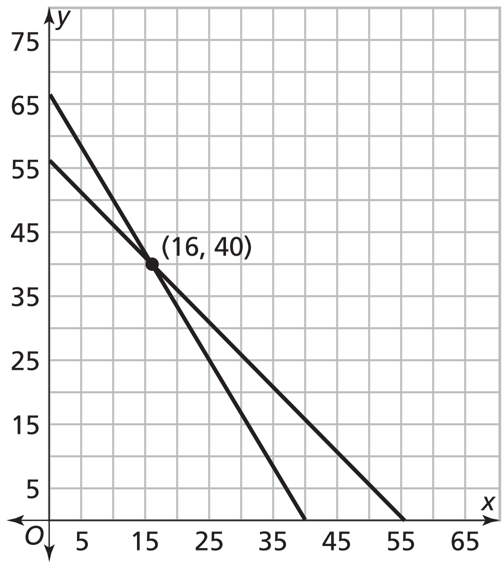
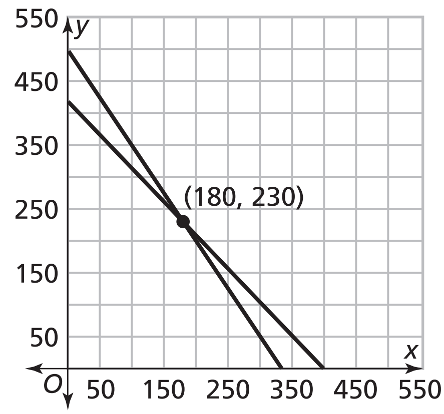
Investigation 1 Additional Practice

1. a. $I = 500x + 300y$; In this equation, the number of oil paintings is x and the number of charcoal sketches is y.
   b. \$6,500
   c. $\$20{,}000 = 500x + 300y$
   d. $x + y = 56$; Where x is the number of oil paintings and y is the number of charcoal sketches. Students may use different variables besides x and y.
   e. i. For the graph below, x is the number of oil paintings and y is the number of charcoal sketches.



   ii. The intersection point of the two graphs is (16, 40) where x is the number of oil paintings and y is the number charcoal sketches. If Marcello wants to make \$20,000 and create 56 pieces, he needs to sell 40 oils and 16 charcoals. See note in part (i). Students who label their horizontal axis as the number of charcoal sketches will have an intersection point of (16, 40). However, this still represents the same information; in order to make \$20,000 and create 56 pieces, he needs to sell 40 oils and 16 charcoals.

2. a. $6x + 4y = 2{,}000$
   $x + y = 410$
   b. For the graph below, x is the number of tickets sold at the door and y is the number sold in advance.



   c. 180 tickets sold at the door and 230 tickets in advance
3. a. $3x - y = 0$ (or $-3x + y = 0$); Slope $= 3$, y-intercept $= (0, 0)$
   b. $2x + y = 12$; Slope $= -2$, y-intercept $= (0, 12)$
   c. $-x + y = -10$; Slope $= 1$, y-intercept $= (0, -10)$
   d. $y = 0$ (or $0x + y = 0$); Slope $= 0$, y-intercept $= (0, 0)$
   e. $2x + y = -4$; Slope $= -2$, y-intercept $= (0, -4)$
   f. $x + y = -2$; Slope $= -1$, y-intercept $= (0, -2)$
4. a. $y = -5x + 2$; Slope $= -5$, y-intercept $= (0, 2)$
   b. It is not possible to write an equation in $y = mx + b$ form; Slope can't be found, and there's no y-intercept
   c. $y = x - 20$; Slope $= 1$, y-intercept $= (0, -20)$
   d. $y = -x + 12$; Slope $= -1$, y-intercept $= (0, 12)$
   e. $y = \frac{1}{5}x - 4$; Slope $= \frac{1}{5}$, y-intercept $= (0, -4)$
   f. $y = \frac{2}{3}x - \frac{25}{3}$; Slope $= \frac{2}{3}$, y-intercept $= (0, -\frac{25}{3})$

5. a. $4h + 3s = 26$

b. 2 hammers and 6 screwdrivers, or 5 hammers and 2 screwdrivers

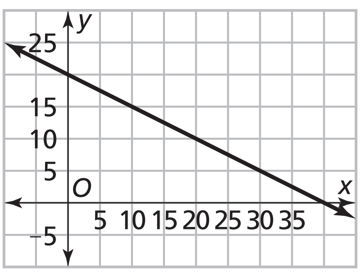
6. At a concession stand, Peter spent \$12 on drinks and popcorn for his friends. He bought a total of 7 items. Each drink cost \$2.00 and each bag of popcorn cost \$1.50.
Ramiro bought a combination of cantaloupes and mini watermelons for a total of 7 pieces of fruit. His total purchase weighs 12 pounds. Each cantaloupe weighs 2 pounds and each mini watermelon weighs 1.5 pounds.
The sum of two numbers is 7. The sum of twice the first and 1.5 times the second is 12.

