Objectives:

- Evaluate Real Numbers with Exponents.
- Use Order of Operations to Evaluate Expressions.
- Translate between English (words) and Algebraic (Numerical) Expressions.
- Evaluate/Simplify Algebraic Expressions by Combining Like Terms.
- Determine the Domain of a Variable.

EVALUATING NUMBERS WITH EXPONENTS:

An exponent (power) tells you to multiply a number by itself a certain number of times. For example x^2 means you multiply x by itself two times - $x^2 = x \cdot x$. x is called the "base", and the 2 is called the "exponent" or "power" of the base.

Sometimes we use parentheses in algebraic expressions, and the placement of the exponent makes an important difference in the way you should evaluate the number, particularly when the base has a negative in front of it. If you have parentheses, everything (every sign and every factor) within the parentheses is raised to that power: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$. This becomes important with negative values because the sign can change depending on the power. However, if you do not have parentheses, you only raise the value that the exponent is directly attached to, and everything else just stays the same.

Examples:

A) $3^2 = \boxed{9}$

$3 \cdot 3$

B) $\left(\frac{5}{2}\right)^2 = \frac{5^2}{2^2} = \boxed{\frac{25}{4}}$

C) $-2^2 = -1 \cdot 2^2 = -1 \cdot 4$

$= \boxed{-4}$

D) $(-2)^2 = (-2)(-2) = \boxed{4}$

E) $-(-2)^3 - 1 \cdot (-2)(-2)(-2) = -1(-8) = \boxed{8}$

SECTION R.4/R.5 - Order of Operations & Algebraic Expressions

ORDER OF OPERATIONS: Always evaluate in this order.

Parentheses: Simplify everything in parentheses first! ( ), [ ] —

Exponents: Apply exponents. Remember - if the exponent applies to parentheses, the value within the parentheses should by simplified first. Watch for the placement of negatives! $(6-4)^2 = (2)^2 = 4$

Multiplication/ **D**ivision: Always do multiplication and division in order from left to right.

Addition/ **S**ubtraction: Go in order left to right. You shouldn't add or subtract anything (that is not in parentheses) if there is still multiplication or division showing.

Examples:

F) $6 + 2 \cdot 7$

$= 6 + 14$

$= \boxed{20}$

G) $-2(6 + 7)$

$= -2(13)$

$= \boxed{-26}$

H) $(4 + 5) \cdot (7 - 3)$

$= (9) \cdot (4)$

$= \boxed{36}$

I) $\dfrac{9+7}{5^2+7} = \dfrac{16}{25+7}$

$= \dfrac{16}{32} = \dfrac{\cancel{16} \cdot 1}{\cancel{16} \cdot 2}$

$= \boxed{\dfrac{1}{2}}$

Examples:

J) $2^3 + [6 - 4(3 - 5)] = 2^3 + [6 - 4(-2)]$

$= 2^3 + [6 + 8] = 2^3 + 14 = 8 + 14 = \boxed{22}$

K) $3(-2)^2 + 4(7 - 2^3) = 3(-2)^2 + 4(7 - 8) = 3(-2)^2 + 4(-1)$

$= 3(4) + 4(-1) = 12 - 4 = \boxed{8}$

L) $\frac{8^2 - 6 \cdot 5}{2 - |12 - 4|} = \frac{64 - 6 \cdot 5}{2 - |8|} = \frac{64 - 30}{2 - 8} = \frac{34}{-6} = \frac{\cancel{2} \cdot 17}{\cancel{2} \cdot -3} = \boxed{-\frac{17}{3}}$

TRANSLATING ENGLISH INTO ALGEBRAIC EXPRESSIONS:

An algebraic expression is any combination of variables (values that can change and are represented by letters), constants (usually numbers, although they can be a letter that represents a fixed value), grouping symbols (like parentheses), and mathematical operations.

SECTION R.4/R.5 - Order of Operations & Algebraic Expressions

Addition	Subtraction
plus	minus
more than	*less than ex: 3 less than 12
the sum of	the difference of 12 − 3 = 9
increased by	decreased by
added to	*subtracted from 3 sub. from 12 12 − 3 = 9
Multiplication	**Division**
the product of	the quotient of
multiplied by	divided by
times	the ratio of
twice	half
Exponents	
squared	
cubed	
to the ____ power	

Examples: Express each English phrase as an algebraic expression.

M) The sum of a number n and 5.

$n+5$

N) The difference of a number k and 7.

$k-7$

O) The sum of twice a number x and 2.

$2x+2$ $\quad$ $\cancel{2(x+2)}$

P) The quotient of a number y and 3.

$\frac{y}{3}$ or $y \div 3$

Evaluating an Algebraic Expression:

To "evaluate" an expression means to find the numerical value of an expression. If there are variables in the expression, we must be given a value for the variable that we substitute into the expression before we can evaluate it.

Examples: Evaluate each expression for the given value of the variable.

Q) $5z - 3$ for $z = 2$

$= 5(2) - 3$

$= 10 - 3$

$= \boxed{7}$

R) $\frac{4n - n^2}{n+2}$ for $n = -5$

$= \frac{4(-5) - (-5)^2}{(-5) + 2} = \frac{4(-5) - 25}{-3} = \frac{-20 - 25}{-3}$

$= \frac{-45}{-3} = \boxed{15}$

Simplifying Algebraic Expressions by Combining Like Terms:

A **"term"** is a number or product of a number and one or more variables raised to a power. (Example: $5x, 12, x^2$). Terms in algebraic expressions are separated by algebraic operators.

"Like Terms" are terms that have the same variables to the same exponents. (Examples: x and $5x$, $3x^2y$ and $-10x^2y$. Unlike terms could be $3y^2z$ and $4\,yz^2$)

We **combine like terms** by adding the values of the coefficients (the numbers at the beginnings of like terms) to each other. We leave the variables alone. For example: $5x + 4x = (5 + 4)x = 9x$. Think of it like this… If we say that $x = 1$ ☺, then we have 5 ☺'s and another 4 ☺ 's. How many ☺'s do we have? 9☺'s.

Examples: Simplify each expression by combining like terms.

S) $2n + 7n$ $= 9n$

T) $r - 7 + 5r$ $= 6r - 7$

$5r$

$-7 + 6r$

U) $5k + 6 + 4k - 10k - 5$

$= \boxed{-k + 1}$

Examples: Simplify each expression by combining like terms.

V) $4(x-2)-x$

$= 4x - 8 - x$

$= 4x - x - 8$

$= \boxed{3x - 8}$

W) $2(3m+4) - (8m+2)$

$= 6m + 8 - 8m - 2$

$= \boxed{-2m + 6}$

Determining the Domain of a Variable:

The definition of DOMAIN is the set of values that a variable can assume. There is only one restriction to values of variables. We cannot have a fraction with a denominator of zero! So the domain of a variable is every number except one that would make a denominator equal to zero.

Examples: Determine which of the following numbers are in the domain of the variable x in the expression $\frac{4}{x-5}$.

X) $x = 7$ ☺ yes works

Y) $x = 5$ ☹ makes denominator 0

Z) $x = 0$ ☺ yes works

$x - 5 = 0$

$+5 \quad +5$

$x = 5$

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Can you?

Homework:

Section R.4: pg. 39 - # 6, 27-35 all, 42, 43

AND

Section R.5: pg. 47 - # 13-27 odds, 37-43 odds, 55-65 odds, 75

SHOW YOUR WORK! No calculators.

(31 problems)