**Checkpoint** Evaluate the expression.

1. \(10 + 3^2\)
2. \(16 - 2^3 + 4\)
3. \(28 \div 2^2 + 1\)
4. \(4 \cdot 5^2 + 4\)

---

**Example 2** *Evaluate expressions with grouping symbols*

Evaluate the expression.

a. \(6(9 + 3) = 6(\underline{\hspace{2cm}})\)  
   \[\underline{\text{within parentheses.}}\]
   \[= \underline{\text{____}}\]

b. \(50 - (3^2 + 1) = 50 - (\underline{\hspace{2cm}} + 1)\)  
   \[\underline{\text{within power.}}\]
   \[= 50 - (\underline{\hspace{2cm}})\]  
   \[\underline{\text{within parentheses.}}\]
   \[= \underline{\text{____}}\]

c. \(3[5 + (5^2 + 5)] = 3[5 + (\underline{\hspace{2cm}} + 5)]\)  
   \[\underline{\text{within power.}}\]
   \[= 3[5 + (\underline{\hspace{2cm}})]\]  
   \[\underline{\text{within parentheses.}}\]
   \[= 3[\underline{\hspace{2cm}}]\]  
   \[\underline{\text{within brackets.}}\]
   \[= \underline{\text{____}}\]
**Your Notes**

**Checkpoint** Evaluate the expression.

5. \(6(3 + 3^2)\)

6. \(2[(10 - 4) ÷ 3]\)

**Example 3** Evaluate an algebraic expression

Evaluate the expression \(\frac{12k}{3(k^2 + 4)}\) when \(k = 2\).

**Solution**

\[
\begin{align*}
\frac{12k}{3(k^2 + 4)} &= \frac{12(\phantom{2})}{3(\phantom{2})} \\
&= \frac{12(\phantom{2})}{3(\phantom{2})} \\
&= \frac{12(\phantom{2})}{3(\phantom{2})} \\
&= \frac{12(\phantom{2})}{3(\phantom{2})} \\
&= \phantom{0}.
\end{align*}
\]

Substitute \(2\) for \(k\).

A fraction bar can act as a grouping symbol. Evaluate the numerator and denominator before dividing.

**Checkpoint** Evaluate the expression when \(x = 3\).

7. \(x^3 - 5\)

8. \(\frac{6x + 2}{x + 7}\)
Example 1  Translate verbal phrases into expressions

Translate the verbal phrase into an expression.

<table>
<thead>
<tr>
<th>Verbal Phrase</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 6 less than the quantity 8 times a number x</td>
<td></td>
</tr>
<tr>
<td>b. 2 times the sum of 5 and a number a</td>
<td></td>
</tr>
<tr>
<td>c. The difference of 17 and the cube of a number n</td>
<td></td>
</tr>
</tbody>
</table>

Checkpoint  Translate the verbal phrase into an expression.

1. The product of 5 and the quantity 12 plus a number n

   _________

2. The quotient of 10 and the quantity a number x minus 3

   __________

Example 2  Use a verbal model to write an expression

Food Drive  You and three friends are collecting canned food for a food drive. You each collect the same number of cans. Write an expression for the total number of cans collected.

Solution

Step 1 Write a verbal model. Amount ÷ Number of cans

Step 2 Translate the verbal model into an algebraic expression.

An expression that represents the total number of cans is ________.
**Checkpoint** Complete the following exercise.

3. In Example 2, suppose that the total number of cans collected are distributed equally to 2 food banks. Write an expression that represents the number of cans each food bank receives.

**Example 3** *Find a unit rate*

Three gallons of milk cost $9.15. Find the unit rate.

**Solution**

\[
\frac{\text{gallons}}{3} = \frac{\text{gallons}}{\text{gallon}}
\]

The unit rate is _______ , or _______.

**Checkpoint** Find the unit rate.

4. \[
\frac{420 \text{ miles}}{3 \text{ hours}}
\]

5. \[
\frac{\$12}{3 \text{ ft}^2}
\]

6. \[
\frac{20 \text{ cups}}{8 \text{ people}}
\]
**Goal**  • Translate verbal sentences into equations or inequalities.

**VOCABULARY**

- Open sentence
- Equation
- Inequality
- Solution of an equation
- Solution of an inequality

**EXPRESSING OPEN SENTENCES**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
<th>Associated Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a = b$</td>
<td>$a$ is ______ to $b$</td>
<td>$a$ is the ______ as $b$</td>
</tr>
<tr>
<td>$a &lt; b$</td>
<td>$a$ is _________ $b$</td>
<td>$a$ is ______ than $b$</td>
</tr>
<tr>
<td>$a \leq b$</td>
<td>$a$ is ______ than $b$, or ______ to $b$</td>
<td>$a$ is _______ than $b$</td>
</tr>
<tr>
<td>$a &gt; b$</td>
<td>$a$ is ___________ $b$</td>
<td>$a$ is ______ than $b$</td>
</tr>
<tr>
<td>$a \geq b$</td>
<td>$a$ is ______ than $b$, or ______ to $b$</td>
<td>$a$ is _______ than $b$</td>
</tr>
</tbody>
</table>
Example 1  Write equations and inequalities

Write an equation or an inequality.

