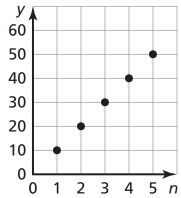
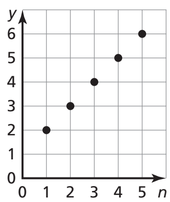
4.6 Explorations

1. a. 10, 20, 30, 40, 50



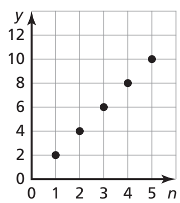
The y-value increases by 10 each time.

b. 2, 3, 4, 5, 6



The y-value increases by 1 each time.

c. 2, 4, 6, 8, 10



The y-value increases by 2 each time.

2. An arithmetic sequence can describe a pattern in which the difference between consecutive terms is the same; *Sample answer:* The amount of money earned for selling candy bars at $2 each.

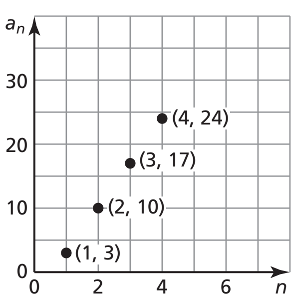
3. Each molecule added to the group increases the number of atoms by 3; 69 atoms

4.6 Practice

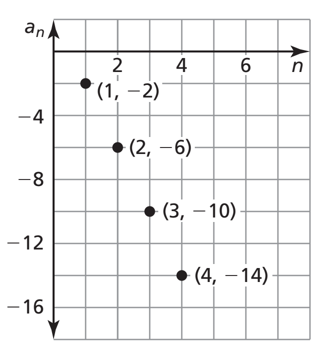
1. 14, 25, 36 **2.** 11, 7, 3 **3.** $d = 6$

4. $d = -30$ **5.** $d = 5$ **6.** $d = \frac{1}{4}$

7.



8.



9. no **10.** yes; $d = 7$

11. $a_n = 2n - 5$; $a_{10} = 15$

12. $a_n = -5n + 7$; $a_{10} = -43$

13. $a_n = \frac{3}{2}n + 3$; $a_{10} = 18$

14. $a_n = \frac{2}{5}n$; $a_{10} = 4$ **15.** 10, 14, 18

16. a. $a_n = -3n + 21$

b. $a_7 = 0$; The tank is empty after 7 hours.

c. no

Chapter 5

5.1 Explorations

1. a. $C = 15x + 600$

b. $R = 75x$

c. $C = 15x + 600$
$R = 75x$

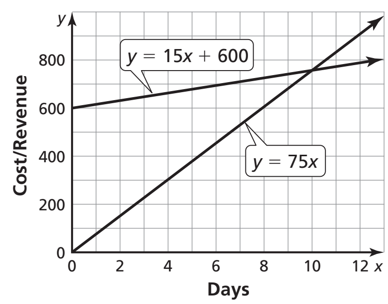
2. a.

x (nights)	0	1	2	3	4	5
C (dollars)	600	615	630	645	660	675
R (dollars)	0	75	150	225	300	375

x (nights)	6	7	8	9	10	11
C (dollars)	690	705	720	735	750	765
R (dollars)	450	525	600	675	750	825

b. 10 nights

c.



d. (10, 750); the point where both functions have the same x- and y-values; It is the same point; The break-even point is the point where both functions have the same x- and y-values.

3. Graph both equations and find the point of intersection; Substitute the x-coordinate for x in both of the equations and verify that both results are the y-coordinate of the point of intersection.

4. a. $(-1, 3)$; *Sample answer:* table because decimals are difficult to graph

b. (2, 2); *Sample answer:* graph because it is easier to draw

c. $\left(-\frac{3}{2}, \frac{1}{2}\right)$; *Sample answer:* graph because it is easier to draw

5.1 Practice

1. yes **2.** no **3.** (3, 0) **4.** $(2, -4)$

5. (2, 6) **6.** $(-3, 5)$ **7.** $(8, -2)$ **8.** (0.67, 3.5)

9. 16 bracelets, 21 necklaces

10. $y = 4x + 4$, $y = 6x - 6$; (5, 24); When $x = 5$, the rectangles have the same area (24 square units).

