LESSON 3.3

TEACHER'S NAME ______________ CLASS ______ ROOM ______ DATE ______

Lesson Plan

1-day lesson (See *Pacing the Chapter,* TE pages 136C–136D) **For use with pages 156–162**

GOALS
1. **Graph a system of linear inequalities to find the solutions of the system.**
2. **Use systems of linear inequalities to solve real-life problems.**

State/Local Objectives ______________

____

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

STARTING OPTIONS
____ Homework Check: TE page 152; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 156 and 155, CRB page 39, or Transparencies

TEACHING OPTIONS
____ Motivating the Lesson: TE page 157
____ Lesson Opener (Activity): CRB page 40 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 41
____ Examples 1–3: SE pages 157–158
____ Extra Examples: TE pages 157–158 or Transparencies
____ Closure Question: TE page 158
____ Guided Practice Exercises: SE page 159

APPLY/HOMEWORK
Homework Assignment
____ Basic 12–14, 16–32 even, 40–46 even, 51, 60–61, 67–77 odd
____ Average 12–46 even, 51–54, 59–61, 67–77 odd
____ Advanced 12–50 even, 51–55, 59–65, 67–77 odd

Reteaching the Lesson
____ Practice Masters: CRB pages 42–44 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 45–46 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson
____ Cooperative Learning Activity: CRB page 48
____ Applications (Interdisciplinary): CRB page 49
____ Challenge: SE page 162; CRB page 50 or Internet

ASSESSMENT OPTIONS
____ Checkpoint Exercises: TE pages 157–158 or Transparencies
____ Daily Homework Quiz (3.3): TE page 162, CRB page 53, or Transparencies
____ Standardized Test Practice: SE page 162; TE page 162; STP Workbook; Transparencies

Notes ______________

____

____

LESSON 3.3

TEACHER'S NAME ______________________ CLASS ______ ROOM ______ DATE ______

Lesson Plan for Block Scheduling

Half-day lesson (See *Pacing the Chapter,* TE pages 136C–136D) **For use with pages 156–162**

GOALS

1. Graph a system of linear inequalities to find the solutions of the system.
2. Use systems of linear inequalities to solve real-life problems.

State/Local Objectives ______________________

____

____

CHAPTER PACING GUIDE	
Day	**Lesson**
1	3.1 (all)
2	3.2 (all)
3	**3.3 (all)**; 3.4(all)
4	3.5 (all); 3.6 (all)
5	Review/Assess Ch. 3

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

STARTING OPTIONS

____ Homework Check: TE page 152; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 156 and 155, CRB page 39, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 157
____ Lesson Opener (Activity): CRB page 40 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB page 41
____ Examples 1–3: SE pages 157–158
____ Extra Examples: TE pages 157–158 or Transparencies
____ Closure Question: TE page 158
____ Guided Practice Exercises: SE page 159

APPLY/HOMEWORK

Homework Assignment (See also the assignment for Lesson 3.4.)

____ Block Schedule: 12–46 even, 51–54, 59–61, 67–77 odd

Reteaching the Lesson

____ Practice Masters: CRB pages 42–44 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 45–46 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Cooperative Learning Activity: CRB page 48
____ Applications (Interdisciplinary): CRB page 49
____ Challenge: SE page 162; CRB page 50 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 157–158 or Transparencies
____ Daily Homework Quiz (3.3): TE page 162, CRB page 53, or Transparencies
____ Standardized Test Practice: SE page 162; TE page 162; STP Workbook; Transparencies

Notes ______________________

____

____

LESSON 3.3

NAME ______________________ DATE __________

Available as a transparency

Warm-Up Exercises

For use before Lesson 3.3, pages 156–162

1. The admission to a carnival is $5.00. Each ride is $0.40. You can spend no more than $12. Write and solve an inequality to find the number of rides you can go on.

2. Graph $2x - y > 2$ in the coordinate plane.

Daily Homework Quiz

For use after Lesson 3.2, pages 147–155

1. Use substitution to solve.

   $x + 5y = 33$

   $4x + 3y = 13$

2. Use the linear combination method to solve.

   $-2x + 3y = -13$

   $6x + 2y = 28$

3. A tank was being filled with water at the rate of 1.5 gal/min. By 10 A.M., it contained 50 gal. Several minutes later, the water going into the tank was turned off, the plug was pulled, and the tank was drained at the rate of 2.3 gal/min. The tank was empty at 11:08 A.M. How many minutes did it take to drain the tank?

Lesson 3.3

NAME ______________________________ DATE ________

Activity Lesson Opener

For use with pages 156–162

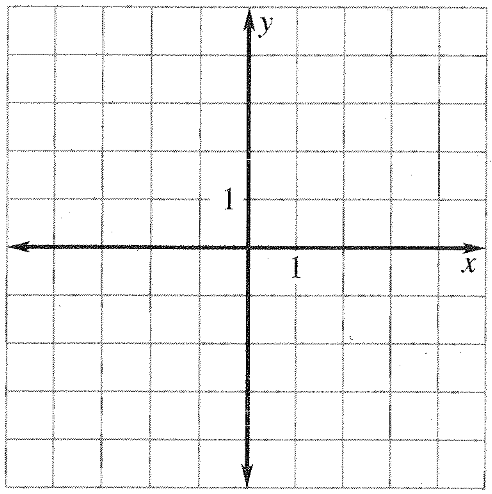
SET UP: Work with a partner.

YOU WILL NEED: • red, green, and blue colored pencils

1. Graph the following system of equations.

$2x + 3y = 6$

$x - 2y = 2$



2. Decide whether the ordered pair is a solution to the linear inequality. If it is, write yes. If not, write no.

	(0, 0)	(2, 3)	(3, −1)	(4, 0)	(−3, 4)
$2x + 3y \leq 6$					
$x - 2y \leq 2$					

3. Plot each point from the table on the graph above. If the point is a solution to both inequalities, plot it with a red pencil. If it is a solution to neither, plot it with a blue pencil. If it is a solution to only one, plot it with a green pencil.

4. Finish the system of inequalities by using a red pencil to shade the region that includes solutions to both inequalities.

LESSON 3.3

NAME ______________________ DATE __________

Graphing Calculator Activity Keystrokes

For use with page 161

For Exercises 52–54

TI-82

Y= 3.7 X,T,θ + 91 ENTER

4.9 X,T,θ + 119 ENTER

WINDOW ENTER 0 ENTER 20

ENTER 1 ENTER 90 ENTER 240

ENTER 10 ENTER

2nd [QUIT] CLEAR 2nd [DRAW] 7 2nd

[Y-VARS] 11 , 2nd [Y-VARS]1 2) ENTER

TRACE

Because 6 feet is 14 inches more than 4 feet 10 inches, move the trace cursor using ◀ or ▶ to $x \approx 14$. Find the corresponding value of y on each boundary line (use ▼ or ▲ to move to the other boundary line).

TI-83

Y= 3.7 X,T,θ,n + 91 ENTER

4.9 X,T,θ,n + 119 ENTER

WINDOW 0 ENTER 20 ENTER 1

ENTER 90 ENTER 240 ENTER 10

ENTER 1 ENTER

2nd [QUIT] CLEAR 2nd [DRAW] 7 VARS ▶ 11

, VARS ▶ 1 2) ENTER

TRACE

Because 6 feet is 14 inches more than 4 feet 10 inches, move the trace cursor using ◀ or ▶ to $x \approx 14$. Find the corresponding value of y on each boundary line (use ▼ or ▲ to move to the other boundary line).

