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 $z = 2$.

$z^4 - 3$	$= 2^4 - 3$	Replace z with 2.
	$= 16 - 3$	Evaluate 2^4
$z^4 - 3$	$= 13$	Subtract 16 and 3

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

a. $x^3 + 10y$ $= 2^3 + 10 \cdot 4$ $= 8 + 40$ $= 48$

b. $\dfrac{22}{x} + 16$ $= \dfrac{22}{2} + 16$ $= 11 + 16$ $= 27$

c. $\dfrac{z}{3} + y$ $= \dfrac{6}{3} + 4$ $= 2 + 4$ $= 6$

d. $y + z + x$ $= 4 + 6 + 2$ $= 12$

e. $x + 5$ $= 2 + 5$ $= 7$

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 $c = 3$.

$a^2 - (b^3 - 4c)$	$= 8^2 - (5^3 - 4 \cdot 3)$	Replace a with 8, b with 5, and c with 3.
	$= 64 - (125 - 4 \cdot 3)$	Evaluate 8^2 and 5^3
	$= 64 - (125 - 12)$	Multiply 4 and 3
	$= 64 - 113$	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. $2r + st^2 - u$ $= 2(4) + (6)(3^2) - 12$ $= 8 + 6(9) - 12$ $= 54 - 4$ **$= 50$**

g. $tu - rs$ $= (3)(12) - (4)(6)$ $= 36 - 24$ **$= 12$**

h. $st - 4r$ $= (6)(3) - 4(4)$ $= 18 - 16$ **$= 2$**

i. $r^3 + u + s^t$ $= 4^3 + 12 + 6^3$ $= 64 + 12 + 216$ **$= 292$**

j. $tu - 3r$ $= (3)(12) - 3(4)$ $= 36 - 12$ **$= 24$**

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. $\dfrac{2r(s-t)}{tu-s}$ $= \dfrac{2(4)(6-3)}{(3)(12)-6}$ $= \dfrac{8(3)}{36-6}$ $= \dfrac{24}{30}$ **$= \dfrac{4}{5}$**

b. $\dfrac{u}{s} + \dfrac{3s}{t^2}$ $= \dfrac{12}{6} + \dfrac{3(6)}{3^2}$ $= 2 + \dfrac{18}{9}$ $= 2 + 2$ **$= 4$**

c. $\dfrac{rs^2 - 3u}{2}$ $= \dfrac{(4)(6^2) - 3(12)}{2}$ $= \dfrac{4(36) - 36}{2}$ $= \dfrac{144 - 36}{2}$ $= \dfrac{108}{2}$ **$= 54$**

d. $\dfrac{3r + s}{t^2 - s}$ $= \dfrac{3(4) + 6}{3^2 - 6}$ $= \dfrac{12 + 6}{9 - 6}$ $= \dfrac{18}{3}$ **$= 6$**

e. $\dfrac{2u + s^2}{r + 2t}$ $= \dfrac{2(12) + 6^2}{4 + 2(3)}$ $= \dfrac{24 + 36}{4 + 6}$ $= \dfrac{60}{10}$ **$= 6$**