Verbal Sentence  
Equation or Inequality

a. The sum of three times a number \( a \) and 4 is 25.  
\[ 3a + 4 = 25 \]

b. The quotient of a number \( x \) and 4 is fewer than 10.  
\[ \frac{x}{4} < 10 \]

c. A number \( n \) is greater than 6 and less than 12.  
\[ 6 < n < 12 \]

Example 2  Check possible solutions

Check whether 2 is a solution of the equation or inequality.

<table>
<thead>
<tr>
<th>Equation or Inequality</th>
<th>Substitute</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 7x - 8 = 9</td>
<td>7(2) - 8 = 9</td>
<td>a solution</td>
</tr>
<tr>
<td>b. 4 + 5y &lt; 18</td>
<td>4 + 5(2) &lt; 18</td>
<td>a solution</td>
</tr>
<tr>
<td>c. 6n - 9 ≥ 2</td>
<td>6(2) - 9 ≥ 2</td>
<td>a solution</td>
</tr>
</tbody>
</table>

Checkpoint  Check whether the given number is a solution of the equation or inequality.

1. 6r + 1 = 25  
   \[ r = 4 \]

2. \( x^2 - 5 > 10 \)  
   \[ x = 5 \]

3. 7a ≤ 21  
   \[ a = 6 \]
Use a Problem Solving Plan

Goal • Use a problem solving plan to solve problems.

VOCABULARY
______________________________
Formula

A PROBLEM SOLVING PLAN
Use the following four-step plan to solve a problem.

Step 1 ______________________________ Read the problem carefully. Identify what you want to know and what you want to find out.

Step 2 ______________________________ Decide on an approach to solving the problem.

Step 3 ______________________________ Carry out your plan. Try a new approach if the first one isn’t successful.

Step 4 ______________________________ Check that your answer is reasonable.

Example 1 Read a problem and make a plan

You have $7 to buy orange juice and bagels at the store. A container of juice costs $1.25 and a bagel costs $.75. If you buy two containers of juice, how many bagels can you buy?

Solution

Step 1 ______________________________ What do you know? You know how much money you have and the price of a _____ and a container of juice.

What do you want to find out? You want to find out the number of _____ you can buy.

Step 2 ______________________________ Use what you know to write a _____ that represents what you want to find out. Then write an _________ and solve it.
Your Notes

Example 2  Solve a problem and look back

Solve the problem in Example 1 by carrying out the plan. Then check your answer.

Solution

Step 3  Write a verbal model. Then write an equation. Let \( b \) be the number of bagels you buy.

<table>
<thead>
<tr>
<th>Price of Number</th>
<th>Price of Number</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>juice of bagel (in dollars)</td>
<td>of containers (in dollars)</td>
<td>of bagels</td>
</tr>
<tr>
<td>( _ \cdot _ + _ \cdot _ \cdot b = _ )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The equation is \( \_ + \_ \cdot b = \_ \). One way to solve the equation is to use the strategy guess, check, and revise.

Guess an even number that is easily multiplied by \( \_ \).

Try 4.

\( \_ + \_ \cdot 4 = \_ \)  Write equation.

\( \_ + \_ \cdot (4) \) \( \_ \) Substitute 4 for \( b \).

\( \_ \) Simplify; 4 check.

Because \( \_ \), try an even number \( \_ \).

Try 6.

\( \_ + \_ \cdot 6 = \_ \)  Write equation.

\( \_ + \_ \cdot (6) \) \( \_ \) Substitute 6 for \( b \).

\( \_ \) Simplify.

For \( \_ \) you can buy \( \_ \) bagels and \( \_ \) containers of juice.

Step 4  Each additional bagel you buy adds \( \_ \) to the \( \_ \) you pay for the juice. Make a table.

<table>
<thead>
<tr>
<th>Bagels</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

The total cost is \( \_ \) when you buy \( \_ \) bagels and \( \_ \) containers of juice. The answer in step 3 is \( \_ \).
Your Notes

**Checkpoint** Complete the following exercise.

1. Suppose in Example 1 that you have $12 and you decide to buy three containers of juice. How many bagels can you buy?

**FORMULA REVIEW**

Temperature

\[ C = \frac{5}{9}(F - 32) \]

where \( F = \) ____________
and \( C = \) ____________

Simple interest

\[ I = Prt, \]

where \( I = \) ________, \( P = \) ________,
\( r = \) ____________ (as a decimal), and \( t = \) ________

Distance traveled

\[ d = rt, \]

where \( d = \) ________________, \( r = \) ____,
and \( t = \) ________

Profit

\[ P = I - E, \]

where \( P = \) ________, \( I = \) ________, and
\( E = \) ____________

**Checkpoint** Complete the following exercise.

2. In Example 1, the store where you bought the juice and bagels had an income of $7 from your purchase. The profit the store made from your purchase is $2.50. Find the store's expense for the juice and bagels.
**Example 3**  
*Use mental math to solve an equation*