SHARP EL-9600C

Y= 3.7 X/θ/T/n + 91 ENTER

4.9 X/θ/T/n + 119 ENTER

WINDOW 0 ENTER 20 ENTER 1

ENTER 90 ENTER 240 ENTER 10

ENTER

2ndF [QUIT] CL 2ndF [DRAW] [G] 1

Use the − key to select Y1 ENTER ▶

Use the − key to select Y2 ENTER

TRACE

Because 6 feet is 14 inches more than 4 feet 10 inches, move the trace cursor using ◀ or ▶ to $x \approx 14$. Find the corresponding value of y on each boundary line (use ▼ or ▲ to move to the other boundary line).

CASIO CFX-9850GA PLUS

From the main menu, select GRAPH.

F3 F6 F3 3.7 X,θ,T + 91 EXE

F3 F6 F4 4.9 X,T,θ + 119 EXE

SHIFT F3 0 EXE 20 EXE 1 EXE 90

EXE 240 EXE 10 EXE EXIT F6

F1

Because 6 feet is 14 inches more than 4 feet 10 inches, move the trace cursor using ◀ or ▶ to $x \approx 14$. Find the corresponding value of y on each boundary line (use ▼ or ▲ to move to the other boundary line).

LESSON 3.3

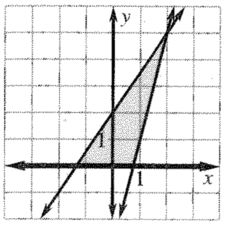
NAME ______________________________ DATE ________

Practice A

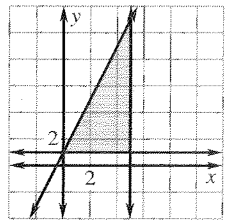
For use with pages 156–162

Tell whether the ordered pair is a solution of the system.

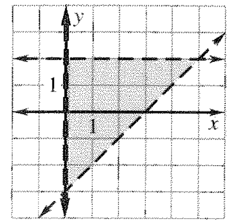
1. (0, 1)



2. (3, 2)



3. (5, 2)



Tell whether the ordered pair is a solution of the system.

4. (0, 0)
$x + y \geq 2$
$x \geq 0$

5. (1, 1)
$2x - y < 1$
$x + y \geq 2$

6. (1, 2)
$2x + y < 4$
$x - y < 1$
$x > 0$

Give an ordered pair that is a solution of the system.

7. $2x + 3y < 5$
$x < 12$

8. $x - 3y > 3$
$y < 8$

9. $5x \leq 2y$
$x < 0$
$y > 0$

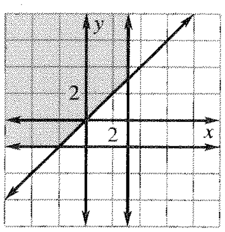
Match the system of linear inequalities with its graph.

10. $y \leq x$
$y \geq -2$
$x \leq 3$

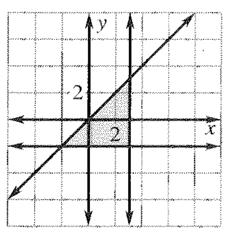
11. $y \geq x$
$y \geq -2$
$x \leq 3$

12. $y \leq x$
$y \leq -2$
$x \leq 3$

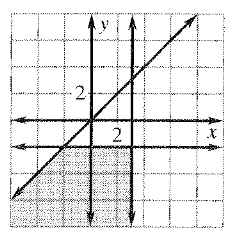
A.



B.



C.



Lesson 3.3

Graph the system of linear inequalities.

13. $x > -4$
$y < 2$

14. $x \geq 0$
$y \leq x + 2$

15. $-2x + y < 1$
$y \geq 2$

Distance Traveled **In Exercises 16 and 17, use the following information.**
You are taking a trip with your family. You are going to share driving time with your dad. You are only allowed to drive for at most two hours at one time. The speed limit on the highway on which you are traveling is 65 miles per hour.

16. Write a system of inequalities that describes the number of hours and miles you might possibly drive.

17. Is it possible for you to have driven 200 miles?

LESSON **3.3**

NAME ______________________________ DATE ________

Practice B

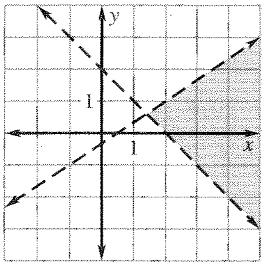
For use with pages 156–162

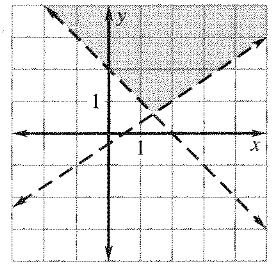
Match the system of linear inequalities with its graph.

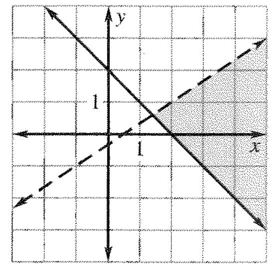
1. $x + y > 2$
$2x - 3y < 1$

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

3. $x + y > 2$
$2x - 3y > 1$

A.


B.


C.


Graph the system of linear inequalities.

4. $x > -2$
$y \leq 4$

5. $y < 2$
$y > -3$

6. $y \geq 0$
$x < 5$

7. $x + y < 3$
$2x - y > 5$

8. $y \leq 2x$
$x < 3$

9. $2x + y \leq -1$
$y > 3x$

10. $x + 2y > 4$
$x - 3y < 1$

11. $y \leq 5$
$x > -3$
$y \leq 2x - 2$

12. $x \geq -3$
$x \leq 4$
$y < x + 5$

13. $y > \frac{1}{2}x - 4$
$y \leq -x + 3$
$y \leq 2x$

14. $x + y < 1$
$2x - y < 4$
$x \geq -2$

15. $y \geq 3x - 4$
$y \leq -\frac{1}{2}x + 3$
$x > -2$

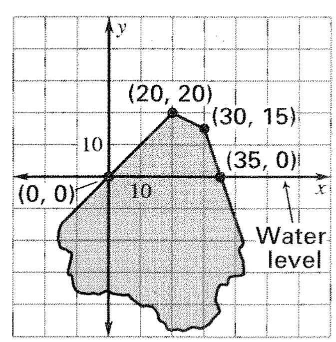
16. $2x + y < 3$
$x - y > -6$
$y \geq 0$

17. $x + 2y \leq 10$
$2x + y \leq 8$
$2x - 5y < 20$

18. $-2x + y > 1$
$x + 2y < 4$
$x - 2y > -4$

19. ***Field Trip*** Your class has rented buses for a field trip. Each bus seats 44 passengers. The rental company's policy states that you must have at least 3 adult chaperones on each bus. Let x represent the number of students on each bus. Let y represent the number of adult chaperones on each bus. Write a system of linear inequalities that shows the various numbers of students and chaperones that could be on each bus. (Each bus may or may not be full.)

20. ***Iceberg*** The diagram at the right shows the cross section of an iceberg. Write a system of inequalities that represents the portion of the iceberg that extends above the water.



Lesson 3.3

LESSON **3.3**

NAME ______________________________ DATE __________

Practice C

For use with pages 156–162

Lesson 3.3

Graph the system of linear inequalities.

