Honors Algebra 1 Notes...

Date: _____

2.1 Identify and Order Numbers *Goal* • *Identify the types of numbers and put in ascending order.*

VOCABULARY

Real number ANY NUMBER THAT IS ON THE NUMBER LINE

Whole number are 0, 1, 2, 3...

Integer are whole numbers and their opposites
$-\infty \ldots -3, -2, -1, 0, 1, 2, 3 \ldots +\infty$

Rational number A NUMBER THAT CAN BE WRITTEN AS A FRACTION.

Irrational number CAN NOT BE WRITTEN AS A FRACTION.
WHEN WRITTEN AS A DECIMAL, DOES NOT TERMINATE OR REPEAT

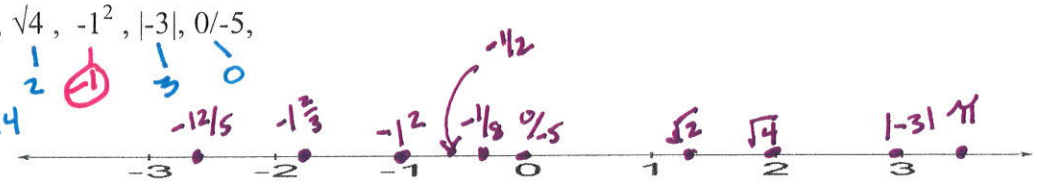
EXAMPLE 1: ***Classify numbers***- Tell whether each of the following numbers is a whole, integer, rational or irrational number.

Number	Real Number	Whole #	Integer	Rational #	Irrational #
100	yes	yes	yes	yes	no
-3	Y	N	Y	$-3/1$ Y	N
1.7	Y	N	N	$17/10$ Y	N
$-\frac{1}{2}$	Y	N	N	$-1/2$ Y	N
$5\frac{2}{3}$	Y	N	N	$17/3$ Y	N
π	Y	N	N	3.1415... N	π is an IRR #
$-\sqrt{4}=-2$	Y	N	Y	$-2/1$ Y	N
$\sqrt{9}=3$	Y	Y	Y	$3/1$ Y	PERFECT SQUARES ARE RAT. #'S (N)
$\sqrt{2}$	Y	N	N	1.414... N	NOT PERFECT SQ IRR. #
$\sqrt{-1}$	N	$\sqrt{-1} = i$ (an imaginery number)			

EXAMPLE 2: ***Order rational numbers*** Graph the numbers on a number line and then write in ascending order.

π, $-\frac{1}{2}$, $-\frac{1}{8}$, $-1\frac{2}{3}$, $-12/5$, $\sqrt{2}$, $\sqrt{4}$, -1^2, $|-3|$, $0/-5$,

3.14 | -.5 | -.125 | -1.66 | -2.4 | 1.4 | 1/2 | -1 | 1/3 | 0



Order (the original) Numbers: $-12/5, -1\,2/3, -1^2, -1/2, -1/8, 0/-5, \sqrt{2}, \sqrt{4}, |-3|, \pi$

VOCABULARY

Opposite Two numbers that are the same distance from 0. EXAMPLE 2 and -2.

Symbol for Opposite is $-a$ TAKE THE OPPOSITE OF A

EXAMPLE 3: ***Find opposites of numbers***

a. If $x = -4$, then $-x = -(-4) = 4$

b. If $x = \frac{2}{3}$, then $-x = -(2/3) = -2/3$

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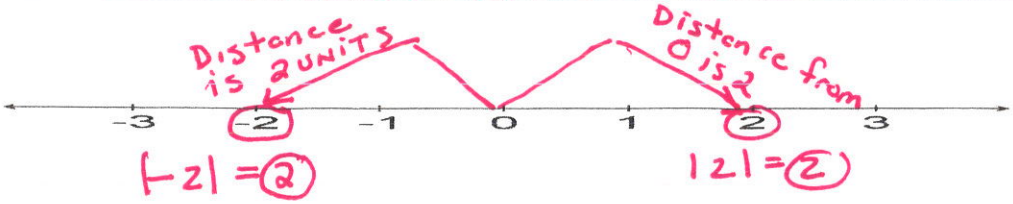
VOCABULARY

Symbol for Absolute value → || symbols. Treat like ( )'s

Absolute value IS THE DISTANCE FROM 0



EXAMPLE 4: *Find absolute values of numbers*

a. If x = 10, then $|x| = |10| = 10$.

b. If x=0, then $|x| = |0| = 0$.

c. If x = −½, then $|x| = |-1/2| = 1/2$

EXAMPLE 5: *Think!* Why are these not equal? $|-100| \neq -|-100|$ ⇒ $100 \neq -100$

Abs Value is 100

Take the absolue value (100) then take the opposite (−100)

2.2 PROPERTIES OF ADDITION Goal •. *Identify properties of addition*

VOCABULARY

Additive identity is the number ZERO because → the sum of a number X and 0 is X.

