Properties of Addition and Multiplication

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

- **Commutative Property of Addition**
  Changing the *order* of the addends does not change the sum.
  \[
  a + b = b + a \\
  5 + 9 = 9 + 5 \\
  14 = 14
  \]
  *Think “order”*

- **Commutative Property of Multiplication**
  Changing the *order* of the factors does not change the product.
  \[
  a \times b = b \times a \\
  3 \times 8 = 8 \times 3 \\
  24 = 24
  \]

- **Associative Property of Addition**
  Changing the *grouping* of the addends does not change the sum.
  \[
  (a + b) + c = a + (b + c) \\
  (1 + 4) + 7 = 1 + (4 + 7) \\
  5 + 7 = 1 + 11 \\
  12 = 12
  \]
  *Think “grouping”*

- **Associative Property of Multiplication**
  Changing the *grouping* of the factors does not change the product.
  \[
  (a \times b) \times c = a \times (b \times c) \\
  (6 \times 5) \times 2 = 6 \times (5 \times 2) \\
  30 \times 2 = 6 \times 10 \\
  60 = 60
  \]

- **Identity Property of Addition**
  The sum of zero and a number is that number.
  \[
  a + 0 = a \\
  0 + a = a \\
  89 + 0 = 89 \\
  0 + 89 = 89
  \]
  *Think “same”*

- **Identity Property of Multiplication**
  The product of one and a number is that number.
  \[
  1 \times a = a \\
  a \times 1 = a \\
  1 \times 8 = 8 \\
  8 \times 1 = 8
  \]

- **Zero Property of Multiplication**
  The product of zero and a number is zero.
  \[
  0 \times a = 0 \\
  a \times 0 = 0 \\
  0 \times 33 = 0 \\
  33 \times 0 = 0
  \]
  *Think “0 product”*

Name the property of addition or multiplication used.

1. \( 18 + 53 = 53 + 18 \) 
2. \( (7 + 8) + 2 = 7 + (8 + 2) \) 
3. \( 90 + 0 = 90 \)
4. \( 11 \times 12 = 12 \times 11 \) 
5. \( 2 \times (30 \times 8) = (2 \times 30) \times 8 \) 
6. \( 1 \times 25 = 25 \)