

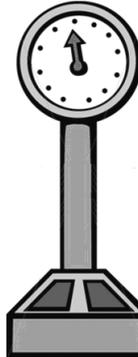
Section 4.5

Systems of Linear Inequalities



Does Your Weight Fit You?

This chapter opened by noting that the modern emphasis on thinness as the ideal body shape has been suggested as a major cause of eating disorders. In this section, the textbook will demonstrate how systems of linear inequalities in two variables can enable you to establish a healthy weight range for your height and age.



Healthy Weight Region for Men and Women, Ages 19 to 34

Source: U.S. Department of Health and Human Services

Healthy Weight Region for Men and Women, Ages 35 and Older

Source: U.S. Department of Health and Human Services

First Steps:

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 4.5 of your textbook which begins on page 327.
- Complete the *Concept and Vocabulary Check* on page 330 of the textbook.

Guided Practice:

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

Objective #1: Use mathematical models involving systems of linear inequalities. **Solved Problem #1**

1. The healthy weight region for men and women ages 19 to 34 shown in the figure on the previous page can be modeled by the following system of linear inequalities:

$$\begin{cases} 4.9x - y \geq 165 \\ 3.7x - y \leq 125 \end{cases}$$

Show that point B in the figure, $(66,130)$, is a solution of the system of inequalities that describes healthy weight for this age group.

Substitute the coordinates of point B into both inequalities of the system.

$$\begin{cases} 4.9x - y \geq 165 \\ 3.7x - y \leq 125 \end{cases}$$

Point $B = (66,130)$

$$4.9x - y \geq 165$$

$$4.9(66) - 130 \geq 165$$

$$193.4 \geq 165, \text{ true}$$

$$3.7x - y \leq 125$$

$$3.7(66) - 130 \leq 125$$

$$114.2 \leq 125, \text{ true}$$

Point B is a solution of the system.

 **Pencil Problem #1**

1. The healthy weight region for men and women ages 35 and older shown in the figure on the previous page can be modeled by the following system of linear inequalities:

$$\begin{cases} 5.3x - y \geq 180 \\ 4.1x - y \leq 14 \end{cases}$$

Show that point A in the figure, $(66,160)$, is a solution of the system of inequalities that describes healthy weight for this age group.

Objective #2: Graph the solution sets of systems of linear inequalities. **Solved Problem #2**

- 2a. Graph the solution set of the system:

$$\begin{cases} x + 2y > 4 \\ 2x - 3y \leq -6 \end{cases}$$

Graph $x + 2y > 4$ by graphing $x + 2y = 4$ as a dashed line using the x -intercept, 4, and the y -intercept, 2.

Use $(0,0)$ as a test point. $x + 2y > 4$

$$0 + 2(0) > 4$$

$$0 > 4, \text{ false}$$

Because $0 + 2(0) > 4$ is false, shade the half-plane *not* containing $(0,0)$.

 **Pencil Problem #2**

- 2a. Graph the solution set of the system:

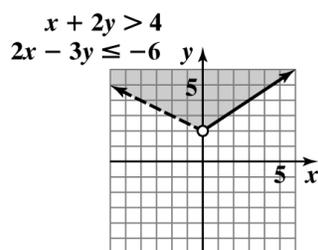
$$\begin{cases} x - 2y > 4 \\ 2x + y \geq 6 \end{cases}$$

Graph $2x - 3y \leq -6$ by graphing $2x - 3y = -6$ as a solid line using the x -intercept, -3 , and the y -intercept, 2 .

Use $(0,0)$ as a test point. $2x - 3y \leq -6$
 $2(0) - 3(0) \leq -6$
 $0 \leq -6$, false

Because $2(0) - 3(0) \leq -6$ is false, shade the half-plane *not* containing $(0,0)$.

The solution set of the system is the intersection of the two shaded regions.



2b. Graph the solution set of the system:

$$\begin{cases} y \geq x + 2 \\ x \geq 1 \end{cases}$$

Graph $y \geq x + 2$ by graphing $y = x + 2$ as a solid line using the y -intercept, 2 , and the slope, 1 .

Use $(0,0)$ as a test point. $y \geq x + 2$
 $0 \geq 0 + 2$
 $0 \geq 2$, false

Because $0 \geq 0 + 2$ is false, shade the half-plane *not* containing $(0,0)$.

Graph $x \geq 1$ by graphing $x = 1$ as a solid vertical line through $x = 1$.

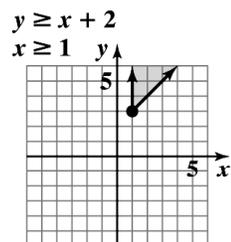
Use $(0,0)$ as a test point. $x \geq 1$
 $0 \geq 1$, false

2b. Graph the solution set of the system:

$$\begin{cases} x + y > 1 \\ x + y < 4 \end{cases}$$

Because $0 \geq 1$ is false, shade the half-plane *not* containing $(0,0)$.

The solution set of the system is the intersection of the two shaded regions.



Answers for Pencil Problems (Textbook Exercise references in parentheses):

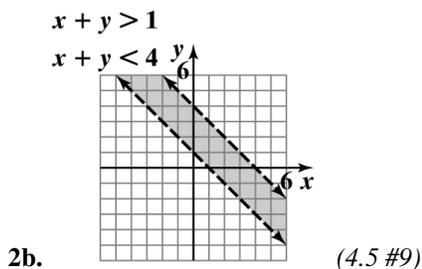
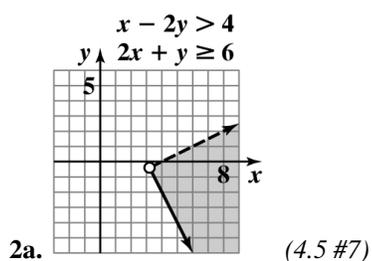
$5.3x - y \geq 180$

$4.1x - y \leq 14$

$5.3(66) - 160 \geq 180$

$4.1(66) - 160 \leq 140$

1. $189.8 \geq 180$, true $110.6 \leq 140$, true (4.5 #45)



Homework:

- Review the Section 4.5 summary on page 335 of the textbook.
- Insert your homework into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.