Chapter 8: Equations and Relationships

Getting Started, p. 251

1. a) \[3n + 5 = 3(6) + 5\]
   \[= 23\]

b) \[2n + 4n - 6 = 2(6) + 4(6) - 6\]
   \[= 12 + 24 - 6\]
   \[= 30\]

c) \[6n - 2n + 8 = 6(6) - 2(6) + 8\]
   \[= 36 - 12 + 8\]
   \[= 32\]

d) \[0.5n + 1.5n = 0.5(6) + 1.5(6)\]
   \[= 3 + 9\]
   \[= 12\]

2. a) \[4a + 2 = 4(2.5) + 2\]
   \[= 10 + 2\]
   \[= 12\]

b) \[3a - 0.5 = 3(2.5) - 0.5\]
   \[= 7.5 - 0.5\]
   \[= 7\]

c) \[2 \times 10a = 2 \times 10(2.5)\]
   \[= 2 \times 25\]
   \[= 50\]

d) \[4a \div 5 = 4(2.5) \div 5\]
   \[= 10 \div 5\]
   \[= 2\]

3. a) \[2n + 3: \text{Two counters are added each time, so the}\]
    \[\text{pattern rule must include } 2n, \text{ where } n \text{ represents}\]
    \[\text{the figure number. Figure 1 has 5 counters. “}2n\text{” accounts}\]
    \[\text{for 2 of them, which leaves 3 counters to be expressed.}\]
    \[\text{Therefore, add 3 to } 2n \text{ to complete the algebraic}\]
    \[\text{expression for this pattern rule.}\]

b) \[m + 1: \text{Since one orange square is added each time,}\]
    \[\text{the pattern rule must include } 1m, \text{ or just } m, \text{ where } m\]
    \[\text{represents the figure number. There is always one}\]
    \[\text{green triangle for all three of the figures, so add 1 to } m,\]
    \[\text{which gives } m + 1 \text{ for this pattern rule.}\]

4. a) The pattern rule is \[4n - 1\], where \[n\] represents the
    \[\text{figure number.}\]

<table>
<thead>
<tr>
<th>Figure number</th>
<th>Number of counters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>

5. a) \[t = 1.6\] on the horizontal axis. Place your ruler
    \[\text{vertically at } 1.6 \text{ and see where the ruler touches}\]
    \[\text{the graph. Then place the ruler horizontally from the}\]
    \[\text{intersection to the vertical axis. This is just below }$10\]
    \[\text{on the vertical axis, so the cost of 1.6 kg of nails is a}\]
    \[\text{little less than }$10, \text{ about }$9.60.\]

b) \[t = 24\] on the vertical axis. Place your ruler
    \[\text{horizontally from 24 across to the graph. Then place}\]
    \[\text{the ruler vertically from the intersection to the}\]
    \[\text{horizontal axis. It touches at 4, so you could buy 4 kg}\]
    \[\text{of nails for }$24.\]

6. You need to make \[3n + 5\] equal to 41. Try \[n = 11.\]
   \[3(11) + 5 = 33 + 5\]
   \[= 38 \, \text{too low}\]

Try a greater value, such \[n = 12.\]
   \[3(12) + 5 = 36 + 5\]
   \[= 41 \checkmark\]

Figure 12 contains 41 counters.

7. a) \[t = 49, \text{ then } 7t = 7(49)\]
   \[= 343 \, \text{too high}\]

b) \[w = 12, \text{ then } 3w + 3 = 3(12) + 3\]
   \[= 36 + 3\]
   \[= 39 \checkmark\]

The solution is \[w = 12, \text{ so there is no need to evaluate}\]
\[w = 13.\]

c) \[a = 7, \text{ then } 5a - 5 = 5(7) - 5\]
   \[= 35 - 5\]
   \[= 30 \, \text{too low}\]

The solution is \[a = 8.\]
d) If \( y = 9 \), then
\[
2y - 7 = 2(9) - 7
\]
\[
= 18 - 7
\]
\[
= 11 \checkmark
\]
The solution is \( y = 9 \), so there is no need to evaluate \( y = 2 \).

8. a) Solve by inspection.
\( m + 2 = 21 \) means something + 2 = 21
\( m = 19 \)
The solution is \( m = 19 \).

b) Solve by inspection.
\( 5s = 10 \) means 5 times something = 10
\( s = 2 \)
The solution is \( s = 2 \).

c) Try different values for \( w \). For example, \( w = 3 \).
\[
4w + 2 = 4(3) + 2
\]
\[
= 12 + 2
\]
\[
= 14 \leftarrow \text{too low}
\]
Try a greater value, such as \( w = 4 \).
\[
4w + 2 = 4(4) + 2
\]
\[
= 18 \checkmark
\]
The solution is \( w = 4 \).

d) Try different values for \( y \). For example, \( y = 5 \).
\[
4y - 2 = 4(5) - 2
\]
\[
= 20 - 2
\]
\[
= 18 \checkmark
\]
The solution is \( y = 5 \).

9. Try different values for \( n \).

a) For example, if \( n = 6 \), then
\[
3n - 2 = 3(6) - 2
\]
\[
= 18 - 2
\]
\[
= 16 \leftarrow \text{too high}
\]
Try a lower value, such as \( n = 5 \).
\[
3n - 2 = 3(5) - 2
\]
\[
= 15 - 2
\]
\[
= 13 \checkmark
\]
This is the desired value, so the solution is \( n = 5 \).

b) For example, if \( n = 20 \), then
\[
3n - 2 = 3(20) - 2
\]
\[
= 60 - 2
\]
\[
= 58 \leftarrow \text{too low}
\]
Try a greater value, such as \( n = 25 \).
\[
n - 2 = 3(25) - 2
\]
\[
= 75 - 2
\]
\[
= 73 \leftarrow \text{too high}
\]
Try a lower value, such as \( n = 23 \).
\[
3n - 2 = 3(23) - 2
\]
\[
= 69 - 2
\]
\[
= 67 \checkmark
\]
This is the desired value, so the solution is \( n = 23 \).

\[
\begin{align*}
c) \quad 2n - 3 &= 31 \\
d) \quad 8n - 7 &= 9
\end{align*}
\]
\[
\begin{align*}
2n &= 34 \\
n &= 17 \\
n &= 2
\end{align*}
\]

8.1 Solving Equations by Graphing, pp. 254–255

3. Place a ruler horizontally from 17 on the vertical axis to touch the graph of \( 2n + 3 \). Then place the ruler vertically from the intersection to 7 on the horizontal axis. The solution to the equation \( 2n + 3 = 17 \) is \( n = 7 \).

4. a)
\[
\begin{array}{c|c}
\text{Figure number} & \text{Number of tiles} \\
\hline
1 & 3 \\
2 & 4 \\
3 & 5 \\
\end{array}
\]

b) Each time, 1 tile is added to the previous figure, so \( 1 \times n \) is in the pattern rule, where \( n \) represents the figure number. Each number of tiles is 2 more than \( n \), so \( n + 2 \) is the algebraic expression of this pattern rule.

c) An algebraic expression for the pattern rule is \( n + 2 \), so an equation to determine which figure number has 22 tiles is \( n + 2 = 22 \).

d) Draw a scatter plot using the data in a). Then connect the points to form a line. Extend this line. Draw a horizontal line from 22 on the vertical axis to touch the graph. They intersect at Figure number 20, so Figure 20 will be made with 22 tiles. Check: \( 20 + 2 = 22 \checkmark \)

5. a)
\[
\begin{array}{c|c}
\text{Figure number} & \text{Number of counters} \\
\hline
1 & 5 \\
2 & 8 \\
3 & 11 \\
\end{array}
\]

b) Each time, 3 counters are added, so \( 3n \) is in the pattern rule, where \( n \) represents the figure number. Figure 1 has 5 counters, of which 3 are represented by \( 3n \), so there are 2 counters left to be expressed. Add 2 to \( 3n \) to get \( 3n + 2 \) for an algebraic expression of this pattern rule.
c) An algebraic expression for the pattern rule is $3n + 2$, so an equation to determine which figure has 23 counters is $3n + 2 = 23$.

d)

\[
\text{Number of Blue Counters Compared to Figure Number}
\]

Draw a scatter plot using the data in a). Then connect the points to form a line. Extend this line. Draw a horizontal line from 23 on the vertical axis to touch the graph. They intersect at Figure number 7, so Figure number 7 will be made with 23 counters.

Check the solution: 

\[
3(7) + 2 = 21 + 2 = 23 \checkmark
\]

6. a)

<table>
<thead>
<tr>
<th>Week number</th>
<th>Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

b) Each week, the bank balance increases by $5, so $5w$ is in the pattern rule. In the first week David has $10 in the account. Of that $10, $5 is represented by $5w$, so the other $5 still needs to be expressed. So, add 5 to $5w$. An algebraic expression of David’s balance after $w$ weeks is $5w + 5$.

c) An algebraic expression for the bank balance is $5w + 5$, so an equation to determine when the bank balance is 60 is $5w + 5 = 60$.

For d), e), and f) see the following graph.

d) Place a ruler horizontally from 60 on the vertical axis to the graph. They intersect at week 11. David’s bank balance will be $60 after 11 weeks.

Check the solution: 

\[
5(11) + 5 = 55 + 5 = 60 \checkmark
\]

e) Place a ruler horizontally from 100 on the vertical axis to the graph. The graph shows that if the pattern continues, his bank balance will reach $100 after 19 weeks. Check the solution:

\[
5(19) + 5 = 95 + 5 = 100 \checkmark
\]

f) Draw a line up from 20 on the horizontal axis to touch the graph. The graph shows that if the pattern continues, his bank balance will reach about $105 after 20 weeks. Check the solution:

\[
5(20) + 5 = 100 + 5 = 105 \checkmark
\]

7. a) Make a table of values.