**Solve the equation using mental math.**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a.</strong> $n + 6 = 11$</td>
<td><strong>b.</strong> $18 - x = 10$</td>
<td><strong>c.</strong> $7a = 56$</td>
</tr>
</tbody>
</table>

**Solution**

<table>
<thead>
<tr>
<th>Equation</th>
<th>Think</th>
<th>Solution</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $n + 6 = 11$</td>
<td>What number plus 6 equals 11?</td>
<td>___ ___ + 6 = 11</td>
<td></td>
</tr>
<tr>
<td>b. $18 - x = 10$</td>
<td>___ ___ = 10</td>
<td>18 - ___ = 10</td>
<td></td>
</tr>
<tr>
<td>c. $7a = 56$</td>
<td>___ ___ = 56</td>
<td>7(___ ) = 56</td>
<td></td>
</tr>
<tr>
<td>d. $\frac{b}{11} = 3$</td>
<td>___ ___ = 3</td>
<td>___ ___ = 3</td>
<td></td>
</tr>
</tbody>
</table>

**Checkpoint**  
Solve the equation using mental math.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4. $x + 9 = 14$</td>
<td>5. $5t - 4 = 11$</td>
<td>6. $\frac{y}{4} = 15$</td>
</tr>
</tbody>
</table>

---

**Homework**
Goal • Represent functions as rules and as tables.

VOCABULARY

Function

Domain

Range

Independent variable

Dependent variable

Example 1 Identify the domain and range of a function

The input-output table shows temperatures over various increments of time. Identify the domain and range of the function.

<table>
<thead>
<tr>
<th>Input (hours)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (°C)</td>
<td>24</td>
<td>27</td>
<td>30</td>
<td>33</td>
</tr>
</tbody>
</table>

Solution

Domain: __________________

Range: __________________
**Checkpoint** Identify the domain and range of the function.

1. 

<table>
<thead>
<tr>
<th>Input</th>
<th>4</th>
<th>7</th>
<th>11</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>10</td>
<td>20</td>
<td>35</td>
<td>45</td>
</tr>
</tbody>
</table>

**Example 2** Identify a function

Tell whether the pairing is a function. Explain your reasoning.

**Solution**

a. 

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

b. 

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

**Checkpoint** Tell whether the pairing is a function.

2. 

<table>
<thead>
<tr>
<th>Input</th>
<th>5</th>
<th>5</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

3. 

<table>
<thead>
<tr>
<th>Input</th>
<th>0</th>
<th>4</th>
<th>12</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>
 FUNCTIONS

Verbal Rule: The output is 2 less than the input.

<table>
<thead>
<tr>
<th>Input</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example 3: Make a table for a function

The domain of the function \( y = 3x \) is 0, 1, 2, and 3. Make a table for the function, then identify the range of the function.

Solution

<table>
<thead>
<tr>
<th>( x )</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( y = 3x )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The range of the function is ________.

Example 4: Write a function rule

Write a rule for the function.

<table>
<thead>
<tr>
<th>Input</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>6</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>22</td>
</tr>
</tbody>
</table>

Solution

Let \( x \) be the input and let \( y \) be the output. Notice that each output is ______ the corresponding input. So, a rule for the function is ________.

Checkpoint Write a rule for the function. Identify the domain and the range.

<table>
<thead>
<tr>
<th>Yarn (yd)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost ($)</td>
<td>1.5</td>
<td>3</td>
<td>4.5</td>
<td>6</td>
</tr>
</tbody>
</table>

Homework
Represent Functions as Graphs

**Goal**
- Represent functions as graphs.

**Your Notes**

**GRAPHING A FUNCTION**
- You can use a graph to represent a ________.
- In a given table, each corresponding pair of input and output values forms an ____________.
- An ordered pair of numbers can be plotted as a ________.
- The x-coordinate is the ________.
- The y-coordinate is the ________. 
- The horizontal axis of the graph is labeled with the ____________.
- The vertical axis is labeled with the the ________.

**Example 1**

*Graph a function*

Graph the function \( y = x + 1 \) with domain 1, 2, 3, 4, and 5.

**Solution**

Step 1 Make an ____________ table.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 2 Plot a point for each ____________ \((x, y)\).
Write a function rule for the function represented by the graph. Identify the domain and the range of the function.

Solution

Step 1 Make a table for the graph.

<table>
<thead>
<tr>
<th>x</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td></td>
</tr>
</tbody>
</table>

Step 2 Find a relationship between the input and output values.

Step 3 Write a relationship that describes the relationship.

\[ y = \text{ } \]

A rule for the function is \( y = \text{ } \). The domain of the function is _______. The range is _______.
Complete the following exercise.

1. Graph the function \( y = \frac{1}{3}x + 1 \) with domain 0, 3, 6, 9, and 12.

![Graph of the function \( y = \frac{1}{3}x + 1 \).]

Write a rule for the function represented by the graph. Identify the domain and the range of the function.

2. ![Graph of a linear function.]

3. ![Graph of a nonlinear function.]

Homework