7. $y = 3x - 2$: $2y - 6x = -4$, $3x - y = 2$, $6x - 2y = 4$
$y = 2x + 1$: $-1 = 2x - y$, $6x - 3y = -3$

Skill: Writing Equations With Two Variables

1. a. $5x + 10y = 200$

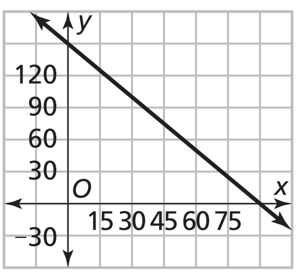
b.



c. Answers may vary. Possible answers: (6 5-lb bags, 17 10-lb bags), or (12 5-lb bags, 14 10-lb bags)

2. a. $5x + 3y = 450$

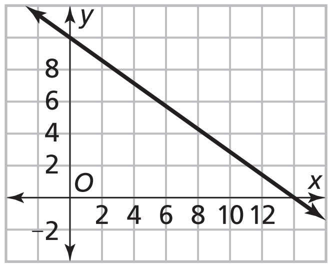
b.



c. Answers may vary. Possible answers: (75 adult, 25 student), (60 adult, 50 student)

3. a. $5x + 7y = 70$

b.



4. $5.99x + 4.99y = 50$

Skill: Standard Form and Slope-Intercept Form

1. $y = 5x - 4$

2. $y = \frac{1}{2}x + 1$

3. $y = 4x + 7$

4. $y = -x + \frac{2}{3}$

5. $y = -\frac{1}{3}x - 3$

6. $y = -\frac{2}{5}x + 4$

Investigation 2 Additional Practice

1. a. (5, 13); Possible solution:

$$\begin{aligned} 3x - 2 &= 2x + 3 \\ 3x - 2 + 2 &= 2x + 3 + 2 \\ 3x &= 2x + 5 \\ 3x - 2x &= 2x + 5 - 2x \\ x &= 5 \end{aligned}$$

Substituting this value into either equation to solve for y gives $y = 3(5) - 2 = 13$

b. (5, 39); Possible solution:

$$\begin{aligned} 7x + 4 &= 9x - 6 \\ 7x + 4 + 6 &= 9x - 6 + 6 \\ 7x + 10 &= 9x \\ 7x + 10 - 7x &= 9x - 7x \\ 10 &= 2x \\ x &= 5 \end{aligned}$$

Substituting this value into either equation to solve for y gives $y = 7(5) + 4 = 39$

c. (3, 70); Possible solution:

$$22x + 4 = 14x + 28$$
$$22x + 4 - 4 = 14x + 28 - 4$$
$$22x = 14x + 24$$
$$22x - 14x = 14x + 4 - 14x$$
$$8x = 24$$
$$x = 3$$

Substituting this value into either equation to solve for y gives $y = 22(3) + 4 = 70$

d. $(-7, 16)$; Possible solution:

$$-x + 9 = 2x + 30$$
$$-x + 9 - 9 = 2x + 30 - 9$$
$$-x = 2x + 21$$
$$-x - 2x = 2x + 21 - 2x$$
$$-3x = 21$$
$$x = -7$$

Substituting this value into either equation to solve for y gives $y = 2(-7) + 30 = 16$

e. $(-3, 0)$; Possible solution:

$$2x + 6 = x + 3$$
$$2x + 6 - 6 = x + 3 - 6$$
$$2x = x - 3$$
$$2x - x = x - 3 - x$$
$$x = -3$$

Substituting this value into either equation to solve for y gives $y = 2(-3) + 6 = 0$

f. $(5, -17)$; Possible solution:

$$-5x + 8 = -2x - 7$$
$$-5x + 8 + 7 = -2x - 7 + 7$$
$$-5x + 15 = -2x$$
$$-5x + 15 + 5x = -2x + 5x$$
$$15 = 3x$$
$$x = 5$$

Substituting this value into either equation to solve for y gives $y = -5(5) + 8 = -17$