<table>
<thead>
<tr>
<th>Figure number (term number)</th>
<th>Number of toothpicks (term value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>$n$</td>
<td>$2n + 1$</td>
</tr>
</tbody>
</table>

The pattern rule is $3n + 1$, where $n$ is the figure number.

From the graph, Figure 32 will have 97 toothpicks.

b) Make a table of values.

<table>
<thead>
<tr>
<th>Figure number (term number)</th>
<th>Number of toothpicks (term value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>$n$</td>
<td>$2n + 1$</td>
</tr>
</tbody>
</table>

From the graph, Figure 48 will have 97 toothpicks.
8. Create a table of values for each equation.

   \( 2n + 5 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
</tbody>
</table>

   \( 2n + 7 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>

   \( 2n + 9 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
</tbody>
</table>

From the graph, the solutions are:
\( 4n + 3 = 15 \) when \( n = 3 \), \( 3n + 3 = 15 \) when \( n = 4 \), and \( 2n + 3 = 15 \) when \( n = 6 \).

Each equation line begins at the same spot. But when the value of the graph is 15, the lines are far apart. This is because each line is increasing by a different value.

9. Create a table of values for each equation.

   \( 2n + 3 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

   \( 3n + 3 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

   \( 4n + 3 \)
<table>
<thead>
<tr>
<th>( n )</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
</tbody>
</table>

Use these values to graph the equations.

From the graph, the solutions are:
\( 2n + 5 = 19 \) when \( n = 7 \), \( 2n + 7 = 19 \) when \( n = 6 \), and \( 2n + 9 = 19 \) when \( n = 5 \).

The equations are the same, except that the constant value (5, 7, and 9) increases by 2 each time. As the constant increases, the solution decreases by 1.

10. a)

<table>
<thead>
<tr>
<th>Figure number</th>
<th>Area of pond</th>
<th>Number of border tiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

b) Let \( n \) represent the figure number. The algebraic pattern rule for the area of the pond is \( n \times n \). For the number of border tiles, 4 tiles are added each time. So \( 4n \) must be included in the pattern rule. Figure 1 has 8 border tiles, of which 4 are represented by \( 4n \). Therefore, you need to add 4 to \( 4n \) to complete the pattern rule for the number of border tiles, which is \( 4n + 4 \).

c) A pattern rule for the area of the pond is \( n \times n \), which has a curve for its graph. A pattern rule for the border tiles is \( 4n + 4 \), which has a straight line for its graph.

d) An expression for the pattern rule is \( 4n + 4 \), so solve \( 4n + 4 = 56 \).

\[
4n + 4 = 56 \\
4n = 52 \\
\Rightarrow n = 13
\]

Figure 13 will have 56 tiles.

f) An expression for the pattern rule is \( n \times n \). To solve \( n \times n = 121 \), try different values for \( n \). For example, if \( n = 11 \), then \( n \times n = 121 \). Figure 11 will have a pond with an area of 121 square units.
8.3 Creating and Evaluating Algebraic Expressions, pp. 259–261

4. a) Let the variable \( m \) be the number of muffins sold and variable \( j \) be the number of juice boxes sold at the school snack bar. Then multiply each variable by the price of that type of snack, to get an expression for the total income from the sale of muffins and juice boxes:
\[
1.50m + 1.25j.
\]
b) To determine the total income, let \( m = 30 \) and \( j = 40 \).
\[
1.50(30) + 1.25(40) = 95
\]
The total income is $95.

5. a) \( 7c - 4 = 7(5) - 4 \)
\[
= 31
\]
b) \( (h + 2) \times 2.5 = (5 + 2) \times 2.5 \)
\[
= 17.5
\]
c) \( 2r + 3s = 2(1.2) + 3(2.3) \)
\[
= 9.3
\]
d) \( a + 5b - 2 = -5 + 5(7) - 2 \)
\[
= -5 + 35 - 2
\]
\[
= 28
\]
e) \( (5m - n) + p = (5(5) - 9) + 4 \)
\[
= 4
\]

6. a) \( 8b + 6 = 8(5) + 6 \)
\[
= 46
\]
b) \( p + 1.5 \times 3 = 2.5 + 1.5 \times 3 \)
\[
= 7
\]
c) \( 10n - m = 10(3.5) - 3.4 \)
\[
= 31.6
\]
d) \( 5x - 6y + 8 = 5(-1) - 6(-2) + 8 \)
\[
= 15
\]
e) \( 3p + 4q - 8 = 3(-3) + 4(2) - 8 \)
\[
= -9
\]

7. a) Use \( d \) to represent the number of dimes, \( n \) to represent the number of nickels, and \( q \) to represent the number of quarters in the stack. Since a dime is 10 cents, a nickel is 5 cents, and a quarter is 25 cents, an algebraic expression for the total value of any stack of dimes, nickels, and quarters, in cents, is
\[
10d + 5n + 25q.
\]
The value in dollars is
\[
0.10d + 0.05n + 0.25q.
\]
b) For 21 dimes, 23 nickels, and 25 quarters,
\[
10d + 5n + 25q = 10(21) + 5(23) + 25(25)
\]
\[
= 210 + 115 + 625
\]
\[
= 950$ or $9.50
\]
The total value of the stack is $9.50.

8. a) Since water is pumped through the first hose at a rate of 22 L/min, an algebraic expression to represent the amount of water pumped through the first hose after \( t \) minutes is 22\( t \).

b) Since water is pumped through the second hose at a rate of 18 L/min, an algebraic expression to represent the amount of water pumped through the first hose after \( t \) minutes is 18\( t \).

c) The total amount of water pumped into the pool from both hoses after \( t \) minutes is obtained by adding the expressions in parts a) and b):
\[
22t + 18t = 40t.
\]
d) Since there are 60 min in one hour, 2.5 h = 150 min. Using the formula in part c), with \( t = 150 \),
\[
40t = 40(150)
\]
\[
= 6000
\]
6000 L of water have been pumped into the pool after 2.5 h.

9. a) Since Kurt jumps an average of 4.6 m and each boy’s score is the sum of the lengths of his jumps, if Kurt jumps \( k \) times, an algebraic expression to represent his score is 4.6\( k \).

b) Since Jared jumps an average of 4.4 m and each boy’s score is the sum of the lengths of his jumps, if Jared jumps \( j \) times, an algebraic expression to represent his score is 4.4\( j \).

c) Since the term score is the sum of the scores of both boys, an algebraic expression for the total team score is 4.6\( k + 4.4j \).

d) Set \( k = 5 \) and \( j = 4 \).
\[
4.6k + 4.4j = 4.6(5) + 4.4(4)
\]
\[
= 40.6
\]
The total team score is 40.6 if Kurt jumps 5 times and Jared jumps 4 times.

10. a) If she gets \( t \) 3-mark questions correct, an algebraic expression for the number of marks that she earns for these questions is 3\( t \).

b) If she gets \( w \) 2-mark questions correct, an algebraic expression for the number of marks that she earns for these questions is 2\( w \).

c) To determine the total number of marks that Amy earns on this test, add the formulas in parts a) and b):
\[
3t + 2w.
\]
She will get 41 out of 50 on the test if she answers 5 three-mark questions and 13 two-mark questions correctly.

11. a) Since a box of apples has a mass of 17.5 kg and a box of pears has a mass of 15.5 kg, an algebraic expression for the total mass of \( a \) boxes of apples and \( p \) boxes of pears is 17.5\( a + 15.5p \).

b) For \( a = 32 \) and \( p = 41 \),
\[
17.5a + 15.5p = 17.5(32) + 15.5(41)
\]
\[
= 1195.5
\]
The total mass of a shipment of 32 boxes of apples and 41 boxes of pears is 1195.5 kg.
12. a) Let \( w \) represent the width of the rectangle and \( l \) represent the length of the rectangle. The algebraic expression for the perimeter of the rectangle is \( 2l + 2w \).

b) The area of the rectangle is calculated by multiplying length by width. Therefore, the algebraic expression for the area of the rectangle is \( lw \).

c) For the perimeter,
\[
\text{perimeter} = 2l + 2w = 2(11.2 \text{ m}) + 2(8.4 \text{ m}) = 39.2 \text{ m}
\]
The perimeter of the rectangle is 39.2 m.

The area of the rectangle is calculated by multiplying length by width. Therefore, the algebraic expression for the area of the rectangle is \( lw \).

The area of the rectangle is 94.08 m².

13. a) Let \( h \) represent the rate of pay per hour and \( b \) represent the rate of pay per bundle.

i) \( \text{weekly earnings} = 40h \)

ii) \( \text{weekly earnings} = 40h + 3(40)b = 40h + 120b \)

iii) \( \text{weekly earnings} = 120b \)

b) i) \( 40(8.75) = 350 \)

ii) \( 40(4.75) + 120(1.35) = 190 + 162 = 352 \)

iii) \( 120(2.75) = 330 \)

Nick should take the second offer since he earns the most with that rate of pay.

14. a) Use \( s \) to represent the number of pairs of shoes and \( b \) to represent the number of pairs of boots she sells. Since she earns a commission of $2.45 for each pair of shoes she sells, and $2.85 for each pair of boots, her total commission would be \( 2.45s + 2.85b \).

b) Use \( s = 8 \) and \( b = 7 \).
\[
2.45s + 2.85b = 2.45(8) + 2.85(7) = 39.55
\]
Shannon’s commission is $39.55.

