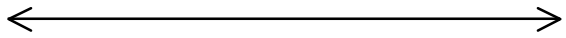
Algebra 1 Name _____
Chapter 2 Note Packet

Sec 2.1 "The Real Number Line"

Real Numbers- All the numbers on the number line, not just whole number integers (decimals, fractions and mixed numbers, square roots, etc).

Examples: 4, -5, 9.78, π, $\sqrt{6}$, 7/8, etc.

Graphing Real Numbers:
Identifying them with a point on a number line

Ex: graph $1\frac{4}{5}$ 

Integers- Positive and Negative "whole" numbers

Examples: {…-3, -2, -1, 0, 1, 2, 3, 4 …}

Opposites:
Two numbers that are the same distance from the origin (zero), but on opposite sides of the origin.

-3 is "negative three" but also "the opposite of 3"

-a is the opposite of a, but do not assume –a is a negative number….
If a = -2, then "-a" = --2 = +2

Example 1: Let x = 4 Opposite of x = -x = _____

Examle 2: Let x = -7 Opposite of x = -x = _____ = _____

The RULE of OPPOSITES
To find the opposite of any number, just change the sign!

Absolute Value- The distance between the origin and a point representing the real number.
Absolute value is _____ _____!

Example 3: Let x = 3 | x | = | 3 | = _____

Example 4: Let x = -6 | x | = | -6 | = _____

*You just take whatever is inside the | | and make it positive…but remember you have to follow PEMDAS inside the | | too, because absolute value bars are a _____ _____ too!

Ex 5: $|4^2 - 5^2|$ Ex 6: $-2 \cdot |7 - 9|$

Sec 2.2 "Addition of Real Numbers"

Some General Rules:
When adding positive numbers the answer is positive
Positive + positive = positive

Ex 1: 72 + 5 = ____

When adding negative numbers the answer is negative
Negative + negative = negative

Ex 2: -12 + -9 = ____

***Rule:**
If same signs, add the numbers & keep the sign

Adding Numbers with Opposite signs
(This is a TUG of WAR)
Ask yourself...Which number is bigger? By how much?

Step 1) Take the larger number and minus the smaller number

Step 2) Attach the sign of the bigger number to your answer

Ex 3: -7 + 4 = ? step 1: ____ - ____ = ____ step 2: answer = ____

Ex 4: 8 + -3 = ? step 1: ____ - ____ = ____ step 2: answer = ____

Properties of Addiiton

1) Commutative:
   The order in which you add does not change the sum
   3 + 2 = 2 + 3

2) Associative:
   The way you group numbers does not change the sum
   (4 + 3) + 2 = 4 + (3 + 2)

3) Identity:
   The sum of a number and zero is the number
   5 + 0 = 5

4) Property of Zero (Inverse Property):
   The sum of a number and its opposite is Zero
   5 + (-5) = 0

Sec 2.3 "Subtraction of Real Numbers"

"Adding the opposite" of a number is **equivalent to** subtracting the number!

Ex 1: $7 + (-4) =$

Ex 2: $-3 + 6 =$

What if there is subtraction instead of addition?

Use the **SUBTRACTION RULE**:
1) Instead of subtracting values, change the subtraction sign to an addition sign.
2) Then follow the rules for addition.

Chop/Chop
Ex 3:
$12 - -24 =$

Chop/Slash
Ex 4:
$12 - 14 =$

***Note: Subtraction is _____ Commutative**
The order that you subtract numbers does make a difference!

Ex 5: $7 – (-2) – 1 + 5 =$

What are TERMS of an EXPRESSION?
***** To find the terms of an expression, use the **subtraction rule**
(re-write the terms with subtraction as "adding the opposite").

The **terms** will be the pieces of the expression between the "+" signs!

Original Expression	Re-write using the subtraction rule	List the terms
$-6p^2 – 2p$		
$-3x^3 - -2x^2 + 4x – 1$		
$3x^3 – 5x^2 – 4x – 8$		

*Note that when you are looking at a term in an expression, the sign to the _____ of the term *belongs to that term!* No Exceptions!

Ex 6: Complete the Input/Output Table for the following function the domain D: {-2 ≤ x ≤ 2}
$y = -2x – x^2$

*First we should re-write the function so it looks like addition…that way we will be sure to get our signs correct!

X-value (input)	Plug in Input	y-value (output)

Sec 2.4 "Adding and Subtracting Matrices"

Matrix- A rectangular arrangement of numbers into horizontal rows and vertical columns.

