

Order of Operations
Hierarchy Chart

Grouping Symbols: Perform operations inside first. $(), [], \{ }, \sqrt{\quad}, \frac{x}{y}, x $	
Exponents	Roots
Multiplication	Division
Addition	Subtraction

Rules for using the chart:

- I. Always perform higher level operations first.
- II. When choosing between operations on the same level, work from left to right.

Order of Operations

1. Parentheses (), Brackets [], and Braces { } – work from the inside out. Parentheses are implied inside absolute value signs, around the numerators and denominators of fractions, and under radical signs (such as a square root).

Examples: $\{ 3+[22-(6+7)]+1 \}$ combine inside-most first, then remove ()

$$\begin{aligned} &= \{ 3+[22-13]+1 \} \\ &= \{ 3+9+1 \} \\ &= 13 \end{aligned}$$

$$\begin{aligned} 4 + \sqrt{12+4} & \text{ parentheses are implied inside radical} = 4 + \sqrt{(12+4)} \\ &= 4 + \sqrt{16} \\ &= 4 + 4 \\ &= 8 \end{aligned}$$

2. Exponents – after all of the above grouping symbols have been taken care of, any exponents should be calculated. Remember, an exponent only affects the number it is directly attached to. Radical signs count as exponents.

Example: $5^2 + 3^4 - 2^5$

$$= 25 + 81 - 32 = 74$$

3. Multiplication and Division – after all exponents have been calculated, work all multiplication and division across the problem from left to right. Do not do all multiplication first, then division; rather, work both as you come to them while working left to right.

Example: $2 \times 3 + 8 \div 4 \times 5$

$$\begin{aligned} &= 6 + 8 \div 4 \times 5 \\ &= 6 + 2 \times 5 \\ &= 6 + 10 \\ &= 16 \end{aligned}$$

4. Addition and Subtraction – these always come last. Work together from left to right like multiplication and division.

Example: $(7+3)^2 \times 2 - 3^3 \div 9 + 5$ parentheses first

$$\begin{aligned} &= 10^2 \times 2 - 27 \div 9 + 5 && \text{exponents second} \\ &= 200 - 27 \div 9 + 5 && \text{multiplication and division third} \\ &= 200 - 3 + 5 \\ &= 197 + 5 && \text{addition and subtraction fourth} \\ &= 202 \end{aligned}$$