Name: _____ Period: _____ Date: _____

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 by 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 $z = 2$.

$$
\begin{aligned}
z^4 - 3 &= 2^4 - 3 && \text{Replace } z \text{ with } 2. \\
&= 16 - 3 && \text{Evaluate } 2^4 \\
z^4 - 3 &= 13 && \text{Subtract } 16 \text{ and } 3
\end{aligned}
$$

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

a. $x^3 + 10y$

b. $\dfrac{22}{x} + 16$

c. $\dfrac{z}{3} + y$

d. $y + z + x$

e. $x + 5$

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

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

$$
\begin{aligned}
a^2 - \left(b^3 - 4c\right) &= 8^2 - \left(5^3 - 4 \cdot 3\right) && \text{Replace } a \text{ with } 8, b \text{ with } 5, \text{ and } c \text{ with } 3. \\
&= 64 - (125 - 4 \cdot 3) && \text{Evaluate } 8^2 \text{ and } 5^3 \\
&= 64 - (125 - 12) && \text{Multiply } 4 \text{ and } 3 \\
&= 64 - 113 && \text{Subtract } 125 \text{ and } 12 \\
a^2 - \left(b^3 - 4c\right) &= -49 && \text{Subtract } 64 \text{ from } 113
\end{aligned}
$$

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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 **81**

$$= \frac{80}{16}$$ Subtract **81** from **1**

$$\frac{x^2 - 1}{4y^2} = 5$$ Divide **80** to **16**

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

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

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

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

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

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