1. $x + 2y < 4$
$-3x + y > 1$

2. $2x - 3y \geq 6$
$x + 4y \leq 8$

3. $-3x + y < 0$
$3x + 4y > 8$

4. $2x + y < 3$
$x - y < 0$
$x > -3$

5. $x + y \leq 2$
$3x - y \geq 4$
$y \geq -4$

6. $2x - y < 1$
$x + 3y < 6$
$x > 0$

7. $x - y > -3$
$-x + 2y > 4$
$x + y < 4$

8. $2x - y \geq -2$
$2x + y \leq 1$
$x + 3y \geq -3$

9. $3x + 6y > 4$
$3x - 4y > 4$
$x - y < 5$

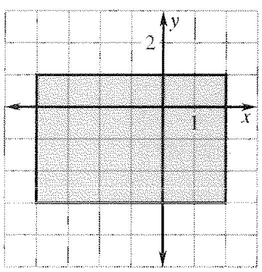
10. $-2x + y < 3$
$x + y > -1$
$x \geq 0$
$x < 2$

11. $-x + y \leq 1$
$-x + 2y \geq 2$
$x + y \leq 4$
$x \geq 1$

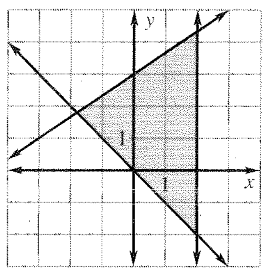
12. $x + y < 2$
$x + y > -3$
$2x - 3y > 0$
$2x - 3y < 9$

Write a system of linear inequalities for the shaded region.

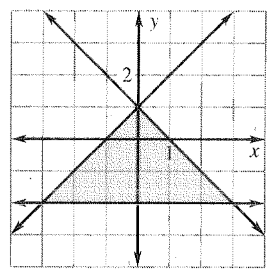
13.



14.



15.



16. ***Toddler Nutrition*** Each day the average toddler needs to consume 900 to 1700 calories. At most 30% of a toddler's total calories should come from fat. Write and graph a system of linear inequalities describing the number of fat calories F and total calories C for the diet of a toddler. According to your model, is a toddler following a healthy diet if he or she consumes 1200 calories a day and 372 of those calories are from fat?

17. ***Weighted Averages*** To determine your grade in science class, your teacher uses a weighted average. Your grade is a combination of quiz and test scores. There are a total of 200 quiz points and 200 test points. Your grade is calculated by adding $\frac{1}{5}$ of your quiz points to $\frac{3}{10}$ of your test points. To receive a B your weighted total must be less than 90 and at least 80. Write and graph a system of inequalities describing the possible combination of quiz and test points that you can earn to receive a B.

LESSON 3.3

NAME ______________________________ DATE __________

Reteaching with Practice

For use with pages 156–162

GOAL **Graph a system of linear inequalities to find the solutions of the system and use systems of linear inequalities to solve real-life problems**

VOCABULARY

A **system of linear inequalities** is two or more linear inequalities in the same variables and is also called a system of inequalities.

A **solution** of a system of linear inequalities is an ordered pair that is a solution of each inequality in the system.

The **graph** of a system of linear inequalities is the graph of all solutions of the system.

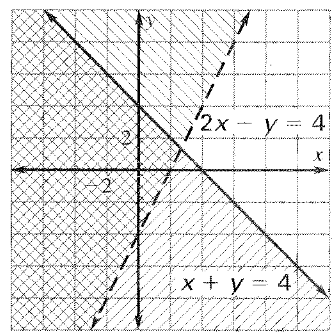
EXAMPLE 1 *Graphing a System of Two Inequalities*

Graph the system. $x + y \le 4$ **Inequality 1**

$2x - y < 4$ **Inequality 2**

SOLUTION

Begin by graphing the line $x + y = 4$ with a solid line. Shade the half-plane that satisfies $x + y \le 4$, which is below the line. Next, graph the line $2x - y = 4$ with a dashed line. Shade the half-plane that satisfies $2x - y < 4$, which is to the left of the line. The graph of the system is the region shaded by both inequalities.



Exercises for Example 1

Graph the system of linear inequalities.

1. $x \ge -2$
$x < 3$

2. $y + 2 < 2x$
$y < x + 6$

3. $y \le 4$
$x > -1$

EXAMPLE 2 *Graphing a System of Three Inequalities*

Graph the system. $x + y < -1$ **Inequality 1**

$x < 2$ **Inequality 2**

$y \ge 0$ **Inequality 3**

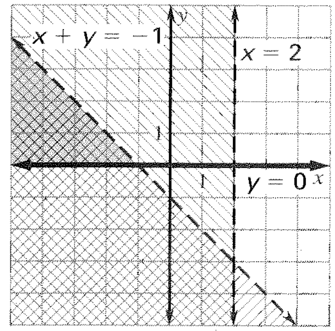
NAME ______________________________ DATE ____________

Reteaching with Practice

For use with pages 156–162

SOLUTION

Begin by graphing the line $x + y = -1$ with a dashed line. Shade the half-plane that satisfies $x + y < -1$, which is to the left of the line. Next, graph the vertical line $x = 2$ with a dashed line. Shade the half-plane that satisfies $x < 2$, which is to the left of the line. The inequality $y \geq 0$ restricts the solutions to the second quadrant. The graph of the system is the triangular region shown.



Exercises for Example 2

Graph the system of linear inequalities.

4. $3x + y \leq 5$
$y \geq 1$
$x \leq 1$

5. $x + 2y \leq 6$
$x - y \geq 3$
$x \geq 0$

6. $x + y > 2$
$y \leq 2$
$x \geq 2$

EXAMPLE 3 *Writing and Using a System of Inequalities*

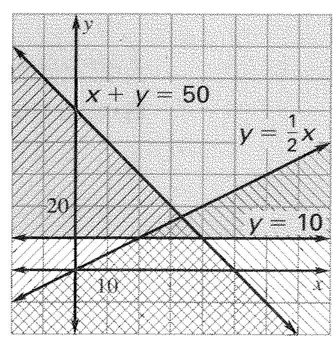
A store sells two brands of CD players. To meet customer demands, it is necessary to stock at least twice as many CD players of brand A as of brand B. It is also necessary to have at least 10 of brand B available. In the store there is room for no more than 50 players. Write and graph a system of inequalities to describe the ways to stock the two brands.

SOLUTION

Let x represent brand A and y represent brand B. From the given information, you can write the following three inequalities.

$x \geq 2y$	Brand A must be at least twice brand B.
$y \geq 10$	There must be at least 10 of brand B.
$x + y \leq 50$	The total can at most be 50.

The graph of the system is shown to the right.



Exercises for Example 3

Write and graph a system of linear inequalities to describe the problem.

7. An arena contains 1200 seats. For an upcoming concert, tickets will be priced \$12.00 for some seats and \$10.00 for others. At least 500 tickets are to be priced at \$10.00, and the total sales must be at least \$7200 to make a profit. What are the possible ways to price the tickets?

LESSON 3.3

NAME ______________________ DATE __________

Quick Catch-Up for Absent Students

For use with pages 156–162

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

Lesson 3.3: Graphing and Solving Systems of Linear Inequalities

____ **Goal 1**: Graph a system of linear inequalities to find the solution to the system. (pp. 156–157)

Material Covered:

____ Activity: Investigating Graphs of Systems of Inequalities

____ Student Help: Look Back

____ Example 1: Graphing a System of Two Inequalities

____ Student Help: Study Tip

____ Example 2: Graphing a System of Three Inequalities

Vocabulary:

system of linear inequalities in two variables, p. 156
solution of a system of linear inequalities, p. 156
graph of a system of linear inequalities, p. 156

____ **Goal 2**: Use systems of linear inequalities to solve real-life problems. (p. 158)

Material Covered:

____ Example 3: Writing and Using a System of Inequalities

____ Other (specify) ______________________

____

Homework and Additional Learning Support

____ Textbook (specify) pp. 159–162

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

____ *Personal Student Tutor* for Lesson 3.3

Lesson 3.3

NAME ______________________ DATE ________

Cooperative Learning Activity

For use with pages 156–162

GOAL **To analyze a person's heart rate after exercising**

Materials: a watch with a second hand; a stethoscope (optional)

Background

A person's theoretical maximum heart rate is $220 - x$, where x is the person's age in years. When a person exercises, it is recommended that the person strive for a heart rate that is at least 70% of the maximum and at most 85% of the maximum.

