Practice 1  Number Patterns and Relationships

Write the next three terms of each number pattern. Then describe the rule for each pattern.

1. 3, 6, 9, 12, ________, ________, ________, ...

Rule: ____________________________________________

2. 4,000,000, 400,000, 40,000, 4,000, ________, ________, ________, ...

Rule: ____________________________________________

3. 3, 6, 12, 24, ________, ________, ________, ...

Rule: ____________________________________________

4. 50, 49, 47, 44, 40, ________, ________, ________, ...

Rule: ____________________________________________
Complete the tables.

5.  
   a.  
<table>
<thead>
<tr>
<th>Number of People</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Fingers</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b.  
<table>
<thead>
<tr>
<th>Number of Copies of a Book</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pages</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the table and answer the questions.

6.  
   The table shows the relationship between temperatures measured in degrees Celsius (°C) and degrees Fahrenheit (°F).

<table>
<thead>
<tr>
<th>Temperature in °C</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature in °F</td>
<td>32</td>
<td>41</td>
<td>50</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   a. If the temperature is 100°F outside, is this temperature greater than or less than 40°C? Explain.

   b. Recently meteorologists added a new color to their weather maps for temperatures of 122°F or greater. What temperature is this in degrees Celsius?
Complete the tables and answer the questions.

7. A set of 20 plastic cups costs $2.50.

<table>
<thead>
<tr>
<th>Number of Cups</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Cups ($)</td>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. What is the cost of 60 cups?

b. What is the cost of 8 sets of cups?

c. How many cups can you get for $17.50?

8. A van travels at a speed of 60 kilometers per hour.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance Traveled (km)</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. How far does the van travel in 6 hours?

b. How long does the van take to travel 180 kilometers?
Complete the table and answer the questions.

9. Alex borrowed $155 from his parents to buy an electronic notepad. He repays some of the loan each week. The table shows how much he still owes after he repays the same amount each week.

<table>
<thead>
<tr>
<th>Weeks Since Purchase</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Still Owed ($)</td>
<td>155</td>
<td>145</td>
<td>135</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. How much of his loan is Alex repaying each week?

b. How much will he have left to repay at week 10?

c. Will it take Alex 15 weeks to repay the loan? Explain.
Practice 2  Using Letters as Numbers

Write an expression for each situation.

1. Susan has 10 apples and 6 oranges. How many pieces of fruit does she have?

2. Juan has $x$ apples and 8 oranges. How many pieces of fruit does he have? Give your answer in terms of $x$.

3. Henry has $18. He spends $2. How much does he have left?

4. Katie has $m$ dollars. She spends $5. How much does she have left? Give your answer in terms of $m$. 
Write an expression for the situation.

5. Hugo has $20. He spends \( n \) dollars. How much does he have left? Give your answer in terms of \( n \).

Write an algebraic expression for each of the following.

Example

Add 9 to \( y \).

\[ y + 9 \text{ or } 9 + y \]

6. Add \( b \) to 11.

7. Subtract 6 from \( c \).

8. Subtract \( p \) from 15.

9. 12 more than \( d \).

10. 15 less than \( g \).

Evaluate each expression for the given values of \( y \).

<table>
<thead>
<tr>
<th>Expression</th>
<th>Value of the Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y = 25 )</td>
<td>( y = 16 )</td>
</tr>
</tbody>
</table>

Example

\[ y + 5 \]

30      21

11. \( y - 12 \)

12. \( 18 + y \)

13. \( 35 - y \)
Write each of the following in at least three other ways.

Example

\[ 6n \quad 6 \times n, \quad n \times 6, \quad 6 \text{ groups of } n \]

14. \[ 18 \times m \]

15. \[ 75 \text{ groups of } y \]

16. \[ y \text{ groups of } 12 \]

Write an expression for each situation.

17. Julio has 4 boxes of pencils. There are 12 pencils in each box. How many pencils does Julio have?

18. Tara has \( k \) boxes of pencils. There are 10 pencils in each box. How many pencils does Tara have? Give your answer in terms of \( k \).
Write an expression for each situation.

19. A restaurant divided 20 gallons of lemonade among 4 containers. How much lemonade does each container contain?

20. \( m \) gallons of lemonade are distributed equally among 3 people. How much lemonade does each person get? Give your answer in terms of \( m \).

Example

Multiply 4 and \( g \).

\[
4 \times g = 4g \text{ or } g \times 4 = 4g
\]


22. Divide \( m \) by 5.

23. Divide 22 by \( p \).

Evaluate each expression for \( t = 156 \).