2. a. $y = -\frac{2}{3}x - 2$ **b.** $y = \frac{1}{2}x - \frac{3}{2}$

c. $y = -3x - \frac{3}{2}$ **d.** $y = 4x + 0$

e. $y = x + \frac{1}{2}$ **f.** $y = -3x + \frac{1}{2}$

3. a. $x = \frac{-3}{2}y - 3$ **b.** $x = 2y + 3$

c. $x = \frac{-y}{3} - \frac{1}{2}$ **d.** $x = \frac{1}{4}y + 0$

e. $x = y - \frac{1}{2}$ **f.** $x = -\frac{y}{3} + \frac{1}{6}$

4. Substitution choices may vary. Possibilities are shown.

a. $3x + 2(x + 2) = 14; x = 2; y = 4$

b. $4x - 2(x - 5) = 24; x = 7; y = 2$

c. $-3x + 51 = 8(-6x); x = -1; y = 6$

d. $3x + 2(4x - 2) = -4; x = 0; y = -2$

e. $x = 5(-1 - 6x) - 26; x = -1; y = 5$

f. $7x - 2x = 18; x = y = \frac{18}{5}$

5. Choices of how to combine may vary. Sample strategies are given below.

a. $x = 11, y = 3$; Add the first equation to the second equation to get the equation $2y = -6$. From this equation you get $y = -3$. Substituting this y-value back into either of the original equations gives $x = 11$. (For example, substituting $y = -3$ into the first equation leads to the equation $2x - 4(-3) = 10$. Solving for x gives $2x = 22$ or $x = 11$.)

b. $x = 1, y = -\frac{1}{10}$; Add the first equation to the second equation to get the equation $14x = 14$. From this equation you get $x = 1$. Substituting this x-value back into either of the original equations gives $y = -\frac{1}{10}$. (For example, substituting $x = 1$ into the first equation leads to the equation $7(1) + 10y = 6$. Solving for y gives $10y = -1$ or $y = -\frac{1}{10}$.)

c. $x = -3, y = -2$; Subtract the second equation from the first equation to get the equation $10x = -30$. From this equation you get $x = -3$. Substituting this x-value back into either of the original equations gives $y = -2$. (For example, substituting $x = -3$ into the second equation leads to the equation $-4(-3) - 7y = 26$. Solving for y gives $-7y = 14$ or $y = -2$.)

d. $x = -3, y = 6$; Add the first equation to the second equation to get the equation $2x = -6$. From this equation you get $x = -3$. Substituting this x-value back into either of the original equations gives $y = 6$. (For example, substituting $x = -3$ into the first equation leads to the equation $-3 + y = 3$. Solving for y gives $y = 6$.)

e. $x = -\frac{76}{35}, y = -\frac{6}{7}$; Subtract the second equation from the first equation to get the equation $-14y = 12$. From this equation you get $y = -\frac{12}{14}$ or $-\frac{6}{7}$. Substituting this y-value back into either of the original equations gives $x = -\frac{76}{35}$. (For example, substituting $y = -\frac{6}{7}$ into the second equation leads to the equation $-5x + 8\left(-\frac{6}{7}\right) = 4$. Solving for x gives $-5x = \frac{76}{7}$ or $x = -\frac{76}{35}$.)

f. $x = \frac{16}{3}, y = 2$; Add the first equation to the second equation to get the equation $2y = 4$. From this equation you get $y = 2$. Substituting this y-value back into either of the original equations gives $x = \frac{16}{3}$. (For example, substituting $y = 2$ into the first equation leads to the equation $3x - 2(2) = 12$. Solving for x gives $3x = 16$ or $x = \frac{16}{3}$.)

6. $x = 1, y = -2$

7. 12; 5

8. $x = 3y + 1$
$2x - 6y - 2 = 0,\ y = \frac{1}{3}(x - 1),\ x - 3y = 1$
$x = 2y - 2$
$y = \frac{1}{2}x + 1, 3x - 6y = -6$

Skill: Substitution Method for Linear Systems

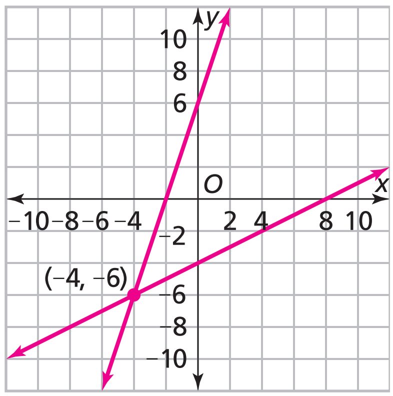
1. $(1, 1)$ **2.** $(2, 6)$
3. $(-3, 2)$ **4.** $(100, 50)$
5. $(-2, -3)$ **6.** $(1, -2)$
7. $\left(-1, -\frac{1}{3}\right)$ **8.** $(4, 8)$