Instructions

1. Working in pairs, have one member of your group measure the heart rate after the other member exercises.
2. Have the exerciser run in place for 60 seconds.
3. Measure the heart rate by
   - **a.** placing the stethoscope over the heart for 15 seconds, counting the beats, and then multiply by 4 or
   - **b.** using a watch with a second hand. Find a pulse along their throat under their chin using the index finger and the middle finger. Count the beats for 15 seconds, then multiply by 4.

Analyzing the Results

1. Determine the recommended heart rates when exercising for each person in your group. Which members of your group reached their recommended heart rates?
2. What would happen if you used a different exercise (push ups, sit-ups, running laps)?

NAME ______________________ DATE __________

Interdisciplinary Applications

For use with pages 156–162

Fashion Merchandising

BUSINESS A person who earns a degree in fashion merchandising can choose from several types of jobs. Some of these employment possibilities include buyer, fashion or bridal consultant, store manager, small business owner, personal shopper, advertising and publicity, and sales and marketing. Other opportunities in the field require less business knowledge but more creativity, such as clothing design.

Students pursuing a fashion merchandising degree have to take a variety of courses. Most fashion merchandising students must take courses in business, economics, communication, marketing, psychology, and mathematics. Additionally, students must also take classes in design, photography, art, history, and consumer and commercial law.

Most programs also give students the opportunity to do some on-the-job training in their field by interning with a company in addition to their classes. This allows students to earn credit and sometimes a paycheck.

In Exercises 1–4, use the following information.

You are buying two types of clothing to sell in your clothing store: T-shirts and sweatshirts. You have \$1250 in your budget to spend on purchasing the clothing, and you want to buy no more than 100 T-shirts and sweatshirts. One T-shirt costs \$8 and one sweatshirt costs \$15.

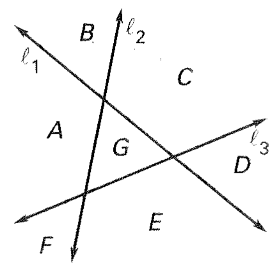
1. Let x be the number of T-shirts and let y be the number of sweatshirts you are buying. Write a system of inequalities for the possible number of T-shirts and sweatshirts you can buy.
2. Graph the system you wrote in Exercise 1.
3. Use your graph from Exercise 2 to determine if it is possible to buy 80 T-shirts and 50 sweatshirts.
4. Use your graph from Exercise 2 to determine the range of the possible number of sweatshirts you can buy if you purchase 36 T-shirts.

NAME ______________________ DATE __________

Challenge: Skills and Applications

For use with pages 156–162

1. Suppose you draw n lines, $\ell_1, \ell_2, \ldots, \ell_n$, in a plane so that no three of the lines have a common point and no two lines are parallel. The diagram illustrates the case for $n = 3$, with the different regions lettered $A, B, C, \ldots, G$.



   a. How many regions will be formed for each of the following values of n: 1, 2, 3, 4, 5?

   b. According to the conditions above, every new line you add must intersect every existing line (in one point). Suppose there are n lines already drawn and you add a new one. In terms of n, how many intersection points will there be on the new line? How many existing regions does the new line pass through?

   c. Write, in terms of n, a sum that gives the number of regions created by n lines. Use " . . . " to stand for missing terms if you don't know how many there are. (*Hint:* Each existing region that a new line passes through is split into two new regions.)

2. On the planet Zork, transportation vehicles can run only north and south or east and west. (They cannot go "diagonally.")

   a. Suppose Ilyria, an important city on Zork, is laid out in a coordinate system. Express the distance d that a transportation vehicle must travel to get from a point (x_1, y_1) in the coordinate system and another point (x_2, y_2), in terms of the coordinates of these points. (*Hint:* Use absolute value.)

   b. Transportation vehicles can travel a distance of 5 units without refueling. Suppose the center of Ilyria is at (1, 3) in the coordinate system. Graph the points that a transportation vehicle can reach without refueling.

   c. *Without using absolute values,* write a system of inequalities whose solution is precisely the set of points you graphed in part (b).

LESSON 3.4

TEACHER'S NAME ______________________ CLASS ______ ROOM ______ DATE ______

Lesson Plan

1-day lesson (See *Pacing the Chapter,* TE pages 136C–136D) **For use with pages 163–169**

GOALS

1. **Solve linear programming problems.**
2. **Use linear programming to solve real-life problems.**

State/Local Objectives ____

____

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

STARTING OPTIONS

____ Homework Check: TE page 159; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 163 and 162, CRB page 53, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 164
____ Lesson Opener (Graphing Calculator): CRB page 54 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB pages 55–56
____ Examples 1–3: SE pages 164–165
____ Extra Examples: TE pages 164–165 or Transparencies
____ Closure Question: TE page 165
____ Guided Practice Exercises: SE page 166

APPLY/HOMEWORK

Homework Assignment

____ Basic 9–17 odd, 25–26, 29–47 odd; Quiz 2: 1–7
____ Average 9–23 odd, 25–26, 29–47 odd; Quiz 2: 1–7
____ Advanced 9–23 odd, 25–26, 29–47 odd; Quiz 2: 1–7

Reteaching the Lesson

____ Practice Masters: CRB pages 57–59 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 60–61 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Real-Life): CRB page 63
____ Math & History: SE page 169; CRB page 64; Internet
____ Challenge: SE page 168; CRB page 65 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 164–165 or Transparencies
____ Daily Homework Quiz (3.4): TE page 168, CRB page 69, or Transparencies
____ Standardized Test Practice: SE page 168; TE page 168; STP Workbook; Transparencies
____ Quiz (3.3–3.4): SE page 169; CRB page 66

Notes ____

____

____

LESSON 3.4

TEACHER'S NAME ______________________ CLASS _______ ROOM ______ DATE ______

Lesson Plan for Block Scheduling

Half-day lesson (See *Pacing the Chapter,* TE pages 136C–136D) **For use with pages 163–169**

GOALS
1. **Solve linear programming problems.**
2. **Use linear programming to solve real-life problems.**

State/Local Objectives ______________________________________

____

____

CHAPTER PACING GUIDE	
Day	**Lesson**
1	3.1 (all)
2	3.2 (all)
3	3.3 (all); **3.4(all)**
4	3.5 (all); 3.6 (all)
5	Review/Assess Ch. 3

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

STARTING OPTIONS

____ Homework Check: TE page 159; Answer Transparencies
____ Warm-Up or Daily Homework Quiz: TE pages 163 and 162, CRB page 53, or Transparencies

TEACHING OPTIONS

____ Motivating the Lesson: TE page 164
____ Lesson Opener (Graphing Calculator): CRB page 54 or Transparencies
____ Graphing Calculator Activity with Keystrokes: CRB pages 55–56
____ Examples 1–3: SE pages 164–165
____ Extra Examples: TE pages 164–165 or Transparencies
____ Closure Question: TE page 165
____ Guided Practice Exercises: SE page 166

APPLY/HOMEWORK

Homework Assignment (See also the assignment for Lesson 3.3.)