Each number in a matrix is called an _____.

Size of a matrix: Number of rows x number of columns… R x C (Remember "RC Cola")

When talking about more than one matrix, the plural of the word matrix is _____.

A 2 x 3 matrix: $\begin{bmatrix} 6 & 1 & 7 \\ 2 & 5 & 3 \end{bmatrix}$ The 3 is in the _____ row, ____ column

***Two matrices are equal if the corresponding positions are equal:**

$\begin{bmatrix} 1 & 6 \\ 3 & 7 \end{bmatrix} \neq \begin{bmatrix} 1 & 6 \\ 7 & 3 \end{bmatrix}$ but… $\begin{bmatrix} 1/2 & 4 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 0.5 & 4 \\ 1 & 9/3 \end{bmatrix}$

To add or subtract matrices, you add or subtract corresponding entries:

Ex 1: $\begin{bmatrix} 3 & 9 \\ 4 & -2 \end{bmatrix} + \begin{bmatrix} -1 & 4 \\ 3 & 6 \end{bmatrix} =$

Ex 2: $\begin{bmatrix} 6 & -1 \\ 5 & 1 \end{bmatrix} - \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix} =$

Ex 3: Hint – to make this easier use the subtraction rule.

$$\begin{bmatrix} 2 & 4 & -3 \\ -7 & 1 & 6 \\ -5 & 0 & -9 \end{bmatrix} - \begin{bmatrix} -2 & 3 & -7 \\ -7 & 11 & -12 \\ 3 & -1 & 5 \end{bmatrix} =$$

Sec 2.5 "Multiplication of Real Numbers"

***Multiplication can be modeled as repeated addition: $3x = x + x + x$**

A product is NEGATIVE if it has an _____ number of negative factors

Ex 1: $(-2)(-3)(7)(-2) =$

A product is POSITIVE if it has an _____ number of negative factors

Ex 2: $(6)(-2)(-3)(4) =$

Properties of Multiplication:

Commutative:
The order in which you multiply numbers together does not change the product
$ab = ba$ Ex: $3 \cdot 5 = 5 \cdot 3$

Associative:
The way you group number when you multiply them does not change **the product**
$(a \times b) \times c = a \times (b \times c)$ Ex: $(2 \cdot 4) \cdot 3 = 2 \cdot (4 \cdot 3)$

Identity: The product of one and a number is the number
$1 \cdot a = a$ Ex: $1 \cdot 5 = 5$

Property of Zero: The product of a number and zero is zero
$a \cdot 0 = 0$ Ex: $2 \cdot 0 = 0$

Property of Opposites:
The product of a number and negative 1 is the opposite of the number
$-1 \cdot a = -a$ Ex: $(-1) \cdot 6 = -6$ Ex: $-1 \cdot -4 = 4$

What is the difference between these two?
$(-x)^2 =$ _____ and $-x^2 =$ _____

Steps for Multiplication Problems with Numbers and Variables:
1) Expand any factors with exponents on the OUTSIDE of the parentheses
2) Count the number of negative signs, decide if your answer will be + or -
3) Multiply all NUMBERS together, write the product with correct sign
4) Count the variables…the total number will be the exponent on the variable in your answer

Ex 3: $-(x)(2x)(-x^2) =$

Ex 4: $(-y)^2(-3y^3)(-4y) =$

Ex 5: $-(-1)(-2)(-6x^3)(-3y^2)(y^4) =$

Ex 6: $(5x^2)(-2x^3)(x^6)(-x) =$

Ex 7: $(-x)^2(-x)^3(-x)(x) =$

Ex 8: $(x)^2(-y)^3(3x^2)(y^5)(-4xy)^2 =$

Sec 2.6 "The Distributive Property"

1) **The product of a and (b + c):**
   $a(b + c) = ab + ac$

   Ex 1: $3(x + 1) =$ Ex 2: $(x + 2)2 =$

2) **The product of a and (b - c):**
   $a(b - c) = ab - bc$

   Ex 3: $4(x - 1) =$ Ex 4: $(x - 3)5 =$

Coefficient: A number multiplied by a variable

In $3x$ …. 3 is the coefficient

In x^3 …. ___ is the coefficient

Constant Terms:
The numbers in an expression that are NOT multiplied by a variable