Skill: Combination Method for Linear Systems

1. $(1, 3)$ **2.** $(4, 8)$ **3.** $(7, 6)$
4. $(2, -1)$ **5.** $(2, 0)$ **6.** $\left(\frac{1}{2}, 2\right)$
7. $(3, 6)$ **8.** $(5, 7)$

Investigation 3 Additional Practice

1. a. $y = 3x + 6$ and $y = \frac{1}{2}x - 4$

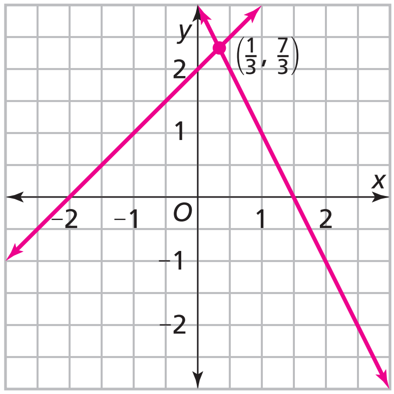


Point of intersection: $(-4, -6)$; Checking using symbolic reasoning will look something like the following:

$$3x + 6 = \frac{1}{2}x - 4$$
$$3x + 6 + 4 = \frac{1}{2}x - 4 + 4$$
$$3x + 10 = \frac{1}{2}x$$
$$3x + 10 - 3x = \frac{1}{2}x - 3x$$
$$10 = -\frac{5}{2}x$$
$$-4 = x$$

To find the corresponding y-value substitute into either equation: $y = 3(-4) + 6 = -12 + 6 = -6$ or using the other equation $y = \frac{1}{2}(-4) - 4 = -2 - 4 = -6$. So the estimate of $(-4, -6)$ was correct.

b. $y = x + 2$ and $y = -2x + 3$

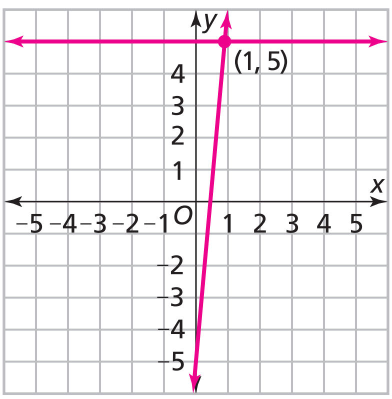


Actual Point of intersection: $\left(\frac{1}{3}, \frac{7}{3}\right)$
Estimates should be close to this point; Checking using symbolic reasoning will look something like the following:

$$x + 2 = -2x + 3$$
$$x + 2 - 2 = -2x + 3 - 2$$
$$x = -2x + 1$$
$$x + 2x = -2x + 1 + 2x$$
$$3x = 1$$
$$x = \frac{1}{3}$$

To find the corresponding y-value, substitute into either equation:
$y = \frac{1}{3} + 2 = \frac{7}{3}$ or using the other equation $y = -2\left(\frac{1}{3}\right) + 3 = \frac{7}{3}$. Any estimate close to $\left(\frac{1}{3}, \frac{7}{3}\right)$ was a good estimate.

c. $y = 5$ and $y = 10x - 5$



Point of intersection: $(1, 5)$; Estimates should be close to this point; Checking using symbolic reasoning will look something like the following:

$$5 = 10x - 5$$
$$5 + 5 = 10x - 5 + 5$$
$$10 = 10x$$
$$x = 1$$

Since $y = 5$ by the first equation, the point of intersection is $(1, 5)$.

2. a. True; When you add the same number to both sides of an inequality, the same inequality holds.

b. True; When you subtract the same number to both sides of an inequality, the same inequality holds.

c. True; Any number times zero is zero, so the inequality $S \times 0 \geq T \times 0$ becomes $0 \geq 0$, which is true.

d. Not necessarily true; If S is -1 and T is -2, then even though $S > T$ it is not true that $\frac{S}{-2} \geq \frac{T}{-2}$, because $\frac{-1}{-2} = \frac{1}{2} < \frac{-2}{-2} = 1$. The inequality $\frac{S}{-2} \geq \frac{T}{-2}$ is true only in the case where $S = T$.

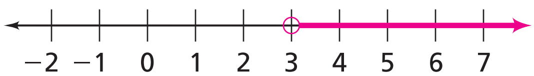
e. True; When you divide both sides of an inequality by the same positive number the same inequality holds.

f. True; When you multiply both sides of an inequality by the same negative number, the inequality sign is reversed.

