

Order of operations

The order in which we perform numerical calculations is called the order of operations.

To get correct answers, you must perform operations in the proper order.

1. Perform all operations within grouping symbols first, starting with the innermost pair if more than one pair is present.
2. Evaluate exponential expression (if any)
3. Perform multiplication or division in the order that they occur from left to right.
4. Perform addition or subtraction in the order that they occur from left to right.

PEMDAS: Parentheses, Exponents, Multiplication, Division, Addition, Subtraction

☞ Remember: this does not imply multiplication before division or addition before subtraction.

Example 1: Evaluate the expression: $10 + 5 \cdot 6^2 - 3$

Solution

$$\begin{aligned} 10 + 5 \cdot 6^2 - 3 &= 10 + 5 \cdot 36 - 3 && \text{Evaluate } 6^2. \\ &= 10 + 180 - 3 && \text{Multiply 5 and 36.} \\ &= 190 - 3 && \text{Add 10 and 180.} \\ &= 187 && \text{Subtract} \end{aligned}$$

Example 2: Evaluate the expression: $-15 + 3[-7 + (64 \div 4^2)]$

Solution:

This expression has two pairs of grouping symbols. Evaluate the expression in the innermost pair first.

$$\begin{aligned} -15 + 3[-7 + (64 \div 4^2)] &= -15 + 3[-7 + (64 \div 16)] && \text{Evaluate } 4^2. \\ &= -15 + 3[-7 + 4] && \text{Divide.} \\ &= -15 + 3[-3] && \text{Add inside the brackets.} \\ &= -15 - 9 && \text{Multiply 3 and } -3. \\ &= -14 && \text{Add.} \end{aligned}$$

Example 3: Evaluate the expression: $(24 \div 3) + 9(24 - 27)^2$

Solution:

This expression has two pairs of grouping symbols. Evaluate the expression in each pair of grouping symbols first.

$$\begin{aligned} (24 \div 3) + 9(24 - 27)^2 &= (8) + 9(-3)^2 && \text{Parentheses.} \\ &= 8 + 9 \cdot 9 && \text{Evaluate } 3^2. \\ &= 8 + 81 && \text{Multiply.} \\ &= 89 && \text{Add.} \end{aligned}$$

Example 4: Evaluate the expression: $-12 - 64 \div 8 \cdot 2^4 + 25$

Solution:

The expression does not have groupings. Apply rule 2 first.

$$\begin{aligned} -12 - 64 \div 8 \cdot 2^4 + 25 &= -12 - 64 \div 8 \cdot 16 + 25 && \text{Evaluate } 2^4. \\ &= -12 - 8 \cdot 16 + 25 && \text{Divide.} \\ &= -12 - 128 + 25 && \text{Multiply.} \\ &= -140 + 25 && \text{Subtract.} \\ &= -115 && \text{Add.} \end{aligned}$$