Math Notes – GM7 Chapter 5 - 2019

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Order of Operations – The order in which you must do certain parts of a math problem in order to get the correct answer

G E M A

Groupings	**Exponents**	**Multiplication OR Division (Working Left to Right)**	**Addition OR Subtraction (Working Left to Right)**

When you run into multiplication or division, always work left to right.
When you run into addition or subtraction, work left to right.

DO NOT DO MULTIPLICATION BEFORE DIVISION if division is first in the sentence.

In other words Multiplication/Division and Addition/Subtraction hold the same weight!
Example: 18 ÷ 6 x 5. Do 18 ÷ 6 FIRST because we work it left to right. THEN multiply by 5. = 15

Numerical expression – A phrase with only numbers and operation symbols. EX: 8 + 5 – 2

Algebraic expression – A mathematical expression with one or more variable. EX: 7b – 2

NOTE: An expression does not have an equal (=) sign.

Examples of Algebraic expressions

A number plus 45	m + 45
The sum of a number and 45	m + 45
45 more than a number	m + 45
The difference of a number and 6	p – 6
6 less than a number	p – 6
A number less than 6	6 – n
4 times a number	4x
The product of 4 and a number	4x
The quotient of a number and 25	z/25
A number divided by 25	z/25

To write an expression:

1) Start with the operation (product, sum, quotient, difference)
2) Include the first term and then the second term in your expression
3) A variable or an unknown should be called “a number”

Example: n + 9

The sum of a number and 9

Example: 10g

The product of 10 and a number

To write multiple step expressions, just work with each part of the expression

Example: 2b – 7

The difference of two times a number and 7

Evaluate – Means to **solve** by replacing the variable with a number

Equation – A mathematical sentence that has an equal sign (=)

Coefficient - The number before a variable that tells you how many times to multiply

5n = 5 times n

If there is no number in front of a variable, then the value is 1

y = 1 times y

Constant – A value that never changes.

Examples: 6, 12, 142

Variable – A Value that changes

Examples: *n, t, x*

To solve an equation, <u>isolate</u> the variable by using <u>inverse</u> operations.

Inverse Operations – Operations that undo each other. You can do anything to one side of an equation if you do the same thing to the other side and it won't change the value of the variable.

Example: 2x = 10

The 2x in this equation means to multiply 2 by the variable.
The inverse (opposite) of multiplying is dividing.

So divide both sides by 2

$2x \div 2 = 10 \div 2$

Simplify the equation

$1x = 5$

$x = 5$

Now substitute 5 for x in the original equation to check it.

$2*5 = 10$

Exponent – Tells you how many times a number, or base, is used as a factor. 3^4 means to multiply 3 by itself four times. 3 x 3 x 3 x 3

Base → 5^{4} ←Exponent

So 5 x 5 x 5 x 5 = 625

Any number without an exponent (or an exponent of 1) equals that base number
$6^1 = 6$
$7 = 7$

Every number or variable without a displayed exponent has an exponent of *1*
$n = n^1$
$80 = 8^1$

Any number with a zero exponent equals 1
$9^0 = 1$
$1{,}450^0 = 1$

Square Roots

A square root of a given number is a number that, when multiplied by itself, is the given number

$\sqrt{16}$ = 4 since 4 x 4 = 16

To find the square root on a calculator, type in the number and then hit the $\sqrt{\ }$ key

Rational numbers are:
* Decimals that terminate or repeat. 6.7 or 1.99999999 for example
* Fractions, like 1/4
* Integers, like -10

Irrational numbers are:
* Decimals that do not repeat or terminate. Example: 3.262272228
* Square roots of numbers that are not perfect squares: $\sqrt{26}$

Distributive Property – Allows you to simplify equations by distributing (through multiplication) numbers outside a parenthesis into the parenthesis.
Example 10(f + 2) = 10f + 20

Associative Property – Changing the *grouping* does not change the answer with multiplication or addition

4 x (5 x 6) = (4 x 5) x 6

Commutative – Changing the *order* of the numbers does not change the answer with multiplication or addition

4 + 5 + 6 = 4 + 5 + 6

Identity – Multiplying by one does not change the number
Adding zero does not change the number

17 x 1 = 17
190 + 0 = 190

Zero – Multiplying by zero = 0

A **sequence** is an ordered list of numbers. Each number in a sequence is a **term**.
In **arithmetic sequences**, each term is found by adding or subtracting the same number to the previous term
Example:

Days	1	2	3	4	5
Total Time	10	11	12	13	14

In **geometric sequences, multiplication or division** is used to find each term
Example:

Days	1	2	3	4	5
Total Time	10	20	30	40	50

Equivalent Expressions – The value of the expression does not change between two equivalent expressions.
Example:
8(x + 5) = 8x + 40

Distributive Property – Examples

3(4 + 6) = 3x4 + 3x6, or 30

(6 + 4)(-4) = -40

5(4 – q) = 20 – 5q

Simplifying Algebraic Expressions
Each part of an algebraic expression is called a term
$4x + 12 - y$ contains three terms: $4x$, 12, and $-y$ ← Notice how the y is negative.

You can combine like terms to simplify an expression.
Example 1: 4x + 5 –x + 6
+5 and +6 can be combined to make +11
4x – x can be combined to make 3x
The simplified expression is then 3x + 11

Example 2:
6y - 7y – 4 + y
Simplifies to: -4
The 6y and y can combine to make 7y, but then you add (-7y) to cancel those terms out.

Linear Expression – an algebraic expression in which the variable is raised to the first power and variables are not multiplied or divided.
Example: 5x + 2
Nonlinear Expression: 5mn; $3x^3 + 2$
You can combine linear expressions using the Distributive Property and combining like terms
(3x + 2) + (x + 5)
= 3x + x + 2 + 5
= 4x + 7

Subtracting Linear expressions.
Example:
(x – 1) – (-2x – 1)
First, multiply -1 into the second parenthesis
-1 * -2x = +2x; -1 * -1 = 1
Notice how the signs are reversed for all the items in the second parenthesis
Then, combine like terms
x -1 + 2x -1 **= 3x -2**

Monomial – A number (constant), variable, or a product of a number and one of more variables
Monomials:
2.5, x, $40x$, 30ab

Not Monomials
$x + 4$, $40x + 30$
(these are actually binomials because there are two monomials separated by an operation)

Find the GCF of each pair of monomials
Step 1) Write the prime factorization of each monomial

Step 2) Find all the common elements between the two factorizations

Example 1:
$12x$, $15x$

$12x = 2 * 2 * \mathbf{3} * \mathbf{x}$
$15x = \mathbf{3} * 5 * \mathbf{x}$

Since 3 and x are both common to the monomials, the GCF is $\mathbf{3x}$.

Example 2:
$12ef$, $24efg$

$12ef = 2 * 2 * 3 * e * f$
$24efg = 2 * 2 * 2 * 3 * e * f *$ g

The GCF is $2 * 2 * 3 * e * f$ or $12ef$

You can also **factor out** the GCF from a linear expression by using the inverse of the Distributive Property.

Example: $4x + 12y \rightarrow 4(x + 3y)$
Four is the common factor in the expression