15. a) Algebraic expressions for the areas of the two squares are \( s^2 \) and \( t^2 \), respectively. Then the sum of the area of the two squares is \( s^2 + t^2 \).

b) For example, if \( s = 1 \) and \( t = 1 \), then
\[
s^2 + t^2 = 1^2 + 1^2 = 2
\]
If \( s = 2 \) and \( t = 3 \), then
\[
s^2 + t^2 = 2^2 + 3^2 = 13
\]
If \( s = 3 \) and \( t = 4 \), then
\[
s^2 + t^2 = 3^2 + 4^2 = 25
\]

c) The resulting value sometimes represents the area of a single square with a whole-number side length. For example, the last example in part b) results a value of 25, which can represent the area the square with a side length of 5.

16. a) Let \( l \) represent the length of the rectangle. Since the length of the rectangle is 2 cm more than its width, we can express the width in terms of \( l \) as \( l - 2 \).

b) The area of a rectangle is the product of its length and width, which can be expressed in terms of \( l \) as \( l(l - 2) \).

c) Let \( w \) represent the width of the rectangle. If the length of a rectangle is 2 cm more than its width, then you can express its length in terms of \( w \) as \( w + 2 \). Then the area of the rectangle in terms of \( w \) is \( w(w + 2) \).

d) The length is 2 cm more than the width, so if the length is 10, the width is 8.

Area from b = \( l(l - 2) \) Area from c = \( w(w + 2) \)
\[
= (10)(10 - 2) = 8(8 + 2) = 80 \]

The area of the rectangle is 80 cm².

17. a) Use \( s \) to represent the number of containers sold by the school. Since the school is selling the containers for $4.25 each, \( 4.25s \) is paid to the school. But because each container costs the school $2.50, you need to subtract 2.50s from the money made to obtain the profit.

So the first algebraic expression for the total profit is \( 4.25s - 2.50s \).

Also, since every container is sold for $4.25 and costs the school $2.50 originally, the profit for each container is $4.25 - $2.50 = $1.75. Therefore, the second expression for the total profit is \( 1.75s \).

b) First Expression:
\[
4.25s - 2.50s = 4.25(174) - 2.50(174) = 304.5
\]
Second Expression:
\[
1.75s = 1.75(174) = 304.5
\]
The total sales of 174 containers is $304.50.

### Mid-Chapter Review, p. 263

#### 1. a)

<table>
<thead>
<tr>
<th>Day number</th>
<th>Number of golf carts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
</tr>
</tbody>
</table>

b) Each time, the value increases by 6 golf carts, so \( 6n \) must be included in the algebraic expression. Since on day 1, the factory produced 9 carts and 6 of them are given by \( 6n \), you need to add 3 to the expression. Therefore, an algebraic expression for the number of golf carts produced after \( n \) days is \( 6n + 3 \).
c) An expression for the number of golf carts is $6n + 3$, so an equation for what day 51 golf carts is produced is $6n + 3 = 51$. Read across the graph from 51 to find the intersection at day 8. The solution to the equation is $n = 8$. So, 51 karts were made on day 8.

2. a)

<table>
<thead>
<tr>
<th>Figure number</th>
<th>Number of counters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
</tr>
</tbody>
</table>

b) the number of counters increases by 4 each time the figure number increases, so $4n$ must be in the algebraic expression, where $n$ represents the figure number.

Figure 1 has 11 counters, 4 of which are taken into account by $4n$. Therefore, you need to add $11 - 4 = 7$ into the expression, which gives $4n + 7$ for an algebraic expression for the pattern rule.

c) An expression for the number of counters is $4n + 7$, so an equation for which figure has 63 counters is $4n + 7 = 63$.

d)

As the graph shows, figure 14 will have 63 counters. Check:

$$4(14) + 7 = 63 \checkmark$$

3. a) A horizontal ruler crosses the graph at 41 when $n = 12$. Therefore, $4n - 7 = 41$ when $n = 12$.

b) A horizontal ruler crosses the graph at 49 when $n = 14$. Therefore, $4n - 7 = 49$ when $n = 14$.

4. a) $3m + 4 = 3(1.2) + 4 = 7.6$

b) $8n - 6 = 8(-2) - 6 = -22$

c) $5m + 2n = 5(1.2) + 2(1.4) = 8.8$

d) $9n + 5 - 6m = 9(-2) + 5 - 6(-3) = 5$

5. a) Since Erin makes a deposit of $12.50 in her savings account each week and she already has $182.73 in her account, an algebraic expression for the amount in her savings account after $n$ weeks is $182.73 + 12.50n$.

b) $n = 8$.

After 8 weeks, Erin will have $282.73 in her account.

8.4 Solving Equations I, pp. 266–267

4. a)

<table>
<thead>
<tr>
<th>Number of lawns mowed</th>
<th>Amount earned ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>150</td>
</tr>
<tr>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td>30</td>
<td>450</td>
</tr>
</tbody>
</table>

b) She earns $15 for each lawn she mows. Let $n$ represent the number of lawns that she mows. Then she earns $15n$ for mowing $n$ lawns. To buy her guitar and amplifier, she needs $525. An equation is $15n = 525$.

c) Solve $15n = 525$.

Try 30, $15(30) = 450$ too low

Try 35, $15(35) = 525 \checkmark$

She needs to mow 35 lawns.

d) For example, my solution in part c) matches my solution by reading from the graph, so yes, I think that my solution is correct.

c) $9.3 = 3n$. For example,

Predict $n$. Evaluate $3n$. Is the answer 9.3?

<table>
<thead>
<tr>
<th>Predict $n.$</th>
<th>Evaluate $3n$.</th>
<th>Is the answer 9.3?</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3(3) = 9</td>
<td>No, too low.</td>
</tr>
<tr>
<td>3.1</td>
<td>3(3.1) = 9.3</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

$n = 3.1$

d) Solve $2n - 2.5 = 5.5$. For example,

Predict $n$. Evaluate $2n - 2.5$. Is the answer 5.5?

<table>
<thead>
<tr>
<th>Predict $n.$</th>
<th>Evaluate $2n - 2.5$.</th>
<th>Is the answer 5.5?</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2(3) - 2.5 = 3.5</td>
<td>No, too low.</td>
</tr>
<tr>
<td>4</td>
<td>2(4) - 2.5 = 5.5</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

$n = 4$
6. a) The following table shows the number of lawns mowed and the amount earned in dollars:

<table>
<thead>
<tr>
<th>Number of lawns mowed</th>
<th>Amount earned ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>180</td>
</tr>
<tr>
<td>20</td>
<td>360</td>
</tr>
<tr>
<td>30</td>
<td>540</td>
</tr>
</tbody>
</table>

b) For each lawn she mows, Rowyn earns $18. Let \( n \) represent the number of lawns that she mows. Then she earns \( 18n \) for mowing \( n \) lawns. To buy her guitar and amplifier, she needs $525. An equation is

\[
18n = 525.
\]

c) Solve \( 18n = 525 \).

\[
n = 29.17
\]

Rowyn needs to mow 30 lawns to earn the money she needs.
d) My solution to the equation and my solution from the graph match, so yes, I think that my solution is correct.

7. a) For example, 29 is close to 30, and \( 30 \div 3 = 10 \), so my estimate is \( x \approx 10 \).
b) For example, 129 is close to 130 and 387 is close to 390. Since \( 390 \div 130 = 3 \), my estimate is \( c \approx 3 \).
c) For example, Since \( 2 \times 35 = 70 \), then \( 2 \times 35 + 5.4 \) is about 75. My estimate is \( a \approx 35 \).
d) For example, Round 1.2 to 1 and 8.3 to 9. Since \( 5 \times 2 - 1 = 9 \), my estimate is \( h \approx 2 \).
e) For example, Round 1.1 down to 1, and 6.4 to 6. Since \( 2 \times 2.5 + 1 = 6 \), my estimate is \( p \approx 2.5 \).
f) For example, try \( n = 6 \).

\[
4n - 5 = 4(6) - 5
\]

\[
= 19
\]

This is close to the desired value. My estimate is \( n \approx 6 \).

8. a) Try \( n = 13 \).

\[
3n - 3 = 3(13) - 3
\]

\[
= 36 \leftarrow \text{too low}
\]

The given solution is incorrect.

Use systematic trial to determine the correct solution. For example,

\[
\text{Predict } n. \quad \text{Evaluate } 3n - 3. \quad \text{Is the answer 42?}
\]

<table>
<thead>
<tr>
<th>( n )</th>
<th>( 3n - 3 )</th>
<th>Is the answer 42?</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>3(14) - 3 = 39</td>
<td>No, too low.</td>
</tr>
<tr>
<td>15</td>
<td>3(15) - 3 = 42</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The correct solution is \( n = 15 \).

b) Try \( m = -7 \).

\[
6m + 6 = 6(-7) + 6
\]

\[
= -36
\]

The given solution is correct.
c) Try \( t = 9 \).

\[
t + 5.1 = 9 + 5.1
\]

\[
= 14.1 \leftarrow \text{too low}
\]

The given solution is incorrect. Use systematic trial to determine the correct solution. For example,

<table>
<thead>
<tr>
<th>( t )</th>
<th>( t + 5.1 )</th>
<th>Is the answer 60?</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>(50) + 5.1 = 55.1</td>
<td>No, too low.</td>
</tr>
<tr>
<td>55</td>
<td>(55) + 5.1 = 60.1</td>
<td>No, just too high.</td>
</tr>
<tr>
<td>54.9</td>
<td>(54.9) + 5.1 = 60</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The correct solution is \( t = 54.9 \).
d) Try \( y = 3 \).

\[
5y + 3 = 5(3) + 3
\]

\[
= 18
\]

The given solution is correct.
e) Try \( x = 1.4 \).

\[
3x - 2.4 = 3(1.4) - 2.4
\]

\[
= 1.8
\]

The given solution is correct.
f) Try \( w = 2.6 \).

\[
5w - 4.3 = 5(2.6) - 4.3
\]

\[
= 8.7 \leftarrow \text{too low}
\]

The given solution is incorrect. Use systematic trial to determine the correct solution. For example,

<table>
<thead>
<tr>
<th>( w )</th>
<th>( 5w - 4.3 )</th>
<th>Is the answer 10.75?</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5(3) - 4.3 = 10.7</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The correct solution is \( w = 3 \).