____ Block Schedule: 9–23 odd, 25–26, 29–47 odd; Quiz 2: 1–7

Reteaching the Lesson

____ Practice Masters: CRB pages 57–59 (Level A, Level B, Level C)
____ Reteaching with Practice: CRB pages 60–61 or Practice Workbook with Examples
____ Personal Student Tutor

Extending the Lesson

____ Applications (Real Life): CRB page 63
____ Math & History: SE page 169; CRB page 64; Internet
____ Challenge: SE page 168; CRB page 65 or Internet

ASSESSMENT OPTIONS

____ Checkpoint Exercises: TE pages 164–165 or Transparencies
____ Daily Homework Quiz (3.4): TE page 168, CRB page 69, or Transparencies
____ Standardized Test Practice: SE page 168; TE page 168; STP Workbook; Transparencies
____ Quiz (3.3–3.4): SE page 169; CRB page 66

Notes ______________________________________

____

____

Lesson 3.4

LESSON **3.4**

NAME ______________________ DATE __________

Available as a transparency

WARM-UP EXERCISES

For use before Lesson 3.4, pages 163–169

Solve each linear system.

1. $x = 2$

$x + y = 5$

2. $x - 2y = 5$

$-x + y = -1$

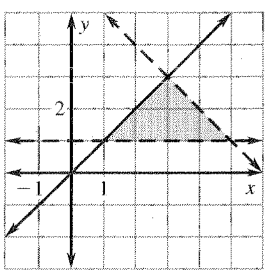
3. $2x + 3y = 8$

$x - 6y = -6$

DAILY HOMEWORK QUIZ

For use after Lesson 3.3, pages 156–162

1. Name all the solutions of the system that have integer coordinates.



Graph each system.

2. $-x + 2y < 3$

$3x + y \leq 7$

3. $y \geq -2$

$2x + 3y > 1$

$y \leq 2x + 4$

Lesson 3.4

NAME ______________________ DATE __________

Available as a transparency

Graphing Calculator Lesson Opener

For use with pages 163–169

Your class plans to raise money by selling T-shirts and caps. The plan is to buy the T-shirts for \$8 and sell them for \$12 and to buy the caps for \$4 and sell them for \$7. The planning committee estimates that you will not sell more than 120 items. Your class can afford to spend as much as \$800 to buy the articles.

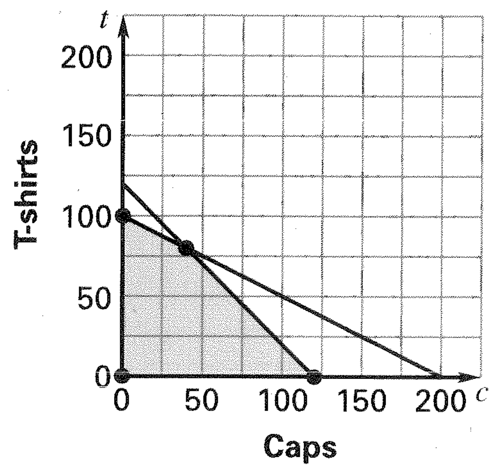
The constraints on your fund-raising activity are given by a system of inequalities whose graph is shown.

$c + t \leq 120$

$4c + 8t \leq 800$

$c \geq 0$

$t \geq 0$



Your class can only sell combinations of T-shirts and caps indicated by points which are solutions to the system.

1. Your club wants to maximize profit. Write the profit function p in terms of c and t.
2. At which point do you think the maximum value of p will occur?
3. Choose 10 points in the solution region, including all the vertices. Use the *list* feature of a graphing calculator to enter the points, with the first list representing the c-coordinates and the second list representing the t-coordinates. Next, set the cursor at the very top of the third list and enter your profit function in terms of the first list and the second list. Which combination of caps and T-shirts maximizes profit? What is the maximum profit?

LESSON 3.4

NAME ______________________________ DATE __________

Graphing Calculator Activity

For use with pages 163–169

GOAL **To find the maximum and minimum values of a linear function from a selected region of possible (x, y) values**

In this activity, you will find the maximum and minimum values for $C = 3x + 2y$ among all of the (x, y) values that satisfy each of the following inequalities.

$y \le -2x + 2$

$y \ge -2x + 6$

$y \ge 0$

$x \ge 0$

Activity

1. Graph the set of points that satisfies the four inequalities given above. This is called the feasible region.
2. Use the *Trace* feature to find all of the vertices of the feasible region. Since the region is bounded, the maximum and minimum values will each occur at one of the vertices.
3. Calculate $C = 3x + 2y$ for each of the four vertices found in Step 2. What is the maximum value? What is the minimum value?

Exercises

1. Find the maximum and minimum values for $z = 2x - 5y$ for the feasible region bounded by the following inequalities.

$y \ge -3x + 4$

$y \le -3x + 6$

$y \ge 0$

$x \ge 0$

2. Find the maximum and minimum values for $z = 10x + 8y$ for the feasible region bounded by the following inequalities.

$y \ge -4x + 1.5$

$y \le -4x + 5.5$

$y \ge 0$

$x \ge 0$

3. Find the maximum and minimum values for $z = 2x - 5y$ for the feasible region bounded by the following inequalitites.

$y \le -3x + 9$

$y \ge 0$

$x \ge 0$

Lesson 3.4

NAME ______________________________ DATE ____________

Graphing Calculator Activity

For use with pages 163–169

TI-82

Y= (-) 2 X,T,θ + 2 ENTER

(-) 2 X,T,θ + 6 ENTER

WINDOW ENTER 0 ENTER 10

ENTER 1 ENTER 0 ENTER 10

ENTER 1 ENTER

2nd [QUIT] 2nd CLEAR [DRAW] 7 2nd

[Y-VARS] 11 , 2nd [Y-VARS]1 2) ENTER

TRACE

Use the *Trace* feature to find the vertices (0, 2), (0, 6), (1, 0), and (3, 0). Evaluate $C = 3x + 2y$ at each vertex to find the maximum and minimum values.

2nd [QUIT]

3 × 0 + 2 × 2 ENTER

3 × 0 + 2 × 6 ENTER

3 × 1 + 2 × 0 ENTER

3 × 3 + 2 × 0 ENTER

TI-83

Y= (-) 2 X,T,θ,n + 2 ENTER

(-) 2 X,T,θ,n + 6 ENTER

WINDOW 0 ENTER 10 ENTER 1 ENTER 0

ENTER 10 ENTER 1 ENTER 1 ENTER

2nd [QUIT] 2nd [DRAW] [7] (-) 2

X,T,θ,n + 2 , (-) 2 X,T,θ,n + 6)

ENTER

TRACE

Use the *Trace* feature to find the vertices (0, 2), (0, 6), (1, 0), and (3, 0). Evaluate $C = 3x + 2y$ for each vertex to find the maximum and minimum values.

2nd [QUIT]

3 × 0 + 2 × 2 ENTER

3 × 0 + 2 × 6 ENTER

3 × 1 + 2 × 0 ENTER

3 × 3 + 2 × 0 ENTER

SHARP EL-9600c

Y= (-) 2 X/θ/T/n + 2 ENTER

(-) 2 X/θ/T/n + 6 ENTER

WINDOW 0 ENTER 10 ENTER 1 ENTER 0

ENTER 10 ENTER 1 ENTER

2ndF [QUIT] CL 2nd [DRAW] [G]1

Use the − key to select Y1 ENTER ▶

Use the − key to select Y2 ENTER

TRACE Use the *Trace* feature to find the vertices (0, 2), (0, 6), (1, 0), and (3, 0). Evaluate $C = 3x + 2y$ for each vertex to find the maximum and minimum values.

