

Order of Operations and Evaluating Expressions Guide Notes

EVALUATE ALGEBRAIC EXPRESSIONS means to find its numerical value.

ORDER OF OPERATIONS is a method used to evaluate an expression involving more than one operation. In algebraic expressions, it can only be evaluated if the values of the variables are known.

- Step 1** Replace the variables with their numerical values.
Step 2 Evaluate expressions inside grouping symbols.
Step 3 Evaluate all powers.
Step 4 Do all multiplications and/or divisions from left to right.
Step 5 Do all additions and/or subtractions from left to right.

Example: Evaluate $z^4 - 3$, if $z = 2$.

$$\begin{aligned} z^4 - 3 &= 2^4 - 3 \\ &= 16 - 3 \end{aligned}$$

Replace z with 2.

Evaluate 2^4

$$z^4 - 3 = 13$$

Subtract 16 and 3

Sample Problem 1: Evaluate each expression if $x = 2$, $y = 4$, and $z = 6$.

- $x^3 + 10y$
- $\frac{22}{x} + 16$
- $\frac{z}{3} + y$
- $y + z + x$
- $x + 5$

GROUPING SYMBOLS, such as parentheses () or brackets [], indicate the order in which the operations should be performed first.

Example: Evaluate $a^2 - (b^3 - 4c)$, if $a = 8$, $b = 5$, and $c = 3$.

$$\begin{aligned} a^2 - (b^3 - 4c) &= 8^2 - (5^3 - 4 \cdot 3) \\ &= 64 - (125 - 4 \cdot 3) \\ &= 64 - (125 - 12) \\ &= 64 - 113 \end{aligned}$$

Replace a with 8, b with 5, and c with 3.

Evaluate 8^2 and 5^3

Multiply 4 and 3

Subtract 125 and 12

$$a^2 - (b^3 - 4c) = -49$$

Subtract 64 from 113

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Sample Problem 2: Evaluate each expression if $r = 4$, $s = 6$, $t = 3$, and $u = 12$.

f. $2r + st^2 - u$

g. $tu - rs$

h. $st - 4r$

i. $r^3 + u + s^t$

j. $tu - 3r$

FRACTION BAR is another type of grouping symbol. It indicates that the numerator and denominator should each be treated as a single value.

Example: Evaluate $\frac{x^2 - 1}{4y^2}$, if $x = 9$, and $y = 2$.

$$\frac{x^2 - 1}{4y^2} = \frac{9^2 - 1}{4 \cdot 2^2}$$

Replace x with **9**, and y with **2**.

$$= \frac{81 - 1}{4 \cdot 4}$$

Evaluate **9^2** and **2^2**

$$= \frac{81 - 1}{16}$$

Multiply **4** and **4**

$$= \frac{80}{16}$$

Subtract **1** from **81**

$$\frac{x^2 - 1}{4y^2} = 5$$

Divide **80** to **16**

Sample Problem 3: Evaluate each expression if $r = 4$, $s = 6$, $t = 3$, and $u = 12$.

a. $\frac{2r(s - t)}{tu - s}$

b. $\frac{u}{s} + \frac{3s}{t^2}$

c. $\frac{rs^2 - 3u}{2}$

d. $\frac{3r + s}{t^2 - s}$

e. $\frac{2u + s^2}{r + 2t}$