In $3x + 2$ …. 2 is a constant term

In $4x^2 + 3 - 2x$ …. ____ is a constant term

Like Terms: Terms in an expression that have the same variable raised to the same exponent

In $3x + 2x$ … $3x$, $2x$ are_____

In $6x - x^2$ … $6x$, $-x^2$ are _____

Combining Like Terms Examples:

Ex 5) $3x + 3 + x^2 - 6 - 2x^2 + 4x$ Ex 6) $6x^3 - 7x^2 + 5x^3 - 2x^2 + 3x - 8 + 7x + 3$

Use the Distributive Property to Combine Like Terms:

Ex 7) $4x + 2(3x + 3) + 6 - 8x =$ Ex 8) $-7x - 5x(3x - 2) + 7x^2$

Sec 2.7 "Division of Real Numbers"

Reciprocal - a fraction "flipped over" (the numerator and denominator switch places)

Ex 1: Reciprocal of ¾ ? **Ex 2:** Reciprocal of ½ ?

The reciprocal of a is _____ (a ≠ 0)

The reciprocal of $\frac{a}{b}$ is _____ (a ≠ 0, b ≠ 0)

Every number (except 0) has a reciprocal….if we try to find the reciprocal of ZERO we get $\frac{1}{0}$, and we are NOT ALLOWED to divide by ZERO!

Anything divided by zero is considered "undefined" in mathematics!

The Inverse Property of Multiplication:
A product of a number and its RECIPROCAL is 1!

Ex 3: Given 3… Ex 4: Given -2/5…

Division Rule- To divide a number "a" by a non-zero number "b," multiply "a" by the reciprocal of "b"

Ex 5: 25 ÷ 5 Ex 6: 21 ÷ ½

The quotient of two numbers with the SAME sign is POSITVE
(+) ÷ (+) = + (-) ÷ (-) = +

The quotient of two numbers with OPPOSITE signs is NEGATIVE
(+) ÷ (-) = - (-) ÷ (+) = -

Remember that the DOMAIN of a function is the x-values....

When we have variables (like "x") in the *denominator* of a function, we have to be CAREFUL which values we allow "x" to be...because we can't have ZERO in the denominator!

Note: It IS OK to have ZERO in the numerator!

What are the "Domain Restrictions" for the following functions?
Ask yourself… ***Which values are we NOT ALLOWED to use for "x"?***

Ex 7: $y = \frac{x}{x-3}$ Ex 8: $y = \frac{2}{x+2}$

Ex 9: $y = \frac{x}{5}$ Ex 10: $y = \frac{5}{x^2-4}$

Sec 2.8 "Probability and Odds"

Probability of an Event:
A measure of the likelihood that an event will occur (a number between 0 and 1)

P = 0	P = ¼	P = ½	P = ¾	P = 1
Impossible	**Unlikely**	**Occurs half the time**	**Quite likely**	**Certain to happen**

Outcomes:
The different possible results in a probability "experiment"

Event: A collection of outcomes

Favorable Outcomes: The outcomes you wish to happen in an event

Theoretical Probability: Expected or calculated probability before an event takes place

Theoretical Probability is calculated by the "Probability of an Event" equation:

$$\mathbf{P(e)} = \frac{NumberOFfavorableOUTCOMES}{TOTALnumberOFoutcomes}$$

Example 1:
Mrs. Hutschenreuter has 21 females and 19 males between 2 sections of Algebra I. If all students' names are put into a hat and we draw, what is the probability of selecting a girl?

Example 2: You have a bag with 8 marbles in it. Three are red, 4 are green, and 1 is blue.

A) How many possible outcomes are there in the event?

B) What is the P(r) = C) P(g) = D) P(b) =

Experimental Probability- based on repetitions of an actual experiment, and calculated by the rule:

$$\mathbf{Exp\ Probability\ P} = \frac{NumberOFfavorableOUTCOMESobserved}{TotalNUMBERofTRIALS}$$

***You can compare experimental probability to theoretical probability!**

Odds of an event- when all outcomes are equally likely, the odds that an event will occur are given by the formula:

$$\mathbf{Odds} = \frac{NumberOFfavorableOUTCOMES}{NUMBERofUNFAVORABLEoutcomes}$$

Ex 3: You have a bag of M&Ms with 18 Blue, 6 Orange, 8 Yellow, 13 Green, 11 Brown, and 15 Red.

A) What are the ODDS of pulling out an orange M&M?

B) What are the ODDS of pulling out a Blue M&M?