2ndF [QUIT]

3 × 0 + 2 × 2 ENTER

3 × 0 + 2 × 6 ENTER

3 × 1 + 2 × 0 ENTER

3 × 3 + 2 × 0 ENTER

CASIO CFX-9850GA PLUS

From the main menu, select GRAPH.

F3 F6 F3 (-) 2 X,T,θ + 2 EXE

F3 F6 F4 (-) 2 X,T,θ + 6 EXE

SHIFT F3 0 EXE 10 EXE 1 EXE 0 EXE 10

EXE 1 EXE EXIT

F6

SHIFT F1

Use the *Trace* feature to find the vertices (0, 2), (0, 6), (1, 0), and (3, 0). Evaluate $C = 3x + 2y$ for each vertex to find the maximum and minimum values.

2nd [QUIT]

3 × 0 + 2 × 2 ENTER

3 × 0 + 2 × 6 ENTER

3 × 1 + 2 × 0 ENTER

3 × 3 + 2 × 0 ENTER

LESSON 3.4

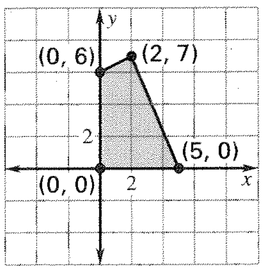
NAME ______________________________ DATE __________

Practice A

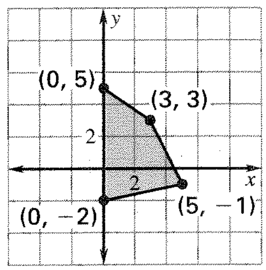
For use with pages 163–169

The feasible region determined by a system of constraints is given. Find the minimum and maximum values of the objective function for the given feasible region.

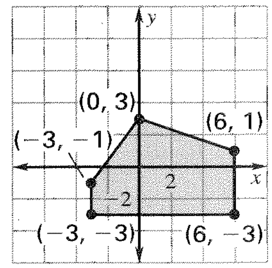
1. $C = x - y$



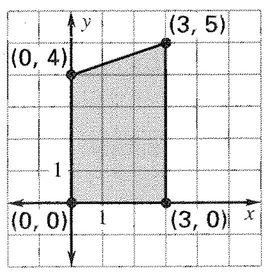
2. $C = x + 2y$



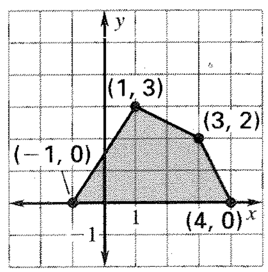
3. $C = -2x + y$



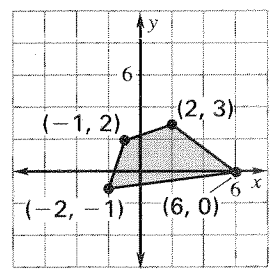
4. $C = x + 3y$



5. $C = 3x + 4y$



6. $C = 3x + 5y$



Find the minimum and maximum values of the objective function subject to the given constraints.

7. **Objective function:**
$C = 2x + y$

Constraints:
$x \geq 0$
$y \geq 0$
$x + y \leq 4$

8. **Objective function:**
$C = x + y$

Constraints:
$x \geq 0$
$x \leq 3$
$y \geq 0$
$y \leq 5$

9. **Objective function:**
$C = x - y$

Constraints:
$x \leq 0$
$y \leq 4$
$x + y \geq -1$

Breakfast Bars **In Exercises 10–13, use the following information.** Your factory makes fruit filled breakfast bars and granola bars. For each case of breakfast bars, you make \$40 profit. For each case of granola bars, you make \$55 profit. The table below shows the number of machine hours and labor hours needed to produce one case of each type of snack bar. It also shows the maximum number of hours available.

Production Hours	*Breakfast bars*	*Granola bars*	*Maximum hours*
Machine hours	2	6	150
Labor Hours	5	4	155

10. Write an equation that represents the profit (objective function).

11. Write a system of inequalities that represents the constraints.

12. Sketch the graph of the constraints found in Exercise 11 and label the vertices.

13. How many cases of each product should you make to maximize profit?

Lesson 3.4

LESSON 3.4

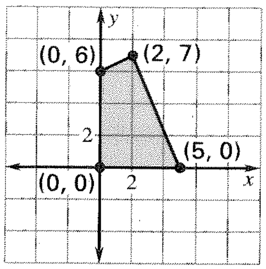
NAME ______________________________ DATE __________

Practice B

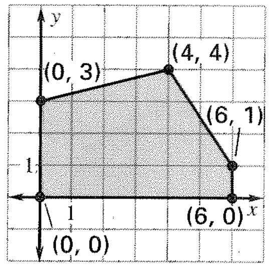
For use with pages 163–169

The feasible region determined by a system of constraints is given. Find the minimum and maximum values of the objective function for the given feasible region.

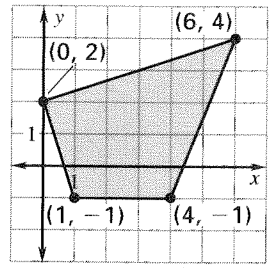
1. $C = x - y$



2. $C = 2x + 4y$



3. $C = x + 5y$



Find the minimum and maximum values of the objective function subject to the given constraints.

4. **Objective function:**
$C = 3x - y$
Constraints:
$x \geq 0$
$y \geq 0$
$2x + y \leq 6$

5. **Objective function:**
$C = 2x + 4y$
Constraints:
$x \leq 3$
$x + y \geq 3$
$2x - 3y \geq -9$

6. **Objective function:**
$C = x + 5y$
Constraints:
$3x + 2y \leq 8$
$2x - y \geq -4$
$x - 4y \leq -2$

7. **Objective function:**
$C = 4x - 3y$
Constraints:
$x \geq 0$
$x \leq 5$
$y \geq 0$
$2x - 5y \geq -15$

8. **Objective function:**
$C = 2x + 3y$
Constraints:
$x \geq 0$
$y \geq 1$
$4x + y \geq 6$
$x + 2y \geq 5$

9. **Objective function:**
$C = 5x + 2y$
Constraints:
$x \leq 4$
$2x + y \geq 3$
$x - 3y \leq -2$
$-x + 2y \leq 6$

10. ***Bakery*** A bakery is making whole-wheat bread and apple bran muffins. For each batch of bread they make \$35 profit. For each batch of muffins they make \$10 profit. The bread takes 4 hours to prepare and 1 hour to bake. The muffins take 0.5 hour to prepare and 0.5 hour to bake. The maximum preparation time available is 16 hours. The maximum baking time available is 10 hours. How many batches of bread and muffins should be made to maximize profits?

11. ***Phone Bill*** On a typical long distance call you talk for 30 minutes. On a typical local call you talk for 10 minutes. Your phone company offers a special low rate of \$0.08 per minute for long distance calls and \$0.03 per minute for local calls, for customers who spend at least 240 minutes on the phone per month. Your parents have set a limit of no more than 15 long distance calls per month and 30 local calls per month. How many minutes of long distance and local calls should you make to qualify for the special rate plan and minimize your phone bill?

NAME ______________________ DATE __________

Practice C

For use with pages 163–169

Find the minimum and maximum values of the objective function subject to the given constraints.