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5.2 Explorations

1. a. $(-2, -5)$; yes; *Sample answer:* Method 2 because both equations can be solved for y easily.
   b. $(1, 2)$; yes; *Sample answer:* Method 1 because the first equation can be solved for x easily.
   c. $(-1, 3)$; yes; *Sample answer:* Method 2 because the first equation can be solved for y easily.
2. a. *Sample answer:* $(2, 4)$
   b. *Sample answer:* $y = x + 2$ and $3x - 4y = -10$
   c. *Sample answer:* $y = x + 2$ and $3x - 4y = -10$; $(2, 4)$; Because the first equation is already solved for y, substitute that expression for y in the second equation.
3. Solve one of the equations for one of the variables. Substitute the expression for that variable into the other equation to find the value of the other variable. Substitute this value into one of the original equations to find the value of the remaining variable.
4. a. $(-5, -1)$; *Sample answer:* The first equation can be solved for x easily.
   b. $(-2, 2)$; *Sample answer:* The first equation can be solved for x easily.
   c. $(2, -2)$; *Sample answer:* The second equation can be solved for y easily.
   d. $(3, 2)$; *Sample answer:* The second equation can be solved for x easily.
   e. $(1, -3)$; *Sample answer:* The second equation can be solved for x easily.
   f. $(-1, 3)$; *Sample answer:* The first equation can be solved for y easily.

5.2 Practice

1. *Sample answer:* Solve either equation for y. The coefficient is 1.
2. *Sample answer:* Solve the second equation for x. The coefficient is 1.
3. *Sample answer:* Solve the first equation for y. The coefficient is -1.

4. $(2, 6)$	5. $(5, 1)$	6. $(-2, 3)$
7. $(10, 2)$	8. $(4, -6)$	9. $(-3, -1)$

10. In Step 1, you must solve for x, not $-x$;
    Step 1: $-x + 4y = -9$; $-x = -4y - 9$; $x = 4y + 9$;
    Step 2: $3(4y + 9) - 2y = 7$; $12y + 27 - 2y = 7$; $10y = -20$; $y = -2$
11. *Sample answer:* $x + y = 5$, $y = 4x$
12. *Sample answer:* $x - y = 12$, $2x + 3y = 9$
13. *Sample answer:* $x + y = -3$, $4x - 9y = 1$
14. a. 29 multiple choice, 7 essay
    b. no; The product of $29 \cdot 4$ is 116, which is greater than 100.
15. $a = 3$, $b = 4$

5.3 Explorations

1. a. Equation 1: $x + y = 4.5$; Equation 2: $x + 5y = 16.5$
   b. $4y = 12$; Solve the resulting equation for y. Then substitute the value of y into one of the original equations and solve for x; $(1.5, 3)$; Drinks cost \$1.50 and sandwiches cost \$3.
2. a. $(1, -3)$; yes; *Sample answer:* method 2
   b. $(2, 2)$; yes; *Sample answer:* method 2
   c. $(-1, 3)$; yes; *Sample answer:* method 1
3. a. no; *Sample answer:* Multiply each side of Equation 2 by –2.
   b. $(2, 3)$
4. Multiply, if necessary, one or both equations by a constant so one pair of like terms has the same or opposite coefficients. Add or subtract the equations to eliminate one of the variables. Solve the resulting equation. Then substitute the value of the variable found into one of the original equations and solve for the other variable.
5. When one of the variables has the same or opposite coefficients in both equations; *Sample answer:* $x + 3y = 2$ and $-x + 5y = 7$; when neither of the variables has the same nor opposite coefficients in both equations; *Sample answer:* $3x - 2y = 12$ and $2x - 3y = -15$
6. Multiplication Property of Equality; Multiplying each side of an equation by the same nonzero number produces an equivalent equation.

5.3 Practice

1. $(5, 1)$	2. $(2, 3)$	3. $(4, 3)$	4. $(-4, 5)$
5. $(3, -1)$	6. $(-2, -3)$	7. $(-2, 9)$	8. $(3, 2)$
9. $(13, 3)$	10. $(5, -4)$	11. $(-4, -1)$	12. $(3, 0)$

13. $x = \$20$, $y = \$1.50$
14. $(3, 1)$; *Sample answer:* elimination; Both equations have $2x$ term.
15. $(-2, 7)$; *Sample answer:* substitution; Equation 2 is already solved for y.
16. $(4, -2)$; *Sample answer:* elimination; It is not easy to isolate one variable.
17. a. 34
    b. $x = y - 2$, $11 + x + y = 45$
    c. $x = 16$, $y = 18$, so 16 medium T-shirts, 18 large T-shirts
    d. 5 medium and 5 large; The number of medium and large shirts already ordered is about the same.

