Properties of Real Numbers

The Commutative Property:

The **Commutative Property of Addition** states that if everything is being added, you can **add in ANY order**.

\[ 3 + 7 = 7 + 3 \]

The **Commutative Property of Multiplication** states that if everything is being multiplied, you can **multiply in ANY order**.

\[ 3 \cdot 7 = 7 \cdot 3 \]

The Associative Property:

The **Associative Property** states that if everything is being **either added or multiplied**, you can **add or multiply by grouping in ANY order**.

\[ (4 + 3) + 2 = 4 + (3 + 2) \]
\[ 4 \cdot (3 \cdot 2) = (4 \cdot 3) \cdot 2 \]

The use of these two properties can make simplifying expressions easier.
Example 1:

Evaluate:

\[4 - 7 + 6 - 9 - 3 + 8 - 1 + 2 + 5\]

We want to rewrite this expression so that everything is being added, then we can use the **Commutative Property of Addition**.

\[4 + (-7) + 6 + (-9) + (-3) + 8 + (-1) + 2 + 5\]

Now that everything is being added, we can **add in any order**.

What numbers seem to “go together”?

\[4 + (-7) + 6 + (-9) + (-3) + 8 + (-1) + 2 + 5\]

\[= 10 + (-10) + (-10) + 10 + 5\]

\[= 0 + 0 + 5\]

\[= 5\]
The Identity Properties:

Name each property:

\[ 5 + 0 = \] 

\[ 0 + 5 = \] 

\[ 5 \cdot 1 = \] 

\[ 1 \cdot 5 = \] 

The Inverse Properties:

Name each property:

\[ 7 + (-7) = \] 

\[ (-7) + 7 = \] 

\[ \frac{3}{4} \cdot \frac{4}{3} = \] 

\[ -\frac{2}{7} \cdot \left( -\frac{7}{2} \right) = \]
The Distributive Property:

Example 2:

Evaluate:

\[ 4(7 + x) = \]

\[ = 4(7) + 4(x) \]

\[ = 28 + 4x \]

Example 3:

Evaluate:

\[ -6(5 - 2x) = \]

\[ = -6( ) - (-6)( ) \]

\[ = ( ) - ( ) \]

\[ = -30 + 12x \]
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Practice Problems

1. Evaluate:
   \[-7 + 4 + 5 - 3 + 9 + 6 + 5\]

2. Evaluate:
   \[\frac{6 \cdot 7}{7 \cdot 6} = \]

3. Evaluate:
   \[\left(-\frac{4}{31}\right) \cdot \left(-\frac{31}{4}\right) = \]

4. What number do you multiply by \(-\frac{2}{3}\) to get 1?

5. Simplify:
   \[-7(x - 3)\]