Additive inverse means the same as OPPOSITE because → the sum of a number X and it's OPPOSITE is 0. → 5 + (-5) = 0

PROPERTIES OF ADDITION

Commutative Property The order in which you add two numbers does not change the sum.

$a + b =$ B + A Example: $-1 + 3 =$ 3 + (-1)

Associative Property The way you group three numbers in a sum does not change the sum.

$(a + b) + c =$ a + (b + c) Example: $(1 + 2) + 3 =$ 1 + (2 + 3)

Additive Identity Property The sum of a number and 0 is the number.

$a + 0 =$ a Example: $4 + 0 =$ 4

Additive Inverse Property The sum of a number and its opposite is 0.

$a + (-a) =$ 0 Example: $-9 +$ 9 $= 0$

EXAMPLE 6: *Identify the property illustrated by the statement.*

Statement	Property Illustrated
a) $y + 0 = y$	IDENTITY
b) $x + 5 = 5 + x$	COMMUTATIVE
c) $-5 + 5 = 0$	ADDITIVE INVERSE
d) $(5 + 2) + 3 = 5 + (2 + 3)$	ASSOCIATIVE
e) $(5 + 2) + 3 = (2+5) + 3$	*Think!* COMMUTATIVE

Honors Algebra 1 Notes...

2.3 Subtract Real Numbers

Goal •. *Subtract real numbers.*

VOCABULARY

SUBTRACTION RULE "ADD THE OPPOSITE" THERE IS NO LONGER SUBTRACT!! WE SIMPLY ADD POSITIVE + NEGATIVE #'S.

Words: To subtract *a* and *b*, add the OPPOSITE of *b* to *a*.

Algebra: $a - b =$ a + (-b)

Numbers: $15 - 7 =$ 15 + (-7)

2.4 PROPERTIES OF Multiplication

Goal •. *Identify properties of multiplication*

VOCABULARY

Multiplicative identity is the number ONE because → a number X times 1 is X.

PROPERTIES OF MULTIPLICATION

Commutative Property The order in which you multiply two numbers does not change the product.

$a \cdot b =$ b • a Example: $-2 \cdot 3 =$ 3 • -2

Associative Property The way you group three numbers when multiplying does not change the product.

$(a \cdot b) \cdot c = a \cdot (b \cdot c)$ Example: $(2 \cdot 3) \cdot -5 =$ 2 • (3 • 5)

Multiplicative Identity Property The product of a number and 1 is that number.

$a \cdot 1 =$ a Example: $(-2) \cdot 1 =$ -2

Multiplicative Property of Zero The product of a number and 0 is 0.

$a \cdot 0 =$ 0 Example: $4 \cdot$ 0 $= 0$

Multiplicative Property of –1 The product of a number and –1 is the opposite of the number.

$a \cdot (-1) =$ -a Example: $5 \cdot (-1) =$ -5

EXAMPLE 7: ***Identify the property illustrated by the statement.***

Statement	Property Illustrated
a) $y \cdot 0 = 0$	MULT. PROPERTY OF ZERO
b) $t \cdot 1 = t$	MULT. IDENTITY
c) $a \cdot 3 = 3 \cdot a$	COMMUNATIVE
d) $7(-1) =$ -7	MULT PROPERTY OF -1
e) $n \cdot (3 \cdot 5) = (n \cdot 3) \cdot 5$	*Think!* ASSOCIATIVE PROPERTY

EXAMPLE 8: ***Use properties of multiplication to find the product .*** **[You do not need to Justify your steps]**

a) $(0.5)(-2z)(-6) =$ 6z

b) $-\frac{1}{2}(2)(-3y)(-1) =$ -3y

c) $(-2x)(-1)(-2)(10)(-5x) =$ *Think!* $200x^2$

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2.5 Apply the Distributive Property

Goal • *Apply the distributive property.*

THE DISTRIBUTIVE PROPERTY *Let a, b, and c be real numbers.*

Be sure to distribute the factor outside of the parentheses to *all* of the terms inside the parentheses.