5.4 Explorations

1. a. $C = 450 + 20x$; $R = 20x$

***x* (skateboards)**	0	1	2	3	4
***C* (dollars)**	450	470	490	510	530
***R* (dollars)**	0	20	40	60	80

***x* (skateboards)**	5	6	7	8	9	10
***C* (dollars)**	550	570	590	610	630	650
***R* (dollars)**	100	120	140	160	180	200

   b. never; Both cost and revenue increase at the same rate, but have different initial values.

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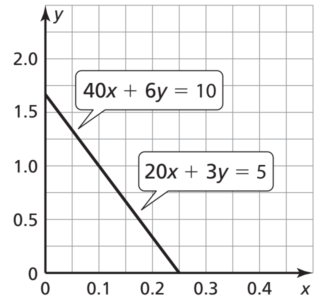
2. **a.** $40x + 6y = 10$; $20x + 3y = 5$

b.



They are the same line.

c. no; Because the equations are equivalent, there are infinitely many solutions.

3. yes; *Sample answer:* The system $y = 3x$ and $y = 3x + 1$ has no solution. The system $y = 3x$ and $2y = 6x$ has infinitely many solutions.

4. **a.** one solution; The lines intersect at one point.

b. no solution; The lines do not intersect.

c. infinitely many solutions; The lines are the same line.

5.4 Practice

1. B; no solution **2.** A; one solution

3. C; infinitely many solutions

4. no solution **5.** (0, 7)

6. infinitely many solutions

7. infinitely many solutions; same slope and same y-intercept

8. no solution; same slope and different y-intercepts

9. one solution; different slopes

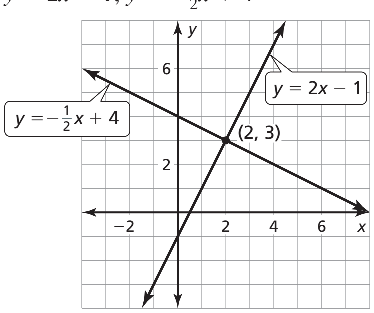
10. Equation 2 is $y = -2x + 5$ in slope-intercept form; $y = -2x + 5$; $2x + y = 5$; The lines have the same slope and the same y-intercept. So, the system has infinitely many solutions.

11. $2x + 10y = 18$, $3x + 15y = 27$; no; Equation 2 is a multiple of Equation 1, so there are infinitely many solutions.

5.5 Explorations

1. **a.** $y = 2x - 1$; $y = -\frac{1}{2}x + 4$

b.



$x = 2$

c. The two sides of the equation are equal to each other. If you set one side of the equation equal to y, the transitive property allows you to set the other side of the equation equal to y.

2. **a.** $x = -4$; yes

b. $x = -3$; yes

c. $x = 3$; yes

d. $x = 2$; yes

e. $x = 1$; yes

f. $x = 0$; yes

3. Write two linear equations setting y equal to each side. Solve the system of linear equations. The x-value of the solution of the system of linear equations is the solution of the equation.

4. The algebraic method will always give the exact solution, but it is difficult to work with fractions as coefficients. The graphical method is easier with fractional coefficients of x because these are the slopes of the lines, but solutions may sometimes be estimates, especially when the solution does not fall on a grid line.

5.5 Practice

1. $x = 2$ **2.** $x = 5$ **3.** $x = -3$

4. $x = 2$ **5.** $x = 2$ **6.** $x = 6$

7. no solution

8. infinitely many solutions

9. $x = 1$ and $x = 0$ **10.** $x = -2$ and $x = 6$

11. $x = 5$ and $x = 1$ **12.** 5 games

5.6 Explorations

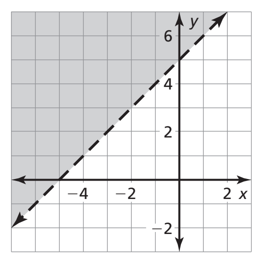
1. **a.** $y = x - 3$

b. all ordered pairs below the graph of $y = x - 3$

c. $y < x - 3$; $<$; *Sample answer:* The point (4, 0) is in the shaded region, and to make the inequality true for that point the $<$ symbol is needed.

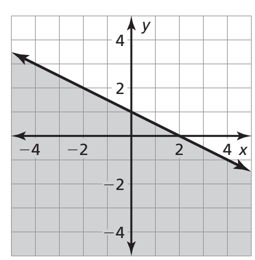
2. $0 \geq -3$

3. **a.**



Sample answer: Graph $y = x + 5$ with a dashed line. Test the point (0, 0), which does not make the inequality true. Shade the half-plane that does not contain the point (0, 0).

b.



Sample answer: Graph $y = -\frac{1}{2}x + 1$ with a solid line. Test the point (0, 0), which does make the inequality true. Shade the half-plane that contains the point (0, 0).