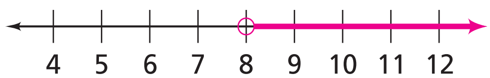
g. True; Since $S \geq T$, adding a greater number to S will maintain the same inequality.

h. Not necessarily true; Though the inequality $S + 5 \geq T + 7$ is true for many S and T pairs, there are values for which this inequality is not true. For example, when $S = 4$ and $T = 3$, it is not true that $4 + 5 \geq 3 + 7$.

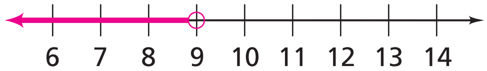
3. a. $3 < x$



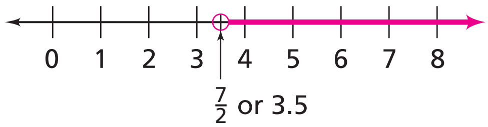
b. $x > 8$



c. $x < 9$



d. $x > \frac{7}{2}$



4. a. Possible estimate: $x > 1.5$

Symbolic reasoning:

$$1.4x - 1 > 1$$
$$1.4x - 1 + 1 > 1 + 1$$
$$1.4x > 2$$
$$x > 2 \div 1.4$$
$$x > 2 \div \frac{7}{5}$$
$$x > \frac{10}{7} \approx 1.43$$

b. Possible estimate: $x > 0$

Symbolic reasoning:

$$1.4x - 1 > -1$$
$$1.4x - 1 + 1 > -1 + 1$$
$$1.4x > 0$$
$$x > 0$$

c. Possible estimate: $x > 0.9$

Symbolic reasoning:

$$-2.4x + 1 < -1$$
$$-2.4x + 1 - 1 < -1 - 1$$
$$-2.4x < -2$$
$$x > -2 \div \left(-\frac{12}{5}\right)$$
$$x > -2 \times \left(-\frac{5}{12}\right)$$
$$x > \frac{10}{12} \approx 0.833$$

d. Possible estimate: $x = 0.5$

Symbolic reasoning:

$$-2.4x + 1 = 1.4x - 1$$
$$-2.4x + 1 + 1 = 1.4x - 1 + 1$$
$$-2.4x + 2 = 1.4x$$
$$-2.4x + 2 + 2.4x = 1.4x + 2.4x$$
$$2 = 3.8x$$
$$2 \div 3.8 = x$$
$$x = 20 \div 38 = \frac{20}{38} = \frac{10}{19} \approx 0.526$$

e. Possible estimate: $x < 0.5$

Symbolic reasoning:

$$-2.4x + 1 > 1.4x - 1$$
$$-2.4x + 1 + 1 > 1.4x - 1 + 1$$
$$-2.4x + 2 > 1.4x$$
$$-2.4x + 2 + 2.4x > 1.4x + 2.4x$$
$$2 > 3.8x$$
$$2 \div 3.8 > x$$
$$x < 20 \div 38 = \frac{20}{38} = \frac{10}{19} \approx 0.526$$

5. a. Estimate: $(5, 5); (-5, -5)$

Exact: $\left(\frac{7}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right), \left(-\frac{7}{\sqrt{2}}, -\frac{7}{\sqrt{2}}\right)$

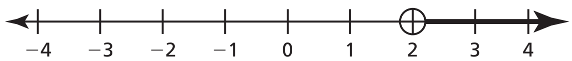
b. Estimate: $(-3, 6); (6, -3)$

Exact: $\left(\frac{3 - \sqrt{89}}{2}, \frac{3 + \sqrt{89}}{2}\right)$, $\left(\frac{3 + \sqrt{89}}{2}, \frac{3 - \sqrt{89}}{2}\right)$

6. $(-4, 8), (2, -4)$

7. $x < 7$

8.

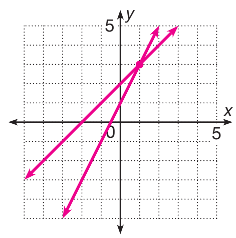


9. Solution: $x = -2,\ x = 1,\ x = 2$

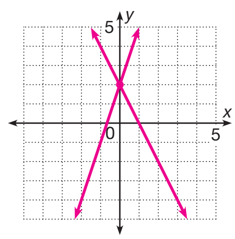
Not a Solution: $x = -25,\ x = -6, x = -15$

Skill: Solving Linear Systems

1. $(1, 3)$

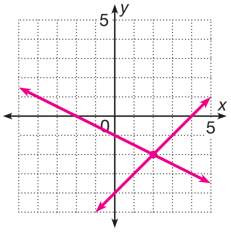


2. $(0, 2)$

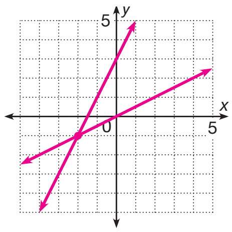


It's In the System Answers

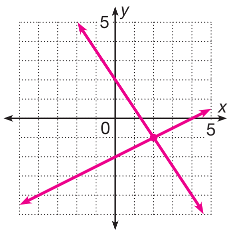
3. (2, −2)