9. a) By inspection, \( 4 + 4 = 8 \), so \( b = 4 \).
b) By inspection, \( 4 + 2 = 6 \), so \( x = 1 \).
c) Use systematic trial to solve. For example,

<table>
<thead>
<tr>
<th>( n )</th>
<th>( 4n + 2 = 6.8 )</th>
<th>Is the answer 6.8?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4(1) + 2 = 6</td>
<td>No, too low.</td>
</tr>
<tr>
<td>1.2</td>
<td>4(1.2) + 2 = 6.8</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \( n = 1.2 \).
d) Use systematic trial to solve. For example,

<table>
<thead>
<tr>
<th>( t )</th>
<th>( 2t + 2.25 )</th>
<th>Is the answer 10.75?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2(4) + 2.25 = 10.25</td>
<td>No, too low.</td>
</tr>
<tr>
<td>4.5</td>
<td>2(4.5) + 2.25 = 11.25</td>
<td>No, too high.</td>
</tr>
<tr>
<td>4.25</td>
<td>2(4.25) + 2.25 = 10.75</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \( t = 4.25 \).
e) Use systematic trial to solve. For example,

<table>
<thead>
<tr>
<th>Predict ( t )</th>
<th>Evaluate ( t - 0.23 )</th>
<th>Is the answer 4.6?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8</td>
<td>(4.8) - 0.23 = 4.57</td>
<td>No, just too low.</td>
</tr>
<tr>
<td>4.83</td>
<td>(4.83) - 0.23 = 4.6</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \( t = 4.83 \).

f) Use systematic trial to solve. For example,

<table>
<thead>
<tr>
<th>Predict ( n )</th>
<th>Evaluate ( 15n - 6.5 )</th>
<th>Is the answer 53.5?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>15(4) - 6.5 = 53.5</td>
<td>It's correct.</td>
</tr>
</tbody>
</table>

The solution is \( n = 4 \).

10. a) For example, let \( n \) be the unknown number. Multiplying it by 6 is represented by \( 6n \). The result is 48, so the equation is \( 6n = 48 \).

\[ 6n = 48 \]

\[ n = 8 \]

b) For example, let \( p \) be the unknown number. To double the number means to multiply it by 2, so you have \( 2p \). Subtracting 10 gives \( 2p - 10 \), and since the result is 37 the equation is \( 2p - 10 = 37 \).

To solve the equation, use systematic trial.

<table>
<thead>
<tr>
<th>Predict ( p )</th>
<th>Evaluate ( 2p - 10 )</th>
<th>Is the answer 37?</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2(24) - 10 = 38</td>
<td>No, just too high.</td>
</tr>
<tr>
<td>23.5</td>
<td>2(23.5) - 10 = 37</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \( p = 23.5 \).

c) For example, let \( w \) be the unknown number. Seven times a number is \( 7w \), and then adding 2.5 gives \( 7w + 2.5 \). This is equal to 58.5, so the equation is \( 7w + 2.5 = 58.5 \).

To solve, try \( w = 8 \).

\[ 7w + 2.5 = 7(8) + 2.5 \]

\[ = 58.5 \]

This is the desired value, so the solution is \( w = 8 \).

11. a) For example, use \( u \) to represent the cost of one uniform, before tax. There were 20 uniforms purchased, so that gives \( 20u \). The sales tax must be added to this cost, so that gives \( 20u + 119.85 \). The total cost overall was \$918.85, so this must equal \( 20u + 119.85 \).

b) Use systematic trial to solve. For example,

<table>
<thead>
<tr>
<th>Predict ( u )</th>
<th>Evaluate ( 20u + 119.85 )</th>
<th>Is the answer 918.85?</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>20(35) + 119.85 = 819.85</td>
<td>No, too low.</td>
</tr>
<tr>
<td>40</td>
<td>20(40) + 119.85 = 919.85</td>
<td>No, just too high.</td>
</tr>
<tr>
<td>39.95</td>
<td>20(39.95) + 119.85 = 918.85</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The cost of one uniform before tax was \$39.95.

12. a) Some coordinates for the graph would be (4, 96) and (8, 192). Plot these points and connect them with a line. Extend the line.

b) To determine the number of boxes needed to hold 744 cans, draw a horizontal line on the graph from 744 on the vertical axis until it touches the graph. Then draw a vertical line down to about 30 on the horizontal axis. With this graph, estimate that about 30 boxes will be needed to pack 744 cans of food.

c) Use \( b \) to represent the number of boxes needed. Each box can hold 24 cans, so \( 24b \) is part of the equation. The total number of cans is 744, so the equation is \( 24b = 744 \).

d) I can tell by inspection that to solve for \( b \), I have to divide 744 by 24.

\[ 24b = 744 \]

\[ b = 31 \]

Therefore, 31 boxes are needed to pack 744 cans.

e) Yes, I think that my solution is correct, because I used two different methods to solve the problem (a graph and an equation) and I got almost the same answer with both methods.

13. a) and b) Some coordinates for the graph would be

<table>
<thead>
<tr>
<th>( x )-value</th>
<th>( y )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

Plot these points and extend the line. The amount of shelving Austin needs to fill is \( 10 \text{ m} - 2 \text{ m} = 8 \text{ m} \). From the graph, draw a horizontal line from 8 m on the vertical axis until it touches the graph. Then draw a vertical line down to the horizontal axis and read that number. I get an estimate of 13 cartons needed to fill 8 m of shelving.
c) Use \(c\) to represent the number of cartons needed. Each carton fills 60 cm = 0.6 m of shelving, so 0.6\(c\) is in the equation. There are 8 m of shelving that needs to be filled, so the equation is 0.6\(c\) = 8.
d) By inspection, you must divide 8 by 0.6 to solve for the number of cartons, \(c\).
\[
0.6c = 8
\]
\[
c = 13.3
\]
13 cartons will almost fill the shelves.
e) Yes, I think my solution is correct, because my estimate using a graph and my answer from solving an equation are very close.

14. Let \(n\) represent one of the consecutive numbers. Then since they are whole numbers, the other two numbers can be represented by \(n + 1\) and \(n + 2\). The sum of these numbers is 36. The equation is below.
\[
n + (n + 1) + (n + 2) = 36
\]
\[
n + n + n + 1 + 2 = 36
\]
\[
3n + 3 = 36
\]
To solve this equation, use systematic trial. For example,

<table>
<thead>
<tr>
<th>Predict (n)</th>
<th>Evaluate (3n + 3)</th>
<th>Is the answer 36?</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(3(10) + 3 = 33)</td>
<td>No, too low.</td>
</tr>
<tr>
<td>11</td>
<td>(3(11) + 3 = 36)</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>
One of the numbers is 11. The other two numbers are:
\[
n + 1 = 11 + 1
\]
\[
= 12
\]
\[
n + 2 = 11 + 2
\]
\[
= 13
\]
The three consecutive whole numbers whose sum is 36 are 11, 12, and 13. Check: 11 + 12 + 13 = 36

15. Let \(d\) represent Daryl’s weekly earnings. Madison’s weekly earnings can be represented by 3\(d\). Together they earn $41.00. The equation is below.
\[
d + 3d = 41.00
\]
\[
4d = 41.00
\]
\[
d = 10.25
\]
Madison earns 3\(d\) = 3($10.25) or $30.75. Therefore, Daryl earns $10.25 each week and Madison earns $30.75 each week.

16. Let \(j\) represent the total number of points Julia scored. One-half of this can be written as 0.5\(j\), and 35 more than half is 0.5\(j\) + 35, which represents the number of points Holly scored. Their total was 107 points, so the equation is as below.
\[
j + 0.5j + 35 = 107
\]
\[
1.5j + 35 = 107
\]
To solve, use systematic trial. For example,

<table>
<thead>
<tr>
<th>Predict (j)</th>
<th>Evaluate 1.5(j) + 35</th>
<th>Is the answer 107?</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1.5(50) + 35 = 110</td>
<td>No, just too high.</td>
</tr>
<tr>
<td>48</td>
<td>1.5(48) + 35 = 107</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>
So Julia’s score was 48. Holly’s score was:
\[
0.5j + 35 = 0.5(48) + 35
\]
\[
= 59
\]
So Julia scored 48 points and Holly scored 59 points. Holly scored 11 more points than Julia.

17. a) Solve 3\(m\) + 4 = –14. It looks like \(m\) must be negative. Use systematic trial. For example,

<table>
<thead>
<tr>
<th>Predict (m)</th>
<th>Evaluate 3(m) + 4</th>
<th>Is the answer –14?</th>
</tr>
</thead>
<tbody>
<tr>
<td>–5</td>
<td>3(–5) + 4 = –11</td>
<td>No, too high.</td>
</tr>
<tr>
<td>–6</td>
<td>3(–6) + 4 = –14</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

\(m = –6\).
b) Solve –3\(m\) + 4 = 13. It looks like \(m\) must be negative. Try \(m = –3\).
\[
–3m + 4 = –3(–3) + 4
\]
\[
= 9 + 4
\]
\[
= 13 \checkmark
\]
This is the desired value, so the solution is \(m = –3\).
c) Solve 5\(t\) – 0.5 = –45.5. It looks like the variable must be negative. Use systematic trial to solve, for example,

<table>
<thead>
<tr>
<th>Predict (t)</th>
<th>Evaluate 5(t) – 0.5</th>
<th>Is the answer –45.5?</th>
</tr>
</thead>
<tbody>
<tr>
<td>–10</td>
<td>5(–10) – 0.5 = –50.5</td>
<td>No, too low.</td>
</tr>
<tr>
<td>–9</td>
<td>5(–9) – 0.5 = –45.5</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \(t = –9\).
Divide the remaining counters on each side by 2, since there are two bags, to determine how many counters are in each bag.

\[ 2n + 2 = 14 \div 2 \]
\[ n = 7 \]

There are 7 counters in each bag.

