Solve each equation. Write a reason for every step.

1. \[4x = 12x + 32\]

2. \[28 + 12x = 8x - 4\]

3. \[60x + 153 = 9x + 51\]

4. \[-4x + 10 = -5x + 18\]

5. \[-3(x + 2) = 16 - x\]

6. \[-x - 2(9 - 8x) = 12\]

7. \[6(x - 6) = x(16 - 7)\]

8. \[\frac{1}{4}x + 10 = 2\]
State the property that justifies each statement.

1. If $80 = m\angle A$, then $m\angle A = 80$.

2. If $RS = TU$ and $TU = YP$, then $RS = YP$.

3. If $7x = 28$, then $x = 4$.

4. If $VR + TY = EN + TY$, then $VR = EN$.

5. If $m\angle 1 = 30$ and $m\angle 1 = m\angle 2$, then $m\angle 2 = 30$.

Complete the following proof.

6. Given: $8x - 5 = 2x + 1$
   Prove: $x = 1$

   Proof:

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $8x - 5 = 2x + 1$</td>
<td>a. __________________________</td>
</tr>
<tr>
<td>b. $8x - 5 - 2x = 2x + 1 - 2x$</td>
<td>b. __________________________</td>
</tr>
<tr>
<td>c. __________________________</td>
<td>c. Substitution Property</td>
</tr>
<tr>
<td>d. __________________________</td>
<td>d. Addition Property</td>
</tr>
<tr>
<td>e. $6x = 6$</td>
<td>e. __________________________</td>
</tr>
<tr>
<td>f. $\frac{6x}{6} = \frac{6}{6}$</td>
<td>f. __________________________</td>
</tr>
<tr>
<td>g. __________________________</td>
<td>g. __________________________</td>
</tr>
</tbody>
</table>

   Write a two-column proof to verify the conjecture.

   7. If $PQ \cong QS$ and $QS \cong ST$ then $PQ = ST$. 

   ![Diagram](image)
2-6 Study Guide and Intervention

Algebraic Proof

Algebraic Proof  A list of algebraic steps to solve problems where each step is justified is called an algebraic proof. The table shows properties you have studied in algebra.

The following properties are true for any real numbers \(a, b,\) and \(c\).

<table>
<thead>
<tr>
<th>Property</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition Property of Equality</td>
<td>If (a = b), then (a + c = b + c).</td>
</tr>
<tr>
<td>Subtraction Property of Equality</td>
<td>If (a = b), then (a - c = b - c).</td>
</tr>
<tr>
<td>Multiplication Property of Equality</td>
<td>If (a = b), then (a \cdot c = b \cdot c).</td>
</tr>
<tr>
<td>Division Property of Equality</td>
<td>If (a = b) and (c \neq 0), then, (\frac{a}{c} = \frac{b}{c}).</td>
</tr>
<tr>
<td>Reflexive Property of Equality</td>
<td>(a = a)</td>
</tr>
<tr>
<td>Symmetric Property of Equality</td>
<td>If (a = b) and (b = a).</td>
</tr>
<tr>
<td>Transitive Property of Equality</td>
<td>If (a = b) and (b = c), then (a = c).</td>
</tr>
<tr>
<td>Substitution Property of Equality</td>
<td>If (a = b), then (a) may be replaced by (b) in any equation or expression.</td>
</tr>
<tr>
<td>Distributive Property</td>
<td>(a (b + c) = ab + ac)</td>
</tr>
</tbody>
</table>

Example

Solve \(6x + 2(x - 1) = 30\). Write a justification for each step.

**Algebraic Steps**

\[
\begin{align*}
6x + 2(x - 1) &= 30 \\
6x + 2x - 2 &= 30 \\
8x - 2 &= 30 + 2 \\
8x &= 32 \\
x &= 4
\end{align*}
\]

**Properties**

- Original equation or Given
- Distributive Property
- Substitution Property of Equality
- Addition Property of Equality
- Substitution Property of Equality
- Division Property of Equality
- Substitution Property of Equality

Exercises

Complete each proof.

1. **Given:** \(\frac{4x + 6}{2} = 9\)
   **Prove:** \(x = 3\)
   **Proof:**
   - **Statements**
     - a. \(\frac{4x + 6}{2} = 9\)
     - b. \(- \frac{4x + 6}{2} = 2(9)\)
     - c. \(4x + 6 = 18\)
     - d. \(4x + 6 - 6 = 18 - 6\)
     - e. \(4x = \) 
     - f. \(\frac{4x}{4} = \)
     - g. 
   - **Reasons**
     - a. 
     - c. 
     - d. 
     - e. Substitution
     - g. Substitution

2. **Given:** \(4x + 8 = x + 2\)
   **Prove:** \(x = -2\)
   **Proof:**
   - **Statements**
     - a. \(4x + 8 = x + 2\)
     - b. \(4x + 8 - x = x + 2 - x\)
     - c. \(3x + 8 = 2\)
     - d. 
     - e. Substitution
     - f. 
     - g. Substitution