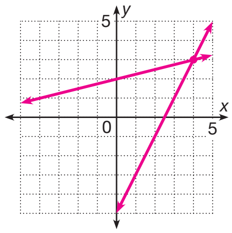
4. (−2, −1)



5. (2, −1)

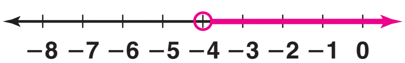


6. (4, 3)

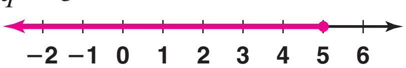


Skill: Solving Linear Inequalities

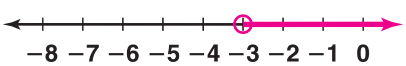
1. $m > -4$



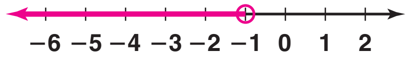
2. $q \leq 5$



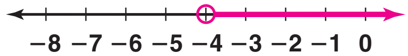
3. $w > -3$



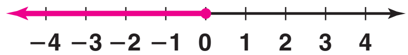
4. $y < -1$



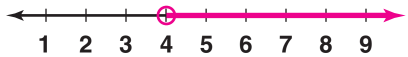
5. $m > -4$



6. $j \leq 0$



7. $v > 4$

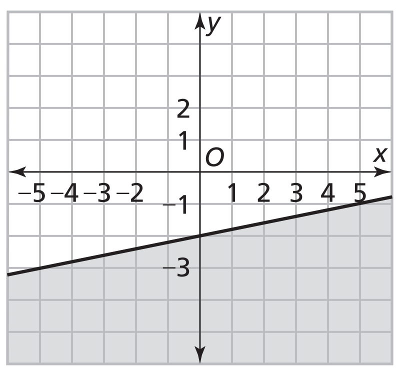


8. $b < 8$

9. $x \leq -4$ 10. $x < 6$ 11. $x > 2$
12. $x \geq -5$ 13. $x \geq 5$ 14. $x > -1.4$
15. $8t \geq 1{,}250 + 830$; $8t \geq 2{,}080$; $t \geq 260$; at least 260 tickets
16. $3.5h + 18.25 \leq 30$; $3.5h \leq 11.75$; $h < 3.36$; at most 3 hamsters

Investigation 4 Additional Practice

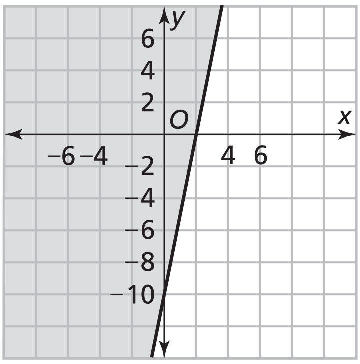
1. a. viii b. vii c. v
   d. i e. iii f. ix
   g. ii h. iv i. vi
2. Answers will vary. Possible answers:
   a. i. (0, −3), (10, 0), (20, 1)
      ii. (10, 1), (10, 2), (10, 3)
      iii. The graph of $x - 5y \geq 10$:



b. **i.** (2, 0), (1, 0), (0,0)

ii. (2, −2), (2, −10), (10, 2)

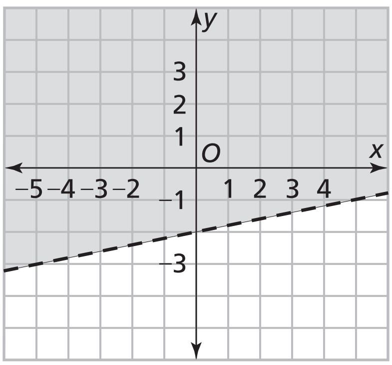
iii. The graph of $5x - y \leq 10$:



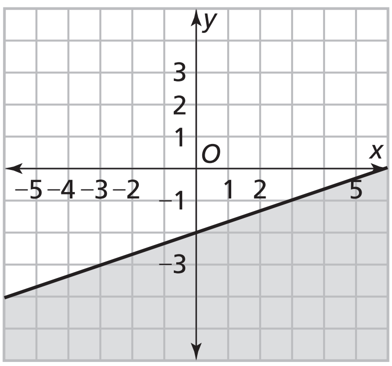
c. **i.** (0,0), (0, 1), (0, 2)

ii. (0, −2), (0, −3), (30, 2)