Check:

\[ 2n + 3 = 2(7) + 3 \]
\[ = 17 \checkmark \]

7. a) To solve, add 3 to both sides.

\[ t - 3 = 9 \]
\[ t - 3 + 3 = 9 + 3 \]
\[ t = 12 \]
Check:

\[ t - 3 = 9 \]
\[ 12 - 3 = 9 \checkmark \]
Therefore, \( t = 12 \).

b) To solve, subtract 4 from both sides.

\[ 7 = a + 4 \]
\[ 7 - 4 = a + 4 - 4 \]
\[ 3 = a \]
Check:

\[ 3 + 4 = 7 \checkmark \]
Therefore, \( a = 3 \).

c) To solve the equation, add 1 to both sides and then divide both sides by 3.

\[ 3b - 1 = 8 \]
\[ 3b - 1 + 1 = 8 + 1 \]
\[ 3b = 9 \]
\[ 3b + 3 = 9 + 3 \]
\[ b = 3 \]
Check:

\[ 3b - 1 = 8 \]
\[ 3(3) - 1 = 8 \checkmark \]
Therefore, \( b = 3 \).

d) To solve, multiply both sides by 2.

\[ x + 2 \times 2 = 8 \times 2 \]
\[ x = 16 \]
Check:

\[ 16 + 2 = 8 \checkmark \]
Therefore, \( x = 16 \).

8. Let \( n \) represent the number of counters in each bag. On the left side there are 6 bags of \( n \) counters and 4 extra counters, giving \( 6n + 4 \). On the right side there are 28 counters. So the equation is \( 6n + 4 = 28 \).

To solve the equation, subtract 4 from both sides and then divide both sides by 6.

\[ 6n = 28 \]
\[ 6n - 4 = 28 - 4 \]
\[ 6n = 24 \]
\[ 6n \div 6 = 24 \div 6 \]
\[ n = 4 \]
Check: \( 6n + 4 = 6(4) + 4 \)
\[ = 28 \checkmark \]
Therefore, there are 4 counters in each bag.

9. a) To solve, add 3 to both sides and then divide both sides by 2.

\[ 2m - 3 = 31 \]
\[ 2m - 3 + 3 = 31 + 3 \]
\[ 2m = 34 \]
\[ 2m \div 2 = 34 \div 2 \]
\[ m = 17 \]
Check:

\[ 2m - 3 = 2(17) - 3 \]
\[ = 31 \checkmark \]
Therefore, \( m = 17 \).

b) To solve, subtract 15 from both sides and then divide both sides by 5.

\[ 5a + 15 = 75 \]
\[ 5a + 15 - 15 = 75 - 15 \]
\[ 5a = 60 \]
\[ 5a + 5 = 60 \div 5 \]
\[ a = 12 \]
Check:

\[ 5a + 15 = 5(12) + 15 \]
\[ = 75 \checkmark \]
Therefore, \( a = 12 \).

c) To solve, add 123 to both sides and then multiply both sides by 8.

\[ (n \div 8) - 123 = 37 \]
\[ (n \div 8) - 123 + 123 = 37 + 123 \]
\[ (n \div 8) = 160 \]
\[ (n \div 8) \times 8 = 160 \times 8 \]
\[ n = 1280 \]
Check:

\[ (n \div 8) - 123 = (1280 \div 8) - 123 \]
\[ = 37 \checkmark \]
Therefore, \( n = 1280 \).

d) To solve, turn the equation around, subtract 19 from both sides, and then divide both sides by 6.

\[ 214 = 6n + 19 \]
\[ 6n + 19 = 214 \]
\[ 6n + 19 - 19 = 214 - 19 \]
\[ 6n = 195 \]
\[ 6n + 6 = 195 \div 6 \]
\[ n = 32.5 \]
Check:

\[ 6n + 19 = 6(32.5) + 19 \]
\[ = 214 \checkmark \]
Therefore, \( n = 32.5 \).
e) To solve, add 145 to both sides and then divide both sides by 10.

\[10w - 145 = 955\]
\[10w - 145 + 145 = 955 + 145\]
\[10w = 1100\]
\[w = 110\]

Check: \(10w - 145 = 10(110) - 145 = 955\)

Therefore, \(w = 110\).
f) To solve, subtract 7 from both sides and then multiply both sides by 4.

\[(n ÷ 4) + 7 = 13\]
\[(n ÷ 4) + 7 - 7 = 13 - 7\]
\[(n ÷ 4) = 6\]

\[n = 24\]

Check: \((n ÷ 4) + 7 = (24 ÷ 4) + 7 = 13\)

Therefore, \(n = 24\).

10. a) To solve, turn the equation around and subtract 0.7 from both sides.

\[1.8 = a + 0.7\]
\[a + 0.7 = 1.8\]
\[a + 0.7 - 0.7 = 1.8 - 0.7\]
\[a = 1.1\]

Check: \(a + 0.7 = 1.1 + 0.7 = 1.8\)

Therefore, \(a = 1.1\).
b) To solve, subtract 1.3 from both sides and then divide both sides by 2.

\[2r + 1.3 = 3.9\]
\[2r + 1.3 - 1.3 = 3.9 - 1.3\]
\[2r = 2.6\]
\[2r ÷ 2 = 2.6 ÷ 2\]
\[r = 1.3\]

Check: \(2r + 1.3 = 2(1.3) + 1.3 = 3.9\)

Therefore, \(r = 1.3\).
c) To solve, add 4.2 to both sides and then multiply both sides by 4.

\[4n - 4.2 = 39.8\]
\[4n - 4.2 + 4.2 = 39.8 + 4.2\]
\[4n = 44\]
\[4n + 4 = 44 + 4\]
\[n = 11\]

Check: \(4n - 4.2 = 4\times 11 - 4.2 = 39.8\)

Therefore, \(n = 11\).

d) To solve, add 5.5 to both sides. Then divide both sides by 6.

\[6x - 5.5 = 42.2\]
\[6x - 5.5 + 5.5 = 42.2 + 5.5\]
\[6x = 47.7\]
\[6x ÷ 6 = 47.7 ÷ 6\]
\[x = 7.95\]

Check: \(6x - 5.5 = 6(7.95) - 5.5 = 42.2\) Therefore, \(x = 7.95\).
e) To solve, subtract 3.3 from both sides and then divide both sides by 3.

\[3n + 3.3 = 86.7\]
\[3n + 3.3 - 3.3 = 86.7 - 3.3\]
\[3n = 83.4\]
\[3n ÷ 3 = 83.4 ÷ 3\]
\[n = 27.8\]

Check: \(3n + 3.3 = 3(27.8) + 3.3 = 86.7\) Therefore, \(n = 27.8\).
f) To solve, subtract 9 from both sides and then multiply both sides by 5.

\[(n ÷ 5) + 9 = 22\]
\[(n ÷ 5) + 9 - 9 = 22 - 9\]
\[(n ÷ 5) = 13\]

\[n = 65\]

Check: \((n ÷ 5) + 9 = (65 ÷ 5) + 9 = 22\) Therefore, \(n = 65\).

11. Let \(n\) represent the number of stones in each bag. There are 4 bags of stones and 4 extra stones, so there are \(4n + 4\) stones. In all there are 28 stones, so the equation is \(4n + 4 = 28\).

To solve, subtract 4 from both sides and then divide both sides by 4.

\[4n + 4 = 28\]
\[4n + 4 - 4 = 28 - 4\]
\[4n = 24\]
\[4n ÷ 4 = 24 ÷ 4\]
\[n = 6\]

Therefore, there are 6 stones in each bag.

12. a) Let \(n\) be the number of stones in each bag. There are 2 bags of stones and 6 extra stones, so there are \(2n + 6\) stones. There are a total of 66 stones, so the equation is \(2n + 6 = 66\).

To solve, subtract 6 from both sides and then divide both sides by 2.

\[2n + 6 = 66\]
\[2n + 6 - 6 = 66 - 6\]
\[2n = 60\]
\[2n ÷ 2 = 60 ÷ 2\]
\[n = 30\]

Therefore, there are 30 stones in each bag.
b) Let \( m \) represent the number of stones in each bag. There are 3 bags, but one bag has had 7 stones removed from it, so there are 3 bags less 7 stones, giving \( 3m - 7 \) stones. There are a total of 32 stones, so the equation is \( 3m - 7 = 32 \).

To solve, add 7 to both sides and then divide both sides by 3.

\[
\begin{align*}
3m &- 7 = 32 \\
3m &- 7 + 7 = 32 + 7 \\
3m & = 39 \\
3m & ÷ 3 = 39 ÷ 3 \\
m &= 13
\end{align*}
\]

Therefore, there are originally 13 stones in each bag.

