2\right)$
21. $\left(-\frac{1}{2}, -2\right), \left(\frac{1}{2}, 1\right), \left(\frac{3}{2}, 0\right)$

22. ***Average Fuel Consumption*** The table shows the average fuel consumption (in gallons) of a passenger car between 1970 and 1996. Use a system of equations to write a quadratic model for average fuel consumption F as a function of time t, where t is the number of years since 1970. Check your model using the quadratic regression feature of a graphing calculator.

Year, t	0	5	10	15	20	25	26
Average Fuel Consumption, F	760	695	576	559	520	530	531

23. ***Geometry*** The table shows the areas of a circle with a given radius. Use the quadratic regression feature of a graphing calculator to write a quadratic model for the area of a circle A as a function of its radius r. Round the values for a, b, and c to three decimal places. Using $A = \pi r^2$, what is a three decimal approximation of π?

Radius, r	2	3	4	5
Area, A	12.5664	28.2743	50.2655	78.5398

LESSON 5.8

NAME _____ DATE _____

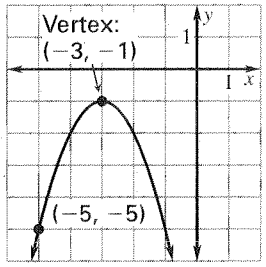
Reteaching with Practice

For use with pages 306–312

GOAL **Write quadratic functions given certain characteristics of their graphs**

EXAMPLE 1 Writing a Quadratic Function in Vertex Form

Write a quadratic function for the parabola shown.



SOLUTION

Since you are given the vertex, use the vertex form $y = a(x - h)^2 + k$. Substitute the values for the vertex to get $y = a(x + 3)^2 - 1$. Use the given point $(-5, -5)$ to find a.

$-5 = a(-5 + 3)^2 - 1$ Substitute -5 for x and -5 for y.

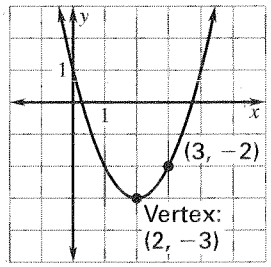
$-5 = 4a - 1$ Simplify.

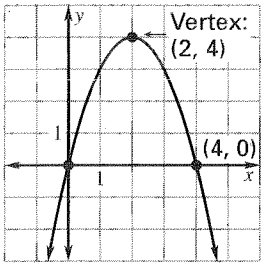
$-1 = a$ Solve for a.

A quadratic function for the parabola is $y = -(x + 3)^2 - 1$.

Exercises for Example 1

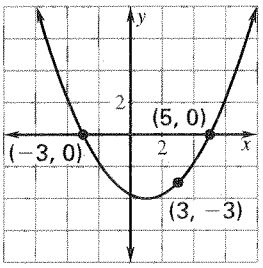
Write a quadratic function in vertex form.

1. 

2. 

EXAMPLE 2 Writing a Quadratic Function in Intercept Form

Write a quadratic function for the parabola shown.



SOLUTION

Since you are given the x-intercepts, use the intercept form $y = a(x - p)(x - q)$. Substitute the values for the x-intercepts to get $y = a(x + 3)(x - 5)$.

Use the given point $(1, -4)$ to find a.

$-4 = a(1 + 3)(1 - 5)$ Substitute 1 for x and -4 for y.

$-4 = -16a$ Simplify.

$\frac{1}{4} = a$ Solve for a.

The quadratic function for the parabola is $y = \frac{1}{4}(x + 3)(x - 5)$.

Lesson 5.8

NAME _____ DATE _____

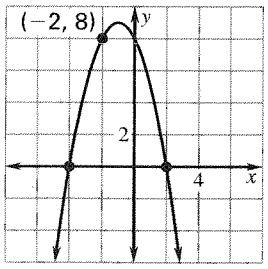
Reteaching with Practice

For use with pages 306–312

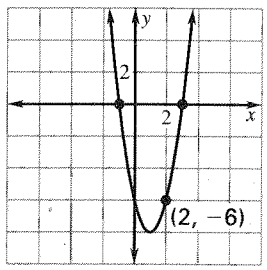
Exercises for Example 2

Write a quadratic function in intercept form.

3.



4.



EXAMPLE 3 Finding a Quadratic Model for a Data Set

Write a quadratic function which contains the data $(0, -6)$, $(-2, 8)$, and $(5, -6)$.

SOLUTION

Substitute the coordinates of the points into the model $y = ax^2 + bx + c$ to obtain a system of three linear equations.

$(0, -6) \rightarrow 0a + 0b + c = -6$

$(-2, 8) \rightarrow 4a - 2b + c = 8$

$(5, -6) \rightarrow 25a + 5b + c = -6$

From the first equation, you can conclude that $c = -6$.

Solve the remaining system of two linear equations in two variables.

The solution is $a = 1$ and $b = -5$.

Substitute the values for a, b, and c into the model $y = ax^2 + bx + c$.

The quadratic model for the data is $y = x^2 - 5x - 6$.

Exercises for Example 3

Write the quadratic functions containing the data.