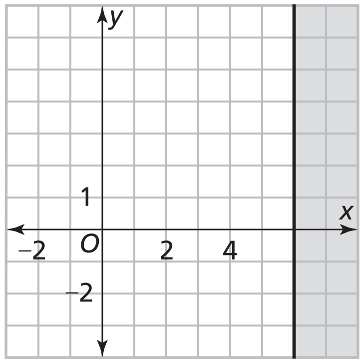
iii. The graph of $x - 5y < 10$:



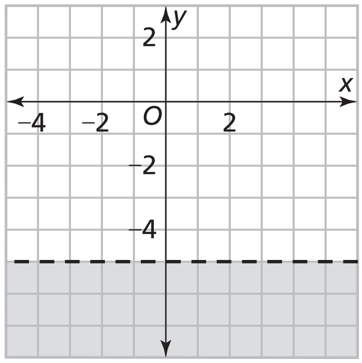
3. **a.** Graph of $x \geq 6 + 3y$:



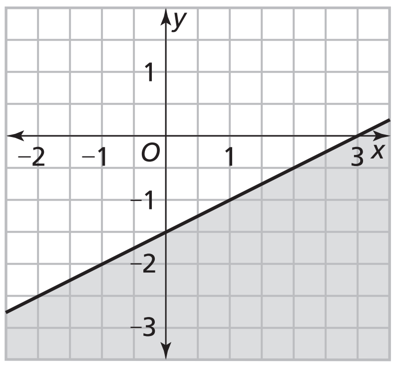
b. Graph of $x \geq 6$:



c. The graph of $y < -5$:



d. Graph of $3x - 6y \geq 9$:



e. Answers will vary. Possible answer: First I graphed the associated linear function, and then I tested points to choose which region to shade.

4. Solutions to i and ii will vary. Possible answers:

a. **i.** (2, 1), (2, 2), (3,1)

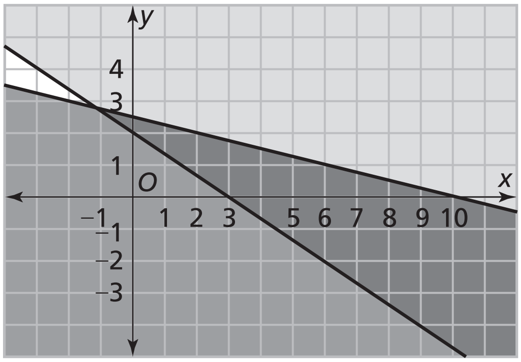
ii. (4,4), (0,0), (1,1)

iii. Graph of the system

$$\begin{cases} 2x + 3y \geq 6 \\ x + 4y \leq 10 \end{cases}$$

or equivalently the system

$$y \geq 2 - \frac{2}{3}x$$
$$y \leq \frac{10}{4} - \frac{x}{4}:$$



b. **i.** (1,1), (0,0), (2,2)

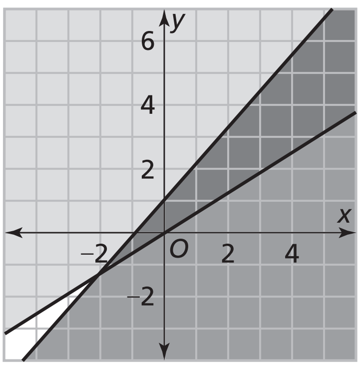
ii. (4, 6), (3, 1), (2,0)

iii. Graph of the system

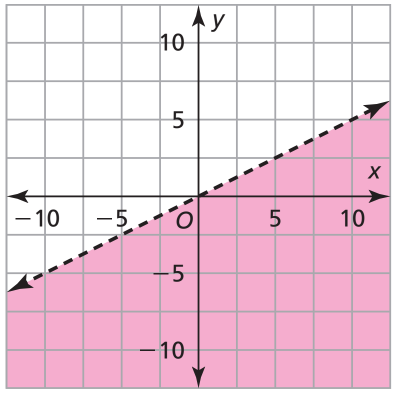
$$\begin{cases} 3x - 5y \leq 0 \\ x - y > -1 \end{cases}$$

or equivalently the system

$$y \geq \frac{3}{5}x$$
$$y < x + 1$$



5.