1. **Objective function:**
$C = 2x - 3y$
Constraints:
$x \geq 0$
$y \geq 0$
$x + y \leq 4$

2. **Objective function:**
$C = x + 3y$
Constraints:
$x + 2y \leq 8$
$x - y \geq 0$
$y \geq 1$

3. **Objective function:**
$C = 3x + 2y$
Constraints:
$x \geq 0$
$y \geq 0$
$x + y \leq 4$
$x - y \geq -3$

4. **Objective function:**
$C = 5x - 2y$
Constraints:
$x \geq 0$
$y \geq 0$
$2x + y \leq 8$
$x + 3y \leq 9$

5. **Objective function:**
$C = 2x + y$
Constraints:
$x \geq 0$
$x \leq 3$
$\frac{3}{2}x - y \geq 0$
$3x + 2y \leq 12$

6. **Objective function:**
$C = 2x + 3y$
Constraints:
$x \leq 6$
$y \leq 5$
$-2x + 3y \leq 6$
$x + 3y \geq 6$

7. **Objective function:**
$C = 3x - y$
Constraints:
$y \leq 4$
$x + y \geq 2$
$2x - y \leq 4$
$-x + y \leq 2$

8. **Objective function:**
$C = 6x + 3y$
Constraints:
$x \geq -3$
$x + y \geq 0$
$-2x + y \leq 11$
$x + y \leq 11$
$-2x + y \geq 2$

9. **Objective function:**
$C = x - 5y$
Constraints:
$x \geq -3$
$y \geq -3$
$y \leq 6$
$-x + y \leq 6$
$3x - y \leq 6$
$x + y \geq -3$

10. ***Gift Basket*** You want to make a gift basket for your mother who is an avid reader. You decide to include hard cover books and paperbacks in the basket. You have $80 to spend on books. Each hard cover costs $24 and each paperback costs $8. The basket will hold at most 3 hardcover books or 7 paperbacks. Find the maximum number of books you can include in the basket.

11. ***Nutrition*** You are planning to have roast pork and twice baked potatoes for dinner. You want to consume at least 250 grams of carbohydrates, but no more than 60 grams of fat per day. So far today you have consumed 170 grams of carbohydrates and 30 grams of fat. The table below shows the number of grams of carbohydrates, fat, and protein in a serving of roast pork and twice baked potatoes. How many servings of each can you eat to fulfill your daily requirements for carbohydrates and fat while maximizing the amount of protein you consume?

	Pork	*Potatoes*
carbohydrates	8 g	20 g
fat	6 g	7 g
protein	23 g	5 g

NAME ______________________ DATE ________

Reteaching with Practice

For use with pages 163–169

GOAL Solve linear programming problems

VOCABULARY

Optimization means finding the maximum or minimum value of some quantity.

Linear programming is the process of optimizing a linear **objective function** subject to a system of linear inequalities called **constraints.**

The graph of the system of constraints is called the **feasible region.** If an objective function has a maximum or a minimum value, then it must occur at a vertex of the feasible region. Moreover, the objective function will have both a maximum and a minimum value if the feasible region is bounded.

EXAMPLE 1 *Solving a Linear Programming Problem*

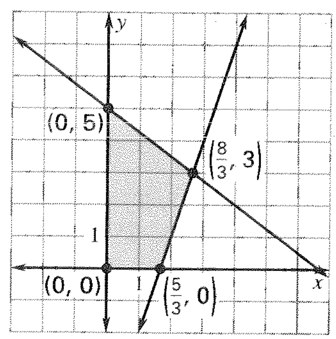
Find the minimum and maximum values of the objective function $C = 3x + 2y$ subject to the following constraints.

$3x + 4y \leq 20$

$3x - y \leq 5$

$x \geq 0$

$y \geq 0$



SOLUTION

The feasible region determined by the constraints is shown. The three vertices $(0, 5)$, $(0, 0)$, and $\left(\frac{5}{3}, 0\right)$ are intercepts. The fourth vertex $\left(\frac{8}{3}, 3\right)$ is found by solving the system of equations $3x + 4y = 20$ and $3x - y = 5$. To find the minimum and maximum values of C, evaluate $C = 3x + 2y$ at each of the four vertices.

At $(0, 5)$: $C = 3(\mathbf{0}) + 2(\mathbf{5}) = 10$

At $(0, 0)$: $C = 3(\mathbf{0}) + 2(\mathbf{0}) = 0$

At $\left(\frac{5}{3}, 0\right)$: $C = 3\left(\mathbf{\frac{5}{3}}\right) + 2(\mathbf{0}) = 5$

At $\left(\frac{8}{3}, 3\right)$: $C = 3\left(\mathbf{\frac{8}{3}}\right) + 2(\mathbf{3}) = 14$

The minimum value of C is 0, which occurs when $x = 0$ and $y = 0$.

The maximum value of C is 14, which occurs when $x = \frac{8}{3}$ and $y = 3$.

NAME ______________________ DATE __________

Reteaching with Practice

For use with pages 163–169

Exercises for Example 1

Find the minimum and maximum values of the objective function subject to the given constraints.

1. Objective function: $C = 6x - 2y$

Constraints: $x + y \leq 9$

$4x + y \geq 12$

$x \geq 0$

$y \geq 0$

2. Objective function: $C = x + 3y$

Constraints: $x + y \leq 5$

$x \geq 1$

$y \geq 2$

EXAMPLE 2 *A Region that Is Unbounded*

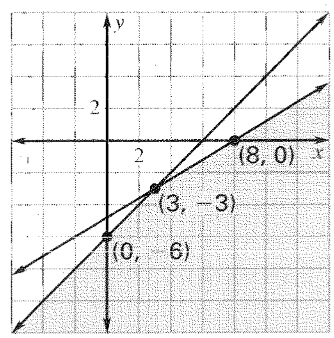
Find the minimum and maximum values of the objective function $C = 2x + 5y$ subject to the following constraints.

$3x - 5y \geq 24$

$x - y \geq 6$

$x \geq 0$

$y \leq 0$



SOLUTION

The feasible region determined by the constraints is shown. The two vertices (8, 0) and (0, −6) are intercepts. The third vertex (3, −3) is found by solving the system of equations $3x - 5y \geq 24$ and $x - y \geq 6$.

Now evaluate $C = 2x + 5y$ at each of the three vertices.

At (0, −6): $C = 2(\mathbf{0}) + 5(\mathbf{-6}) = -30$

At (8, 0): $C = 2(\mathbf{8}) + 5(\mathbf{0}) = 16$

At (3, −3): $C = 2(\mathbf{3}) + 5(\mathbf{-3}) = -9$

Since the feasible region has no lower bound, the objective function has no minimum value. The maximum value of C is 16.

Exercises for Example 2

Find the minimum and maximum values of the objective function subject to the given constraints.

3. Objective function: $C = -2x + y$

Constraints: $y - x \leq 0$

$x \geq 2$

$y \geq 1$

4. Objective function: $C = 3x - y$

Constraints: $-9x - 4y \geq -16$

$5x - 3y \geq 35$

$x \geq 0$

$y \leq -5$

LESSON 3.4

NAME ______________________________ DATE __________

Quick Catch-Up for Absent Students

For use with pages 163–169

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

Lesson 3.4: Linear Programming

____ **Goal 1**: Solve linear programming problems. (pp. 163–164)

Material Covered:

____ Activity: Investigating Linear Programming

____ Example 1: Solving a Linear Programming Problem

____ Student Help: Study Tip

____ Example 2: A Region that is Unbounded

Vocabulary:

optimization, p. 163
objective function, p. 163
feasible region, p. 163
linear programming, p. 163
constraints, p. 163

____ **Goal 2**: Use linear programming to solve real-life problems. (p. 165)

Material Covered:

____ Example 3: Using Linear Programming to Find the Maximum Profit

____ Other (specify) ______________________________

____

Homework and Additional Learning Support

____ Textbook (specify) pp. 166–169

____

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

____ *Personal Student Tutor* for Lesson 3.4

LESSON 3.4

NAME ______________________________ DATE __________

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

For use with pages 163–169

Theatre and Dance–Kwanzaa

Kwanzaa is the observation of African year-end activities in which groups of pan-African dancers tell stories by dance instead of by word. In your town, an artistic celebration is being held at a 1300-seat theatre.