5. $(1, 3), (-3, -5), (0, -2)$

6. $(0, -6), (-1, -5), (-2, 4)$

LESSON 5.8

NAME _____ DATE _____

Quick Catch-Up for Absent Students

For use with pages 306–312

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

Lesson 5.8: Modeling with Quadratic Functions

____ **Goal 1:** Write quadratic functions given characteristics of their graphs. (pp. 306–307)

Material Covered:

____ Example 1: Writing a Quadratic Function in Vertex Form

____ Example 2: Writing a Quadratic Function in Intercept Form

____ Activity: Writing a Quadratic Function in Standard Form

____ Student Help: Look Back

____ Example 3: Finding a Quadratic Model for a Data Set

____ **Goal 2:** Use technology to find quadratic models for real-life data. (p. 308)

Material Covered:

____ Student Help: Keystroke Help

____ Example 4: Using Quadratic Regression to Find a Model

Vocabulary:

best-fitting quadratic model, p. 308

____ Other (specify) _____

_____

Homework and Additional Learning Support

____ Textbook (specify) pp. 309–312 _____

_____

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

____ *Personal Student Tutor* for Lesson 5.8

Lesson 5.8

LESSON 5.8

NAME _____ DATE _____

Interdisciplinary Application

For use with pages 306–312

The Anasazi Indians

HISTORY Arizona, Utah, Colorado, and New Mexico meet at a place called The Four Corners. The Anasazi Indians lived in this area from about 1 A.D. to 1300 A.D. They farmed this desert area with great success.

The Anasazi are recognized for their amazing ability to build structures. The buildings ranged from simple one-room dwellings to multi-story buildings called pueblos. Some of the most famous Anasazi structures are the cliff dwellings found in Mesa Verde National Park in Colorado.

In Exercises 1–4, use the following information.

The largest multi-story building built by the Anasazi Indians is called the *Pueblo Bonito*. The shape of its foundation is nearly parabolic, with a straight base of about 500 feet and a height of about 300 feet.

1. Sketch the foundation of the building on a coordinate plane with the base on the x-axis and the y-axis bisecting the foundation. The y-intercept is $(0, -300)$.
2. Find the x-intercepts.
3. Substitute the three points from Exercises 1 and 2 into the model $y = ax^2 + bx + c$ to obtain a system of linear equations.
4. Solve the linear system to find a quadratic model for the data.

LESSON 5.8

NAME _____ DATE _____

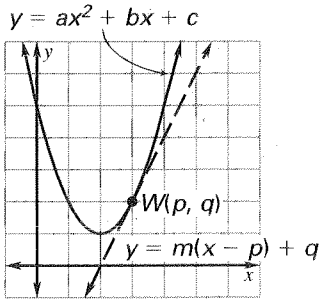
Challenge: Skills and Applications

For use with pages 306–312

In Exercises 1–2, find all possible equations of the parabolas described.

1. The parabola is tangent to the x-axis, has y-intercept 18, and passes through the point (2, 8). (2 possibilities)
2. The vertex of the parabola is on the line $y = 20$, the y-intercept is 15, and 3 is a zero of the equation of the parabola. (2 possibilities)

3. A *tangent* to a parabola is a line, like the one shown in the diagram, that intersects the parabola in only one point.



   a. In order to find an equation of the tangent line, consider the parabola $y = ax^2$. Write the equation of the tangent line at $W(p, ap^2)$ as $y = m(x - p) + ap^2$. By substituting the expression for y from the equation of the parabola into the equation for the tangent line, write an equation involving only x, p, q, and m.

   b. In order for the line to be a tangent, the equation you wrote in part (a) must have only one real solution for x. Use this fact to write an equation involving the discriminant of that equation.

   c. Solve the discriminant equation that you wrote in part (b) for m. This is the slope of the tangent line at (p, ap^2).

   d. In general, the slope of the tangent line to the parabola $y = ax^2 + bx + c$ at $x = p$ is $2ap + b$. Use this fact to find the equation of the parabola passing through (2, 1) and whose tangent line at $x = p$ has slope $12p + 5$.

4. Use the method of Problem 3 to find the equation of the parabola whose tangent line at (2, 11) has slope 3 and which passes through $(-1, 8)$. (*Hint:* Use the fact stated in part (d) of Problem 3.)
5. Suppose the parabola $y = ax^2 + bx + c$ passes through both of the points $(3, -1)$ and $(7, -1)$. Use this information to solve for b and c in terms of a, and write the equation of the parabola in terms of x, y, and a only. (*Hint:* Find the axis of the parabola.)

CHAPTER 5

NAME _____ DATE _____

Chapter Review Games and Activities

For use after Chapter 5

Graph the following equations on the same set of axes to form an interesting portrait. Do it first without the domain restrictions, and then using the domain restrictions.

1. $y = x^2 - 10x + 31$ for $2 \leq x \leq 8$
2. $y = -x^2 + 10x - 18$ for $2 \leq x \leq 8$
3. $y = \frac{1}{2}x^2 - 3x + \frac{15}{2}$ for $2.5 \leq x \leq 5$
4. $y = \frac{1}{2}x^2 - 7x + \frac{55}{2}$ for $5 \leq x \leq 7.5$
5. $y = -4x^2 + 32x - 62$ for $3 \leq x \leq 5$
6. $y = -4x^2 + 48x - 142$ for $5 \leq x \leq 7$
7. $y = \frac{1}{4}x^2 - \frac{5}{2}x + \frac{17}{4}$ for $3 \leq x \leq 7$