13 a) To solve, add 2 to both sides and then divide both sides by 5.

\[
\begin{align*}
5x - 2 &= 10 \\
5x &- 2 + 2 = 10 + 2 \\
5x &= 12 \\
5x &÷ 5 = 12 ÷ 5 \\
x &= 2.4
\end{align*}
\]

Check: \( 5x - 2 = 5(2.4) - 2 \)

\[
= 10 \checkmark
\]

Therefore, \( x = 2.4 \).

b) To solve, subtract 4.1 from both sides and then divide both sides by 2.

\[
\begin{align*}
2n + 4.1 &= 8.5 \\
2n &+ 4.1 - 4.1 = 8.5 - 4.1 \\
2n &= 4.4 \\
2n &÷ 2 = 4.4 ÷ 2 \\
n &= 2.2
\end{align*}
\]

Check: \( 2n + 4.1 = 2(2.2) + 4.1 \)

\[
= 8.5 \checkmark
\]

Therefore, \( n = 2.2 \).

c) To solve, add 7 to both sides and then multiply both sides by 3.

\[
\begin{align*}
(x + 3) - 7 &= 2 \\
(x + 3) &- 7 + 7 = 2 + 7 \\
x &+ 3 = 9 \\
(x + 3) &× 3 = 9 × 3 \\
x &= 27
\end{align*}
\]

Check: \( (x + 3) - 7 = (27 + 3) - 7 \)

\[
= 27 \checkmark
\]

Therefore, \( x = 27 \).

d) To solve, subtract 0.25 from both sides and then multiply both sides by 5.

\[
\begin{align*}
(n ÷ 5) + 0.25 &= 5.75 \\
(n ÷ 5) &+ 0.25 - 0.25 = 5.75 - 0.25 \\
n &÷ 5 = 5.5 \\
(n ÷ 5) &× 5 = 5.5 × 5 \\
n &= 27.5
\end{align*}
\]

Check: \( (n ÷ 5) + 0.25 = (27.5 ÷ 5) + 0.25 \)

\[
= 5.75 \checkmark
\]

Therefore, \( n = 27.5 \).
To solve, subtract 1.45 from both sides and then divide both sides by 5.

\[
5a + 1.45 = 2.7 \\
5a = 1.25 \\
a = 0.25
\]

Therefore, the average mass of each apple is 0.25 kg.

19. The blue counters represent the –4, and the red counters represent the 6. The number of red counters in the bag is \( x \). To solve the equation, remove all of the blue counters from the left side. Each blue counter has a negative value, so each time you remove a blue counter from the right side you need to replace it with a red counter on the left side.

\[
x + (-4) = 6 \\
x + (-4) - (-4) = 6 - (-4) \\
x = 6 + 4 \\
x = 10
\]

When all 4 blue counters have been changed into 4 extra red counters on the right side, there will be 10 red counters on the right side and one bag of counters on the left side, so there are 10 counters in the bag. Therefore, \( x = 10 \).

20. a) Use counters to represent \( x + 6 = -4 \). (Since this manual is printed in black and white, a counter with a negative sign (\( \Theta \)) is used to represent –1 and a counter with a positive sign (\( + \)) is used to represent +1.) To solve the equation, arrange it so there are no counters on the left side, where the bag is.

There are 6 positive counters on the left side. To remove them, add 6 negative counters to the left side. To keep the sides balanced, add 6 negative counters to the right side also.

\[
x + 6 + (-6) = -4 + (-6)
\]

\[6 + (-6) = 0, \text{ so now there is just } x \text{ on the left side.}\\n\]

There are 10 \( \Theta \) counters on the right side, so there must be 10 \( \Theta \) counters in the bag. So, \( x = -10 \).

Check by substitution: \(-10 + 6 = -4 \)

b) Use counters to represent \( 2n + (-2) = 8 \).

There are 2 negative counters on the left side. To remove them, add 2 positive counters to the left side. To keep the sides balanced, add 2 positive counters to the right side also.

\[
2n + (-2) + 2 = 8 + 2
\]

\[(-2) + 2 = 0, \text{ so now there is } 2n \text{ on the left side and 10 on the right side.}\\n\]

\[2n = 10
\]

There are 2 “bags” on the left side, so divide the counters on the right into 2 equal groups.

\[
2n + 2 = 10 ÷ 2
\]

There are 5 positive counters in each group, so \( n = 5 \).

Check by substitution: \(2(5) + (-2) = 10 + (-2)\) or 8.

c) Model \( -2x - 5 = -23 \) with counters.

There are 5 negative counters on the left side. To remove them, add 5 positive counters to the left side. To keep the sides balanced, add 5 positive counters to the right side also.

\[
-2x - 5 + 5 = -23 + 5
\]

\[-5 + 5 = 0, \text{ so now there is } -2x \text{ on the left side and 18 negative counters on the right side.}\\n\]
There are 18 counters on the right side. Divide them into 2 equal groups.

\[-2x = -18\]

\[-x \quad -x\]

\[\begin{array}{c}
-2 \times \frac{-18}{2} = -18 \div 2 \\
\end{array}\]

\[-x = -9\]

There are 9 negative counters in each group, so 

\[x = 9\]  
If \(x = 9\) then \(x\) must be 9. Check by substitution:  

\[-2(9) - 5 = -18 - 5 \text{ or } -23\]  

\[d) \text{ Model } 3n - (-2) = 14 \text{ with counters. } -(-2) \text{ is the same as } +2, \text{ so put 2 positive counters on the left side.}\]

\[\begin{array}{c}
n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

Subtract the 2 positive counters from the left side. To keep the sides balanced, subtract 2 positive counters from the right side also.

\[3n = 12\]

\[\begin{array}{c}
n \quad n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

There are 3 “bags” on the left side, so divide the 12 counters on the right into 3 equal groups.

\[3n \div 3 = 12 \div 3\]

\[\begin{array}{c}
n \quad n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

There are 4 counters in group, so \(n = 4\). Check by substitution: \(3(4) - (-2) = 12 + 2 \text{ or } 14\)

\[e) \text{ Use counters to represent } 2n + (-2) = -6.\]

\[\begin{array}{c}
n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
- \quad + \\
- \quad + \\
\end{array}
\end{array}\]

There are 2 negative counters on the left side. To remove them, add 2 positive counters to the left side. To keep the sides balanced, add 2 positive counters to the right side also.

\[2n + (-2) + 2 = -6 + 2\]

\[\begin{array}{c}
n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

\((-2) + 2 = 0, \text{ so now there is } 2n \quad \text{on the left side and } -4 \text{ on the right side.}\]

\[2n = -4\]

\[\begin{array}{c}
n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

There are 2 “bags” on the left side, so divide the counters on the right into 2 equal groups.

\[2n + 2 = -4 \div 2\]

\[\begin{array}{c}
n \quad n \\
\end{array}\]

\[\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+ \\
+ \\
\end{array}
+ \\
+ \\
\end{array}
\end{array}\]

There are 2 negative counters in each group, so \(n = -2\). Check by substitution: \(2(-2) + (-2) = -4 + (-2) \text{ or } -6\).

\[8.6 \text{ Communicating about Equations, p. 276}\]

4. a) For example, the variable is \(h\), so the cost of one item could be represented by \(h\). The equation contains \(2h\), so there were 2 items bought. The 1.50 can represent another item that was purchased for $1.50, and the total before tax can be represented by the 5.50 in the equation. So, my problem is this:

Alec bought 2 boxes of cereal and a carton of milk. The milk cost $1.50. If his total before tax was $5.50, then how much did each box of cereal cost?

b) Let \(h\) represent the cost of one box of cereal. Alec bought 2 boxes and a carton of milk that cost $1.50, so add these values together. The total cost was $5.50, so the equation is \(2h + 1.50 = 5.50\). To solve, subtract 1.50 from both sides and then divide both sides by 2.
\[2h + 1.50 = 5.50\]
\[2h + 1.50 - 1.50 = 5.50 - 1.50\]
\[2h = 4\]
\[2h \div 2 = 4 \div 2\]
\[h = 2\]

Check:
\[\text{LS} = 2(2.00) + 1.50\]
\[= 5.50\]
\[\text{RS} = 5.50\]
\[\text{LS} = \text{RS} \checkmark\]

Each box of cereal cost $2.00.

c) For example, I created my problem by thinking about buying items from a store, and letting the cost of one of the items be the variable and then cost of another item being $1.50. The total before tax of the items purchased could be $5.50, so that was my problem. I solved my problem by balancing the equation. I then checked my solution to make sure that it was correct, and wrote a concluding statement to my problem.

5. Check that the solution is correct by solving the equation. First add 6 to both sides, and then divide both sides by 12 to get the value of \(n\).
\[12n - 6 = 48\]
\[12n - 6 + 6 = 48 + 6\]
\[12n = 54\]
\[12n \div 12 = 54 \div 12\]
\[n = 4.5\]

Check: \(12n - 6 = 12(4.5) - 6\)
\[= 48 \checkmark\] Therefore, the solution is right.

For example, the variable \(n\) could represent the mass of a pumpkin in kilograms. There could be 12 pumpkins, but these pumpkins have a mass that is 6 kg more than average. Usually the mass of the 12 pumpkins is 48 kg. My problem is this: Braxton and his family entered 12 equal pumpkins in a contest. Last year the total mass was 48 kg. This year the mass is less by 6 kg. What is the mass of each pumpkin?

6. For example, the improved solution is: Let \(s\) represent the number of sweaters the customer bought. Each sweater costs $28.75, so the customer paid $28.75s dollars for the sweaters, plus the shipping charge of $3.25. The total cost was $60.75, so the equation is
\[28.75s + 3.25 = 60.75.\]
\[28.75s + 3.25 = 60.75\]
\[28.75s + 3.25 - 3.25 = 60.75 - 3.25\]
\[28.75s = 57.50\]
\[28.75s + 28.75 = 57.50 + 28.75\]
\[s = 2\]

Check:
\[28.75s + 3.25 = 28.75(2) + 3.25\]
\[= 60.75 \checkmark\]

Therefore \(s = 2\). The customer bought 2 sweaters.