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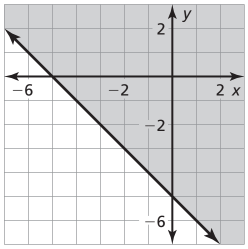
c.



Sample answer: Graph $y = -x - 5$ with a solid line. Test the point (0, 0), which does make the inequality true. Shade the half-plane that contains the point (0, 0).

4. Graph the boundary line for the inequality. Use a dashed line for < or >. Use a solid line for ≤ or ≥. Test a point that is not on the boundary line to determine whether it is a solution of the inequality. When the test point is a solution, shade the half-plane that contains the point. When the test point is not a solution, shade the half-plane that does not contain the point.

5. *Sample answer:* You want to spend no more than $15 at the deli for bologna at $2.99 per pound and cheese at $1.99 per pound. How many pounds of each can you purchase?

5.6 Practice

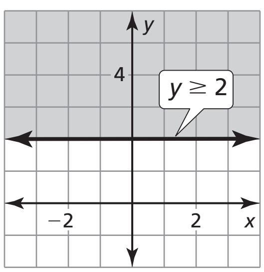
1. no **2.** yes **3.** yes

4. no **5.** no **6.** yes

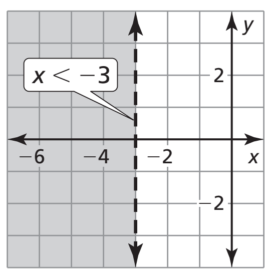
7. yes **8.** yes **9.** yes **10.** no

11. no; The total cost would be $166, which is more than $150.

12.



13.



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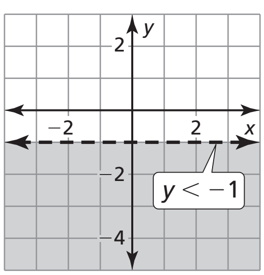

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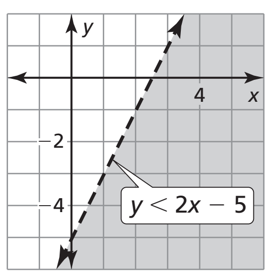

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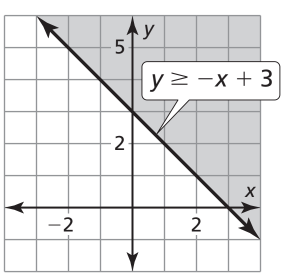

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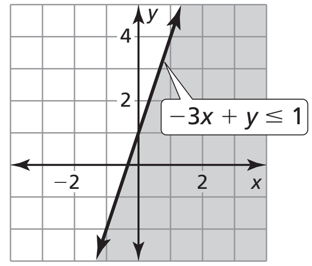

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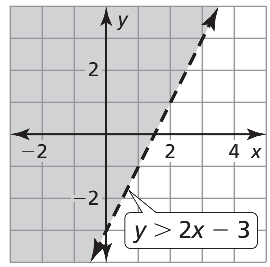
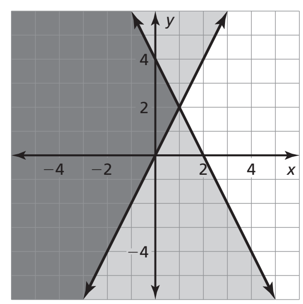


19. $y \leq -x + 2$ **20.** $y > \frac{1}{3}x - 1$

5.7 Explorations

1. Inequality 1: A; The graph has a boundary line of $y = -2x + 4$; Inequality 2: B; The graph has a boundary line of $y = 2x$.

2. a.



Parts of the two half-planes overlap.

b. One shaded region is only shaded the first color, one shaded region is only shaded the second color, and one shaded region is shaded both colors; the values where both inequalities are false

3. Graph each inequality in the same coordinate plane. Find the intersection of the half-planes that are solutions of the inequalities. This intersection is the graph of the system.

4. the region where the shaded half-planes of the inequalities overlap

5. no; When the boundary lines are parallel, it is possible the shaded regions will not overlap.

6. $x \leq 2$ and $y \leq 3$

5.7 Practice

1. no **2.** no **3.** yes

4. no **5.** no **6.** yes

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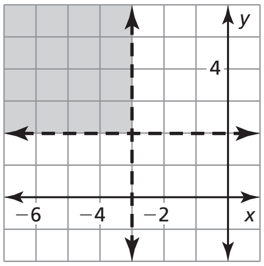
7.