Example

\[
2t = 2 \times t \\
= 2 \times 156 \\
= 312
\]

24. \( \frac{t}{6} = \)

25. \( 16t = \)

26. \( \frac{t}{13} = \)
Write an algebraic expression for each situation.

27. A tank has $x$ gallons of water. Ted adds 3 gallons of water into the tank. He pours the water equally into 4 smaller containers. How much water is in each container?

28. Jenny has $15. She buys 2 books that cost $m$ dollars each. How much does she have left?
Write an algebraic expression for each situation.

29. Betty collected 400 food packages for charity. She gave \(g\) packages to an orphanage, and distributed the rest equally among 4 charities. How many packages did each charity get?

30. To bake muffins, Matt needs \(x\) eggs for every 200 grams of flour. If he used 900 grams of flour, how many eggs did he use?
Write an expression for each situation.

Example
Subtract 12 from the product of 8 and \(a\).
\[8 \times a - 12 = 8a - 12\]

31. Add 14 to the product of 3 and \(b\).

32. Divide the product of 7 and \(d\) by 5.

Evaluate each expression for \(x = 5\).

Example
\[13x - 4 = 13 \times 5 - 4 = 65 - 4 = 61\]

33. \[5x + 12 = \]

34. \[20 - 2x = \]

35. \[\frac{x}{10} + 2 = \]

36. \[\frac{6x}{5} + 12 = \]
Fill in the boxes with the correct expressions. In the last box on the right, evaluate each expression for \( m = 28 \).

**Example**

\[
\begin{align*}
\begin{array}{c}
\text{m} \\
\times 2 \\
\rightarrow \\
2m \\
\rightarrow \\
-3 \\
\rightarrow \\
2m - 3 \\
\rightarrow \\
53
\end{array}
\end{align*}
\]

37. \[ \begin{align*}
3 \times m \\
\rightarrow \\
+ 5 \\
\rightarrow \\
\rightarrow
\end{align*} \]

38. \[ \begin{align*}
76 - m \\
\rightarrow \\
\div 2 \\
\rightarrow \\
\rightarrow
\end{align*} \]

39. \[ \begin{align*}
m + 5 \\
\rightarrow \\
\div 11 \\
\rightarrow \\
\rightarrow
\end{align*} \]

40. \[ \begin{align*}
m \div 14 \\
\rightarrow \\
+ 1 \\
\rightarrow \\
\rightarrow
\end{align*} \]

41. \[ \begin{align*}
m \times 4 \\
\rightarrow \\
\div 16 \\
\rightarrow \\
\rightarrow
\end{align*} \]

**Evaluate each expression for** \( z = 1,256 \).  

42. \[ 41z - 39 \]

43. \[ \frac{18,661 - z}{5} \]

44. \[ \frac{13z}{8} + 7,389 \]

45. \[ \frac{9z - 1,476}{42} \]
Practice 3  Simplifying Algebraic Expressions

Simplify each expression.

Example  
\[ c + c + c + c = 4c \]

1. \[ 6p + 3p = \]
2. \[ b + 3b + 5b = \]

3. \[ 10k - 3k = \]
4. \[ 12p - 12p = \]

5. \[ 6p - 2p - 3p = \]
6. \[ 10a - a + 2a = \]

7. \[ 4c + c - 5c = \]
8. \[ 10f - 4f + f = \]
Simplify each expression.

Example

\[5x + 2x + 4 = 7x + 4\]

9. \[x + 5x - 9 =\] 
10. \[2m + 4 + 6m =\]

11. \[10p - 4p - 5 =\] 
12. \[4 + 5k - 4k =\]

13. \[2 + 6b - 1 + 4b =\] 
14. \[5c + 3 - 2c + 5 =\]

15. \[9e - 2e + 3 + 5e =\] 
16. \[6h + 12 + 2h - 6 =\]
Write an algebraic expression for each situation.

17. The length of a piece of fabric is $8y$ yards. Landon cuts 7 yards from it to make some cushion covers. He then cuts another $3y$ yards to make a curtain. The remaining material is cut into 4 equal pieces. How long is each piece?

18. Ling has $4m$ pounds of flour. She buys another 2 packages of flour, each weighing $m$ pounds. How much flour does Ling have now in terms of $m$?
Write an algebraic expression for each situation.

19. On Monday, Linus made $5k$ paper cranes and gave $2k$ paper cranes to his friends. On Tuesday, he made another $4k$ paper cranes. His friend gave him $5$ paper cranes. How many paper cranes does he have now in terms of $k$?

20. At the market, a pear costs $b$ cents and an apple costs $7$ cents less than a pear. Randy buys $4$ pears and an apple. How much does Randy pay in terms of $b$?
Practice 4  Inequalities and Equations

Complete with \( >, <, \text{ or } = \).