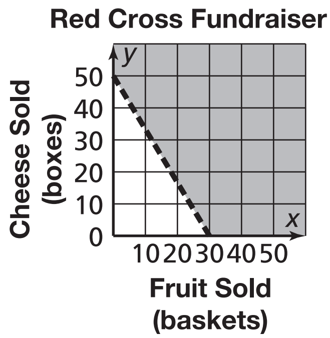
6. mow 6 lawns and babysit for 15 hours, mow 10 lawns and babysit for 5 hours

7. Solution: (0, −5), (2, 2), (5, 0)
Not a Solution: (−7, −4), (−3, 0)

Skill: Inequalities With Two Variables

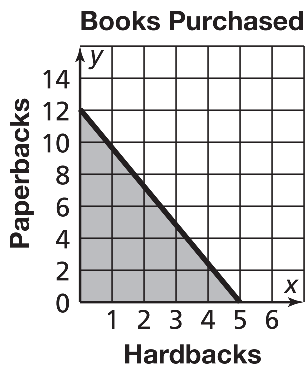
1. **a.** $5x + 3y > 150$

b.



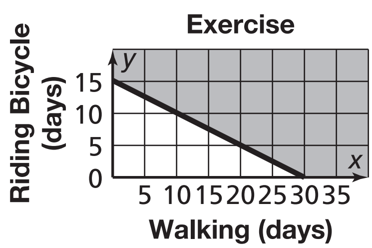
2. **a.** $12x + 5y < 60$

b.

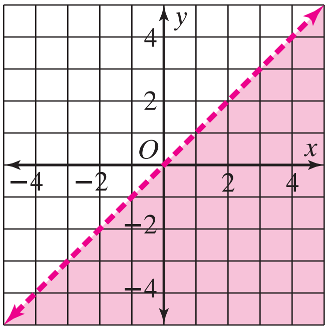


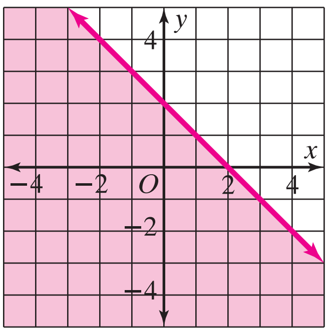
3. **a.** $15x + 10y \geq 150$

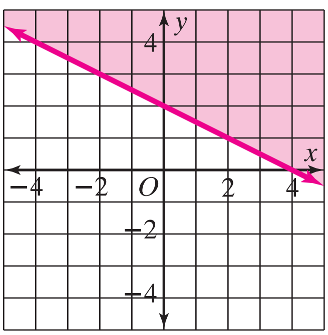
b.

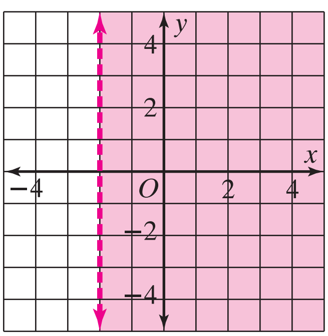


Skill: Graphs of Linear Inequalities

1. 

2. 

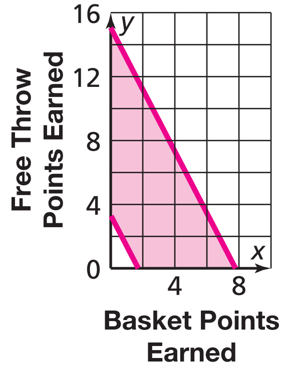
3. 

4. 

Skill: Systems of Linear Inequalities

1. a. $2x + y \geq 3; 2x + y \leq 15$

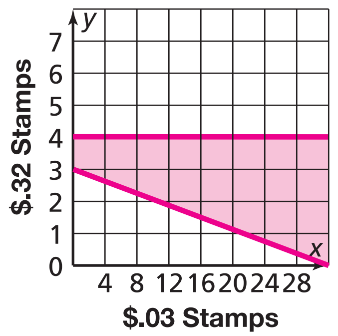
   b. Points Earned in a Basketball Game



   c. Answers may vary. The solutions are all of the coordinates of the points that are both positive integers within the shaded region or on the boundary lines. Sample: 4 baskets and 2 free throws

2. $3x + 32y \geq 100; y \leq 4$

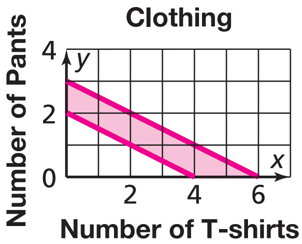
   b. Postage for a Package



   c. Answers may vary. The solutions are all of the coordinates of the points that are both positive integers within the shaded region or on the boundary lines. Sample: 4 3-cent stamps and 3 32-cent stamps

3. a. $10x + 20y \geq 40; 10x + 20y \leq 60$

b.



c. Answers may vary. The solutions are all of the coordinates of the points that are both positive integers within the shaded region or on the boundary lines. Samples: 3 T-shirts and 1 pair of pants, 1 T-shirt and 2 pairs of pants