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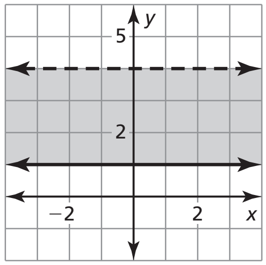

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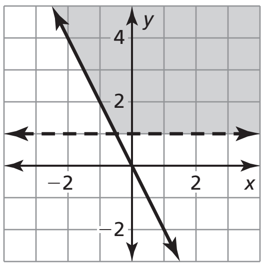

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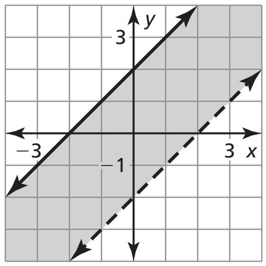

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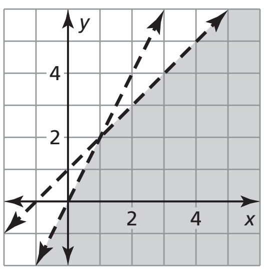

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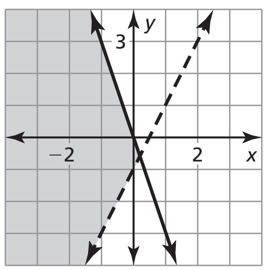
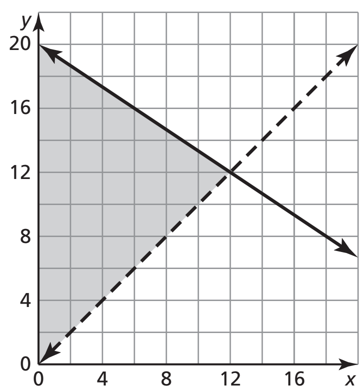


13. $x \geq -1, x < 3$

14. $y < 2, x \geq 1$

15. **a.** $2x + 3y \leq 60, y > x$



b. (8, 14); This solution represents that 8 bags of red beads and 14 bags of blue beads cost \$58, which is less than \$60.

c. yes

Chapter 6

6.1 Explorations

1. **a.** $a^m a^n = a^{m+n}$

i. 2^5

ii. 4^6

iii. 5^8

iv. x^8

b. $\dfrac{a^m}{a^n} = a^{m-n}$

i. 4^1

ii. 2^3

iii. x^3

iv. 3^0

c. $(a^m)^n = a^{mn}$

i. 2^8

ii. 7^6

iii. y^9

iv. x^8

d. $(ab)^m = a^m b^m$

i. $2^2 \cdot 5^2$

ii. $5^3 \cdot 4^3$

iii. $6^2 a^2$

iv. $3^2 x^2$

e. $\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m}$

i. $\dfrac{2^2}{3^2}$

ii. $\dfrac{4^3}{3^3}$

iii. $\dfrac{x^3}{2^3}$

iv. $\dfrac{a^4}{b^4}$

2. Try several examples to find a pattern, then express the pattern using variables.

3. 9^3

6.1 Practice

1. 1 **2.** 1 **3.** $\frac{1}{243}$ **4.** $-\frac{1}{125}$

5. $\dfrac{1}{9}$ **6.** $-\dfrac{1}{6}$ **7.** $\dfrac{1}{x^6}$ **8.** 1

9. $\dfrac{7}{x^4}$ **10.** $\dfrac{12}{g^9}$ **11.** $\dfrac{b^2}{9}$ **12.** $\dfrac{t}{32u^5}$

13. 64 **14.** -27 **15.** 262, 144 **16.** 1

17. h^{12} **18.** $\dfrac{1}{t^{12}}$ **19.** $\dfrac{1}{10}$ cm **20.** $-32y^5$

21. $\dfrac{1}{27d^3}$ **22.** $\dfrac{b^3}{125}$ **23.** $\dfrac{27x^{15}}{8y^{15}}$ **24.** $\dfrac{81b^{36}}{a^{44}}$

25. 4.8×10^5; 480,000 **26.** 3×10^5; 300,000

6.2 Explorations

1. **a.–b.**

Column 1	Column 2
$\sqrt{49} = 7$	$49^{1/2} = 7$
$\sqrt{100} = 10$	$100^{1/2} = 10$
$\sqrt[3]{64} = 4$	$64^{1/3} = 4$
$\sqrt[3]{216} = 6$	$216^{1/3} = 6$
$\sqrt[4]{625} = 5$	$625^{1/4} = 5$
$\sqrt[5]{32} = 2$	$32^{1/5} = 2$

c. *Sample answer:* The answers in column 1 are the same as in column 2. $\sqrt[n]{a} = a^{1/n}$ for any integer $n > 1$.

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