

ORDER OF OPERATIONS

The **ORDER OF OPERATIONS** establishes the necessary rules so that expressions are evaluated in a consistent way by everyone.

A numerical term is a single number, or numbers multiplied together. A numerical expression is a combination of numbers and operation symbols such as $+$, $-$, \cdot , \div . Examples of numerical terms include 5 , $6(3-1)$, $\frac{2+7}{4}$, 8^2 , and $-\frac{1}{4}(2-5)$.

To evaluate an expression:

1. *Circle* the parentheses or any other grouped numbers that are separated by a plus or a minus sign. See note below.
2. Using order of operations: Parentheses, Exponents, Multiplying and Dividing from left to right, *simplify* each expression that is 'SEPARATED' by the plus or minus sign.
3. Finally, *combine* terms by adding and subtracting from left to right.

Note: In the example 4 below, $\frac{12-2}{5}$ is treated as $\frac{1}{5}(12-2)$, that is, a term with parentheses.

Example 1

- Circle the terms.
- Simplify each term until it is one number.
- Add the terms going from left to right.

$$7 + 3 \cdot 8$$

$$(7) + (3 \cdot 8)$$

$$7 + 24$$

$$31$$

Example 2

- Circle the terms.
- Simplify each term until it is one number.
 - Subtract 2 from 5.
 - Evaluate 2^2 .
 - Multiply within each term, left to right.
 - Add the numbers.

$$2^2 \cdot 4 + 4(5-2) + 7$$

$$(2^2 \cdot 4) + (4(5-2)) + (7)$$

$$(4 \cdot 4) + (4(3)) + (7)$$

$$16 + 12 + 7$$

$$35$$

Example 3

- Circle the terms.
- Simplify each term until it is one number.
 - Evaluate 3^2 first.
 - Add $4 + 3$ in the parentheses.
 - Multiply and divide left to right in each term.
 - Add and subtract the numbers from left to right.

$$\begin{aligned} & 7 - 9 \div 3^2 + 4(4 + 3) - 7 \\ & \textcircled{7} - \textcircled{9 \div 3^2} + \textcircled{4(4 + 3)} - \textcircled{7} \\ & \textcircled{7} - \textcircled{9 \div 9} + \textcircled{4(7)} - \textcircled{7} \\ & \textcircled{7} - \textcircled{1} + \textcircled{28} - \textcircled{7} \\ & 27 \end{aligned}$$

Example 4

- Circle the terms.
- Simplify each term until it is one number.
 - Subtract the numerator.
 - Evaluate 3^2 .
 - Divide.
 - Add or subtract the numbers from left to right.

$$\begin{aligned} & 18 + \frac{12-2}{5} - 3^2 + 18 \div 6 \\ & \textcircled{18} + \textcircled{\frac{12-2}{5}} - \textcircled{3^2} + \textcircled{18 \div 6} \\ & \textcircled{18} + \textcircled{\frac{10}{5}} - \textcircled{9} + \textcircled{3} \\ & 18 + 2 - 9 + 3 \\ & 14 \end{aligned}$$

Problems

Circle the terms, then simplify each expression.

- $7 \cdot 3 + 5$
- $8 \div 4 + 3$
- $2(12 - 4) + 4$
- $4(9 + 3) + 10 \div 2$
- $24 \div 3 + 7(9 + 1) - 4$
- $\frac{12}{3} + 5 \cdot 4^2 - 2(12 - 5)$
- $\frac{20}{3+2} + 9 \cdot 2 \div 3$
- $\frac{4+24}{7} + 5^2 - 27 \div 9$
- $3^2 + 8 - 16 \div 4^2 \cdot 2$
- $16 - 4^2 + 4 - 2^2$
- $5(19 - 3^2) + 5 \cdot 3 - 7$
- $(6 - 2)^2 + (8 + 1)^2$
- $4^2 + 8(2) \div 4 + (6 - 2)^2$
- $\frac{16}{2^2} + \frac{7 \cdot 3}{7}$
- $3(8 - 2)^2 + 10 \div 5 - 6 \cdot 5$
- $18 \div 2 + 7 \cdot 8 \div 2 - (9 - 4)^2$
- $\frac{24}{3} + 16 - 12 \div 3 - (3 + 5)^2$
- $22 \cdot 2 \div 4 - (7 + 3)^2 + 3(7 - 2)^2$
- $\left(\frac{22+3}{5}\right)^2 + 4^2 - (2 \cdot 3)^2$
- $5^2 - \left(\frac{40+4}{4}\right)^2 + (3 \cdot 4)^2$

Answers

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|---------|---------|--------|--------|
| 1. 26 | 2. 5 | 3. 20 | 4. 53 |
| 5. 74 | 6. 70 | 7. 10 | 8. 26 |
| 9. 9 | 10. 0 | 11. 58 | 12. 97 |
| 13. 36 | 14. 7 | 15. 80 | 16. 12 |
| 17. -44 | 18. -14 | 19. 5 | 20. 48 |