7. For example, the variable \(n\) could represent a number of people in one group, and the \(4n\) would mean that there are four groups of \(n\) people. The added 7 on the left side could mean that there are 7 more people, maybe parents for a field trip. The total number of people are represented by 55. So my problem is this: The day camp split all of the campers into 4 equal groups for their field trip. There were 7 parent volunteers that also came along. There were 55 people in total. How many campers were in each group? To solve the problem: Let \(n\) represent the number of campers in each group. There are 4 groups and 7 extra people, so there are \(4n + 7\) people. There is a total of 55 people, so the equation is \(4n + 7 = 55\).
\[4n + 7 = 55\]
\[4n + 7 - 7 = 55 - 7\]
\[4n = 48\]
\[4n \div 4 = 48 \div 4\]
\[n = 12\]

Check:
\[4n + 7 = 4(12) + 7\]
\[= 55 \checkmark\]

Therefore, there were 12 campers in each group.

8. For example, the numbers in the equation are to 2 decimal places, so the equation can represent the cost of buying items and the total amount. The total cost could be $8.89, and the 1.39 on the left side could represent the tax. The \(5n\) could represent buying 5 items that each have a cost of \(n\). So the variable \(n\) represents the cost of one item. My problem is: Lolita bought 5 birthday cards for her family members. The tax on the cards was $1.39. The total cost came to $8.89. How much did each card cost?

9. For example, the numbers in the equation are decimal numbers. They could represent measuring a length. The variable \(n\) could stand for the length of 6.5 items, measured in cm. There could be an extra 5 cm to the length of the object, say a poster, and the whole poster is 31 cm long. My problem is: Judith has a poster with a row of equal stars on it. There are a total of 6.5 stars. There is an extra 5 cm of space in total around the stars. If the poster is a total of 31 cm long, then what is the length of each star on the poster? To solve the problem, let \(n\) represent the length of each star. There are 6.5 stars, so the length of all \(n\) stars is 6.5\(n\) cm. The length of the poster is the length of the stars plus an extra 5 cm, and the total length is 31 cm. So the equation is 6.5\(n\) + 5 = 31.
To solve, subtract 5 from both sides and then divide both sides by 6.5.

\[
\begin{align*}
6.5n + 5 &= 31 \\
6.5n + 5 - 5 &= 31 - 5 \\
6.5n &= 26 \\
6.5n ÷ 6.5 &= 26 ÷ 6.5 \\
n &= 4
\end{align*}
\]

Check:

\[
6.5n + 5 = 6.5(4) + 5 = 31 \checkmark
\]

Therefore, each star is 4 cm long.

10. For example, the variable represents what is being solved for, so the variable in this case will represent the number of cedar trees that need to be planted. Let \( c \) be that variable. The sides where the cedar trees need to be planted can be thought of as one big line of cedar trees. The length of that line is 3 times the length of one side of the backyard. The area of the square backyard is 144 m\(^2\), so the length of one side is \( \sqrt{144} = 12 \) m.

The length where trees need to be planted is \( 3 \times 12 \text{ m} = 36 \text{ m} \). So the total length is 36 m. Since the trees will be planted every half metre, they can be thought of as each taking up a half metre of that length, say the half metre that is behind the tree. So \( c \) trees take up \( 0.5c \text{ m} \) of the length. This is true for all of the trees except for the first one, which is right against the house, and does not take up a half metre. So you have to subtract 0.5 m from the length that the trees take up.

This gives the equation as follows:

\[
0.5c - 0.5 = 36
\]

To solve, add 0.5 to both sides and then divide both sides by 0.5.

\[
\begin{align*}
0.5c - 0.5 + 0.5 &= 36 + 0.5 \\
0.5c &= 36.5 \\
0.5c ÷ 0.5 &= 36.5 ÷ 0.5 \\
c &= 73
\end{align*}
\]

Check: \( 0.5c - 0.5 = 0.5(73) - 0.5 = 36 \checkmark \)

Therefore, \( c = 73 \), so 73 cedars need to be planted.

---

**Chapter Self-Test, p. 277**

1. Find 52 on the vertical axis. Place your ruler horizontally at 52 and see where it touches the graph. Then place your ruler vertically from the intersection to the horizontal axis. This is at term number 15. The solution is \( n = 15 \).

2. a) 

<table>
<thead>
<tr>
<th>Figure number</th>
<th>Number of counters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

b) The number of counters increase by 4 each time. So the pattern rule involves 4\(n\), where \( n \) is the figure number. From figure 1, you can see that the number of counters is actually 3 less than 4(1) = 4, and the same with the next two figures also. So a rule is 4\(n\) − 3.

c) For the figure number that has 161 counters, the rule will be equal to 161. An equation is 4\(n\) − 3 = 161.

d) For example, solve the equation using the systematic trial method with a table. For example,

<table>
<thead>
<tr>
<th>Predict ( n )</th>
<th>Evaluate 4(n) − 3</th>
<th>Is the answer 161?</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>4(40) − 3 = 157</td>
<td>No, too low.</td>
</tr>
<tr>
<td>42</td>
<td>4(42) − 3 = 165</td>
<td>No, too high.</td>
</tr>
<tr>
<td>41</td>
<td>4(41) − 3 = 161</td>
<td>It’s correct.</td>
</tr>
</tbody>
</table>

The solution is \( n = 41 \), so figure 41 has 161 counters.

3. a) Substitute 12.25 for \( a \) and 3.7 for \( c \).

\[
7a + 8c = 7(12.25) + 8(3.7) = 115.35
\]

b) Substitute 3 for \( a \) and \(-2\) for \( c \).

\[
-7a + 8c = -7(3) + 8(-2) = -37
\]

4. a) Divide both sides by 6.

\[
78 = 6x \\
78 ÷ 6 = 6x ÷ 6 \\
13 = x
\]

Check: 6\(x\) = 6(13) = 78 \(\checkmark\) Therefore, \( x = 13 \).

b) To solve, subtract 5 from both sides and then divide both sides by 6.

\[
\begin{align*}
6n + 5 &= 41 \\
6n + 5 - 5 &= 41 - 5 \\
6n &= 36 \\
6n ÷ 6 &= 36 ÷ 6 \\
n &= 6
\end{align*}
\]

Check: 6\(n\) + 5 = 6(6) + 5 = 41 \(\checkmark\)

Therefore, \( n = 6 \).
c) To solve, add 11 to both sides and then divide both sides by 4.
\[4m - 11 = 45\]
\[4m - 11 + 11 = 45 + 11\]
\[4m = 56\]
\[m = 14\]
Check: 
\[4m - 11 = 4(14) - 11 = 56 - 11 = 45\]
Therefore, \(m = 14\).

d) To solve, divide both sides by 2.
\[2t = 208.5\]
\[2t ÷ 2 = 208.5 ÷ 2\]
\[t = 104.25\]
Check: 
\[2t = 2(104.25) = 208.5\]
Therefore, \(t = 104.25\).

5. a) To solve, add 2 to both sides.
\[n - 2 = 5\]
\[n - 2 + 2 = 5 + 2\]
\[n = 7\]
Check: 
\[n - 2 = 7 - 2 = 5\] ✓ Therefore, \(n = 7\).

b) To solve, add 6.1 to both sides.
\[x - 6.1 = 12.2\]
\[x - 6.1 + 6.1 = 12.2 + 6.1\]
\[x = 18.3\]
Check: 
\[x - 6.1 = 18.3 - 6.1 = 12.2\] ✓ Therefore, \(x = 18.3\).

c) To solve, subtract 0.23 from both sides.
\[t + 0.23 = 5.6\]
\[t + 0.23 - 0.23 = 5.6 - 0.23\]
\[t = 5.37\]
Check: 
\[t + 0.23 = 5.37 + 0.23 = 5.6\] ✓ Therefore, \(t = 5.37\).

d) To solve, divide both sides by 1.68.
\[1.68h = 67.2\]
\[1.68h ÷ 1.68 = 67.2 ÷ 1.68\]
\[h = 4\]
Check: 
\[1.68h = 1.68(4) = 67.2\] ✓ Therefore, \(h = 4\).

e) To solve, subtract 1 from both sides, and then divide both sides by 6.
\[6p + 1 = 19\]
\[6p + 1 - 1 = 19 - 1\]
\[6p = 18\]
\[6p ÷ 6 = 18 ÷ 6\]
\[p = 3\]
Check: 
\[6p + 1 = 6(3) + 1 = 19\] ✓ Therefore, \(p = 3\).

f) Add 8.5 to both sides, and then divide by 25.
\[25n - 8.5 = 101.5\]
\[25n - 8.5 + 8.5 = 101.5 + 8.5\]
\[25n = 110\]
\[25n ÷ 25 = 110 ÷ 25\]
\[n = 4.4\]
Check: 
\[25n - 8.5 = 25(4.4) - 8.5 = 101.5\] ✓ Therefore, \(n = 4.4\).

6. a) Let \(n\) be the unknown number. Add 7.1 to get \(n + 7.1\). The result is 10.3, so that is on the right-hand side of the equation. The equation is \(n + 7.1 = 10.3\).

b) Let \(n\) be the unknown number. Multiply it by 6, to get \(6n\). The result is 48.6, so that is on the right-hand side of the equation. The equation is \(6n = 48.6\).

c) Let \(m\) be the unknown number. When it is added to itself, then you get \(m + m\). The result is 49, so that is on the right-hand side of the equation. The equation is \(m + m = 49\) or \(2m = 49\).

d) Let \(p\) be the unknown number. Three times a number is \(3p\), and plus 2.5 gives \(3p + 2.5\). This is equal to 83.5, which is the right-hand side of the equation. So the equation is \(3p + 2.5 = 83.5\).