Regular price tickets are \$20.00 and discount tickets for students and senior citizens are \$10.00.

If the proceeds of this celebration were to be donated to the Negro Gata Capoeria Angola Foundation, what combination of sales of each price tickets would yield the maximum donation to the Foundation?

Consider senior citizens and students as one category since the price of tickets for both groups is the same. Name that category *discount tickets*. Let x be the number of regular price tickets sold and let y be the number of discount tickets sold.

1. Write an inequality that expresses the relationship of the number of types of tickets to the total number of tickets sold.
2. Write an inequality that shows the amount of tickets that would be sold to each group at the prices given if the goal is to have the sales total at least \$20,000.00.
3. What is the objective function?
4. Write the constraints in terms of x and y to determine the feasible region.
5. Graph the feasible region.
6. Determine the maximum amount depending on the number of sales of discount and regular tickets.

Lesson 3.4

NAME ______________________________ DATE __________

Math and History Application

For use with page 169

HISTORY Having efficient methods for solving linear programming problems is important because in industrial and business applications these problems often have huge numbers of constraints and variables. For example, a complex routing problem for a telephone company might be described by 60 linear inequalities, each with 40 variables.

You could find the maximum value of your 40-variable objective function by evaluating it at all 10^{15} vertices, but this isn't practical. If you had a computer that could check 1000 vertices every second, it would take about 32,000 years to solve this problem. Before linear programming algorithms were developed, problems on this scale were simply impossible to solve.

The work of Dantzig, Khachyan and Karmarkar, combined with the number-crunching power of modern computers, made this kind of problem accessible and linear programming is now a standard technique for analyzing resource allocation problems. Karmarkar's algorithm is called an *interior point* method because instead of moving from vertex to vertex of the feasible region like Dantzig's original simplex method, it moves through the interior of the feasible region in its search for solutions. AT&T Bell Labs patented some industrial applications of Karmarkar's method. The patent (No. 4,744,028) is titled "Methods and apparatus for efficient resource allocation."

MATH Here are some problems that explore the possible shapes of feasible regions for linear programming problems with two and three variables.

1. How many vertices are in the feasible region described by the constraints $x \geq 0, x \leq 5, y \geq 0, y \leq 2$, and $x + y \leq 5$?
2. Find the minimum value of the objective function $C = 13x + 17y$, subject to the constraints in problem 1.
3. Suppose your linear programming problem has two variables and ten constraints.
   a. What is the largest number of vertices that the feasible region can have?
   b. Could the feasible region be unbounded?
   c. Could the feasible region be empty?
4. If your problem has *three* variables, the feasible region will be a polyhedron in three-dimensional space.
   a. Describe the polyhedron that corresponds to the constraints $x \geq 0, x \leq 1, y \geq 0, y \leq 1, z \geq 0$, and $z \leq 1$.
   b. How many vertices does it have?
   c. Find the maximum of the objective function $C = 2x + 3y + 4z$ subject to these constraints.

LESSON 3.4

NAME ______________________________ DATE __________

Challenge: Skills and Applications

For use with pages 163–169

1. A corral is located on the side of a gentle hill. Imagine a horizontal plane below the corral on which a coordinate system is drawn. In this coordinate system (in yards), the corral is bounded by a fence that runs along the positive coordinate axes and the lines $x + 4y = 170$, $x + y = 50$, and $3x + y = 110$. The height z of the ground above sea level over the point (x, y) is given by the equation

$$z = 20 + \frac{x}{10} - \frac{y}{10}.$$

a. Sketch the region represented by the corral and list the coordinates of its vertices.

b. What is the highest point inside or on the boundary of the corral? What is the lowest point?

2. Let $ax + by$, with $a > 0$ and $b > 0$, be the objective function for a bounded feasible region in the first quadrant bounded by segments of the coordinate axes and other line segments.

a. Suppose the feasible region is *convex*. This means that any two points in the region can be joined by a line segment that lies completely within the region. Explain why the maximum value for $ax + by$ must occur on the boundary of the region, rather than at an interior point. (*Hint:* For any interior point P, there is always a point Q farther from the origin than P.)

b. Suppose one segment of the boundary of the feasible region is given by the parametric equations

$$x = 3 + 4t \qquad y = 7 - t \qquad \text{for } 0 \le t \le 3$$

Express the objective function in terms of t and explain how you know that the maximum of $ax + by$ on this segment must occur at an endpoint of the segment.

3. A company makes two kinds of running shoes, the Jogger and the Sprinter. Each pair of Joggers requires 2 hours of production time, and each pair Sprinters requires 1 hour of production time. The factory can produce no more than 200 pairs of both kinds of shoe per day and has available 300 hours of production time in which to make them.

a. List the constraints and graph the feasible region for production of the running shoes.

b. List the vertices of the feasible region.

c. Suppose the profit on each pair of Joggers is \$35. For each vertex you found in part (b) (except (0, 0)), give a profit function which will obtain a maximum profit at that vertex.

LESSON 3.4

NAME ______________________ DATE __________

Quiz 2

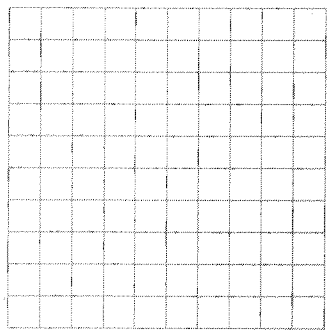
For use after Lessons 3.3–3.4

1. Graph the system of inequalities. *(Lesson 3.3)*

$x \geq 5$

$y \geq -3$

$y \geq 2x - 6$

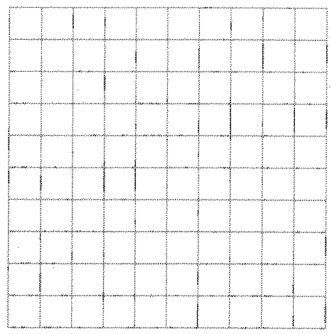


2. Graph the system of inequalities. *(Lesson 3.3)*

$x < 6$

$y > -6$

$y < -2x + 8$



Answers

1. Use grid at left.

2. Use grid at left.

3. ______________

4. ______________

5. ______________

3. Find the minimum value and the maximum value of the objective function $C = 3x + 2y$ subject to the given constraints. *(Lesson 3.4)*

$x \geq 2$

$y \geq 1$

$x \leq 6$

$y \leq 6$

4. Find the minimum value and the maximum value of the objective function $C = -2x + y$ subject to the given constraints. *(Lesson 3.4)*

$x \geq -2$

$y \geq 0$

$2x + y \leq 6$

$3x + 2y \geq 6$

5. You are sewing doll clothes to sell at a craft show. Party dresses take 2.5 hours to make while casual sets take 1 hour. You make a profit of $9.00 on each party dress and $4.00 on each casual set. If you have no more than 30 hours available to sew and can make at most 15 outfits to sell, how many of each kind should you sew to maximize your profit? *(Lesson 3.4)*