1. For \( y = 3 \), \( 6y \) \( \bigcirc \) 11.
2. For \( y = 6 \), \( 6y \) \( \bigcirc \) 36.

3. For \( y = 4 \), \( 6y \) \( \bigcirc \) 26.
4. For \( y = 5 \), \( 6y \) \( \bigcirc \) 24.

Complete with \( >, <, \text{ or } = \) for \( x = 8 \).

5. \( 3x \) \( \bigcirc \) 20
6. \( 5x + 5 \) \( \bigcirc \) 45

7. \( 2x - 9 \) \( \bigcirc \) \( x - 1 \)
8. \( 12 - x \) \( \bigcirc \) \( x \div 2 \)
Solve each equation.

Example

\[ x - 5 = 5 \]
\[ x - 5 + 5 = 5 + 5 \]
\[ x = 10 \]
\[ x = \boxed{10} \]

9. \[ 2a + 4 = 10 \]

\[ a = \boxed{3} \]

10. \[ 5b - 13 = 17 \]

\[ b = \boxed{6} \]

11. \[ 2m - 3 = m \]

\[ m = \boxed{3} \]

12. \[ 12n + 7 = 8n + 15 \]

\[ n = \boxed{4} \]

13. \[ 2s + 16 = 4s - 6 \]

\[ s = \boxed{-11} \]
Practice 5  Real-World Problems: Algebra

Solve. Show your work.

1. Raul has 5 boxes of golf balls. Each box contains $y$ golf balls. His father gives him another 8 golf balls.
   a. Find the total number of golf balls Raul has in terms of $y$.
   
   b. If $y = 4$, how many golf balls does Raul have altogether?

2. Glenda bought $z$ containers of laundry detergent at $9 each. She gave the cashier $50.$
   a. Find the change Glenda received in terms of $z$.
   
   b. If $z = 3$, how much change did Glenda receive?
Solve. Show your work.

3. Garrett is $w$ years old. His mother is 4 times his age. His father is 3 years older than his mother.

a. How old is Garrett’s father in terms of $w$?

b. If $w = 9$, how old is Garrett’s father?

4. An office manager bought 16 boxes of pens, each containing $m$ pens. Workers took 10 pens from the supply room.

a. How many pens were left? Give your answer in terms of $m$.

b. If $m = 5$, how many pens were left in the supply room?
Solve. Show your work.

5. Sarah has a box containing $x$ ribbons and 4 extra ribbons. Jill has 12 ribbons.
   a. Express the number of ribbons that Sarah has in terms of $x$.
   b. For what value of $x$ will Sarah and Jill have the same number of ribbons?

6. Henry made $(2y + 4)$ paper cranes. Elise made $(3y - 9)$ paper cranes.
   a. If $y = 6$, who would have made more paper cranes?
   b. For what value of $y$ will they have made the same number of paper cranes?
**Solve. Show your work.**

7. Mary has \( y \) yards of fabric. She used 2 yards to sew a skirt. She used the remaining fabric to make 5 jackets.
   a. Find the amount of material that was used to make each jacket in terms of \( y \).
   
   b. If she has 17 yards of fabric, how much material was used for each jacket?

8. A magazine costs half as much as a book. The book costs \( p \) dollars. A pen costs $2 more than the magazine.
   a. How much does the pen cost in terms of \( p \)?
   
   b. If the book costs $5, how much does the pen cost?
John’s solutions to the following problems are as shown. Identify and explain the mistakes John has made. Then give the correct solution.

1. \[4w + 12w - 10 = 16w - 10 = 6w\]

2. \[20p - 2p + 4p = 20p - 6p = 14p\]

3. \[6 \div q = \frac{q}{6}\]
4. Clarissa bought 3 cartons of milk for $y$ cents each. She gave the cashier $10. How much change did she receive? Express your answer in terms of $y$.

$3 \times y = 3y$

3 cartons of milk cost $3y$ cents.

$10 - 3y$

Clarissa received $(10 - 3y)$ dollars in change.
Put On Your Thinking Cap!

Wendy bought 7 handbags. Each handbag costs the same amount. She paid the cashier $100 and received $g$ dollars in change.

a. What was the cost of each handbag in terms of $g$?

b. If the price of each handbag was more than $10, what is the least possible value of $g$? (Assume that the cost of each handbag is a whole number.)
Put On Your Thinking Cap!

Problem Solving

There are 40 pupils in a class. There are $x$ more girls than boys.

a. How many boys are there in terms of $x$?

b. If $x = 4$, how many boys are there?