7. a) Let \(s\) represent the amount of money in the savings account. By doubling the money you are multiplying it by 2, so the amount is \(2s\). This would give $150.62, so the equation is \(2s = 150.62\). To solve, divide both sides by 2.
\[2s = 150.62\]
\[2s ÷ 2 = 150.62 ÷ 2\]
\[s = 75.31\]
Currently there is $75.31 in the savings account.

b) Let \(h\) represent the hourly wage. Three times the hourly wage is \(3h\). The money earned in tips is added to the hourly wage, so the left-hand side is \(3h + 7.65\). The total is $27.90, the right-hand side. So, the equation is \(3h + 7.65 = 27.90\). To solve, subtract 7.65 from both sides and then divide both sides by 3.
\[3h + 7.65 = 27.90\]
\[3h + 7.65 - 7.65 = 27.90 - 7.65\]
\[3h = 20.25\]
\[3h ÷ 3 = 20.25 ÷ 3\]
\[h = 6.75\]
The hourly wage is $6.75.

8. For example, use \(p\) to represent the number of pairs of socks that Ying bought. The socks were $2.50 per pair, so for \(p\) pairs of socks the cost was \(2.50p\), or \(2.5p\). She also bought a jacket, which must be added to the cost of the socks, so she spent \(2.5p + 39\). The total for her items was $51.50, so the equation is \(2.5p + 39 = 51.5\).
To solve, subtract 39 from both sides and then divide both sides by 2.5.
\[ 2.5p + 39 = 51.5 \]
\[ 2.5p + 39 - 39 = 51.5 - 39 \]
\[ 2.5p = 12.5 \]
\[ 2.5p ÷ 2.5 = 12.5 ÷ 2.5 \]
\[ p = 5 \]
Therefore, \( p = 5 \) and so Ying bought 5 pairs of socks.

**Chapter Review, p. 279**

1. a) Place a ruler at horizontally from 20 on the vertical axis to the graph. Then place the ruler vertically from the intersection down to the horizontal axis. It meets the horizontal axis at 8, so the solution to \( 2n + 4 = 20 \) is \( n = 8 \).

   b) \[
   \begin{align*}
   2n + 4 &= 12 \\
   2n + 4 - 4 &= 12 - 4 \\
   2n &= 8 \\
   2n ÷ 2 &= 8 ÷ 2 \\
   n &= 4
   \end{align*}
   \]

   Check: \( 2n + 4 = 2(4) + 4 = 12 \)

   Therefore, \( n = 4 \).

2. a) \[
\begin{array}{c|c}
\text{Figure number} & \text{Number of counters} \\
\hline
1 & 13 \\
2 & 19 \\
3 & 25 \\
\end{array}
\]

   b) Let \( n \) represent the figure number. With each figure the number of counters increases by 6, so the expression contains \( 6n \). In figure 1, there are 13 counters. This is \( 13 - 6 = 7 \) counters more than \( 6n \) gives. This is true in the other two figures as well. So, an algebraic expression for the rule is \( 6n + 7 \).

c) To determine which figure has 145 counters, locate 145 on the vertical axis and draw a horizontal line from there to the point where it touches the graph. From there, draw a vertical line down to the horizontal axis, where it is 23. So, figure 23 has 145 counters.

3. Let \( n \) represent the number of ice cream bars that Kyra sells. She gets paid \$0.25 for each ice cream bar she sells, so if she sells \( n \) bars she will receive \( 0.25n \) in commission. She also receives \$40 each day. So she earns \( 0.25n + 40 \) each day. If she sells 77 ice cream bars, replace \( n \) by 77 in the expression to determine how much she will earn that day.

\[
0.25n + 40 = 0.25(77) + 40 = 59.25
\]

Therefore, if Kyra sells 77 ice cream bars in one day she will earn \$59.25.

4. a) To solve, subtract 4 from both sides and then divide both sides by 2.

\[
\begin{align*}
2b + 4 &= 14 \\
2b + 4 - 4 &= 14 - 4 \\
2b &= 10 \\
2b ÷ 2 &= 10 ÷ 2 \\
b &= 5
\end{align*}
\]

Check: \( 2b + 4 = 2(5) + 4 = 14 \)

Therefore, \( b = 5 \).

b) Subtract 2 from both side and divide by 5.

\[
\begin{align*}
5a + 2 &= 10 \\
5a + 2 - 2 &= 10 - 2 \\
5a &= 8 \\
5a ÷ 5 &= 8 ÷ 5 \\
a &= 1.6
\end{align*}
\]

Check: \( 5a + 2 = 5(1.6) + 2 = 10 \)

Therefore, \( a = 2 \).

c) Subtract 4.3 from both sides.

\[
\begin{align*}
n + 4.3 &= 5.1 \\
n + 4.3 - 4.3 &= 5.1 - 4.3 \\
n &= 0.8
\end{align*}
\]

Check: \( n + 4.3 = 0.8 + 4.3 = 5.1 \)

Therefore, \( n = 0.8 \).

d) Simplify the right side and divide by 0.5.

\[
\begin{align*}
0.5x &= 21 - 3 \\
0.5x &= 18 \\
0.5x + 0.5 &= 18 ÷ 0.5 \\
x &= 36
\end{align*}
\]

Check: \( LS = 0.5x = 0.5(36) = 18 \)

\[ RS = 21 - 3 = 18 \]

LS = RS

Therefore, \( x = 36 \).
e) To solve, subtract 1 from both sides and then divide both sides by 4.
\[
4t + 1 = 20
\]
\[
4t + 1 - 1 = 20 - 1
\]
\[
4t = 19
\]
\[
4t ÷ 4 = 19 ÷ 4
\]
\[
t = 4.75
\]
Check: 
\[
4t + 1 = 4(4.75) + 1 = 20 \checkmark \]
Therefore, \( t = 4.75 \).

f) To solve, subtract 7 from both sides and then divide both sides by 4.
\[
4m + 7 = 43.8
\]
\[
4m + 7 - 7 = 43.8 - 7
\]
\[
4m = 36.8
\]
\[
4m ÷ 4 = 36.8 ÷ 4
\]
\[
m = 9.2
\]
Check: 
\[
4m + 7 = 4(9.2) + 7 = 43.8 \checkmark
\]
Therefore, \( m = 9.2 \).

5. a) Let \( n \) represent the unknown number. Adding 3.21 to this number gives a sum of 16.05, so the equation is 
\[
n + 3.21 = 16.05
\] To solve, subtract 3.21 from both sides.
\[
n + 3.21 - 3.21 = 16.05 - 3.21
\]
\[
n = 12.84
\]
Check: 
\[
n + 3.21 = 12.84 + 3.21 = 16.05 \checkmark
\]
Therefore, \( n = 12.84 \).

b) Let \( n \) represent the unknown number. The product of a number and 3.21 is represented by \( 3.21n \), and the result is 16.05. The equation is \( 3.21n = 16.05 \). To solve, divide both sides by 3.21.
\[
3.21n = 16.05
\]
\[
3.21n ÷ 3.21 = 16.05 ÷ 3.21
\]
\[
n = 5
\]
Check: 
\[
3.21n = 3.21(5) = 16.05 \checkmark
\]
Therefore, \( n = 5 \).

c) Let \( n \) represent the unknown number. When this number is doubled, it is multiplied by 2, and then subtracting 3.21 gives \( 2n - 3.21 \). The result is equal to 16.05, so the equation is \( 2n - 3.21 = 16.05 \). To solve, add 3.21 to both sides and divide by 2.
\[
2n = 16.05
\]
\[
2n + 3.21 + 3.21 = 16.05 + 3.21
\]
\[
2n = 19.26
\]
\[
2n ÷ 2 = 19.26 ÷ 2
\]
\[
n = 9.63
\]
Check: 
\[
2n - 3.21 = 2(9.63) - 3.21 = 16.05 \checkmark
\]
Therefore, \( n = 9.63 \).

6. For example, use \( n \) to represent the amount of money each team must be charged to meet the goal. There are 34 teams, so there will be \( 34n \) raised. They have already raised $351, so this is added to the amount they raise from the shoot-out challenge. They need to raise a total of $895. So the equation is 
\[
34n + 351 = 895
\]
\[
34n + 351 - 351 = 895 - 351
\]
\[
34n = 544
\]
\[
34n ÷ 34 = 544 ÷ 34
\]
\[
n = 16
\]
Check: 
\[
4n + 351 = 4(16) + 351 = 895 \checkmark
\]
Therefore, they should charge $16 per team.

7. For example, the numerical values in this equation look like they represent dollar values, so the variable \( t \) can represent the number of items bought. Since it is multiplied by 10.99, each item costs $10.99. The right-hand side of the equation is 21.98, so the total spent is $21.98. My problem is this: Eva noticed a sale at the book store: any book for $10.99. If her total without tax was $21.98, how many books did Eva buy?
To solve: Let \( t \) represent the number of books that Eva bought. Each book was $10.99, so she paid \( 10.99t \), before tax. The total before tax was $21.98. So the equation is \( 10.99t = 21.98 \). To solve, divide both sides by 10.99.
\[
10.99t = 21.98
\]
\[
\]
\[
t = 2
\]
Check: 
\[
\]
\[
= 21.98 \checkmark
\]
Therefore, Eva bought 2 books.

8. For example, use \( t \) to represent the cost of each ticket. Edna bought 2 tickets, and the delivery charge of $3.75 was added to the cost. The total cost was $54.75, so the equation is \( 2t + 3.75 = 54.75 \). To solve, subtract 3.75 from both sides and divide both sides by 2.
\[
2t + 3.75 = 54.75
\]
\[
2t + 3.75 - 3.75 = 54.75 - 3.75
\]
\[
2t = 51
\]
\[
2t ÷ 2 = 51 ÷ 2
\]
\[
t = 25.50
\]
Therefore, the cost of each ticket was $25.50.