Algebra	Expressions	DISTRIBUTE	Simplify
$a(b + c) = ab + ac$	$-4(x + 3) =$	$-4(x)+(-4)(3) =$	$-4x-12$
$(b + c)\,a = ab + ac$	$(x + 5)\,2 =$	$2(x)+2(5) =$	$2x+10$
$a(b - c) = ab - ac$	$7(x - 3) =$	$7(x)+7(-3) =$	$7x-21$
$(b - c)a = ab - ac$	$(x - 4)\,9x =$	$9x(x)+9x(-4) =$	$9x^2-36x$
	Think!		

VOCABULARY

Terms *are separated by addition and subtraction signs (i.e. 2x-3y-5 has 3 terms: 2x, -3y, -5)*

Coefficient *(of variable terms)* IS THE NUMBER BEFORE THE VARIABLE

Constant term HAS NO VARIABLE TERM

Like terms ARE TERMS THAT HAVE THE SAME VARIABLES RAISED TO THE SAME EXPONENTS (i.e. $2x^2, -2x^2$)

SIMPLIFY Use the distributive property to combine like terms with variable parts.
Your expression is *simplified* if there are no grouping symbols and all like terms are combined.

ORDER OF EXPRESSIONS

- Variable terms go first and constant terms are last (i.e. 2X - 10)
- Variable terms are in ABC order (i.e. -2A + 3B -4C +5)
- Order Variable terms HIGH to LOW exponents (i.e. $2X^3 - X^2 + X - 10$)

EXAMPLE 9: ***Identify parts of an expression***

a) Identify the terms, like terms, coefficients, and constant terms of the expression: $x - 4 + 6x + 8 - x^2$

- Write the expression as a sum: $x + (-4) + 6x + 8 + (-x^2)$
- terms: $x, -4, 6x, 8, -x^2$
- like terms: x and $6x$; -4 and 8
- variable terms: $x, 6x, -x^2$
- coefficients: $1, 6, -1$
- constant terms: $-4, 8$

b) Simplify the expression $-x^2 + 7x + 4$

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2.6 Divide Real Numbers

Goal •. *Divide real numbers*

VOCABULARY

Multiplicative inverse means the same as RECIPROCAL.

Examples: For each, give the Multiplicative inverse:

(a) $\frac{2}{3} \rightarrow \frac{3}{2}$ (b) $-\frac{7}{8} \rightarrow -\frac{8}{7}$ (c) $\frac{1}{2} \rightarrow \frac{2}{1} = 2$

(d) $-5 \rightarrow \frac{1}{-5}$ (e) $0 \rightarrow \frac{1}{0}$ = UNDEFINED

ZERO HAS NO RECIPROCAL

DIVISION RULE

Words: To divide a number "a" by a nonzero number "b", multiply the number behind the division sign by the multiplicative inverse.

Algebra: $a \div b = a \cdot \frac{1}{b}$ $\quad b \neq 0$

Numbers: *Find the quotient.* $-40 \div \frac{2}{3} = \frac{-40}{1} \cdot \frac{3}{2} = \frac{-120}{2} = -60$

a) A fraction is a quotient. Are the following fractions equal?

$$\frac{-2}{3} \overset{?}{=} \frac{2}{-3} \overset{?}{=} -\frac{2}{3}$$ ← ARE ALL EQUAL

b) The quotient of 2 real numbers with the same sign is POSITIVE. [ex. $\frac{-50}{-10}$, $\frac{12}{3}$]

c) The quotient of 2 real numbers with different signs is NEGATIVE. [ex. $\frac{-6}{2}$, $\frac{6}{-2}$]

PROPERTIES - Inverse Property Of Multiplication

Words: The product of a nonzero number and its multiplicative inverse is **1.**

Algebra: Inverse Property Of Multiplication

$$a \cdot \frac{1}{a} = 1 \text{; where } a \neq 0$$

Why can't "0" be a mult. inverse? → $\frac{0}{1} \cdot \frac{1}{0}$ = UNDEFINED

Numbers: Identify the multiplicative inverse and justify your answer. MULT • MULT = 1

a) $\frac{2}{3} \cdot \frac{3}{2} = 1$ ✓ b) $-5 \cdot \frac{-1}{5} = 1$ ✓

Distributive Property for Division

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}, \quad \text{where } c \neq 0$$

EXAMPLE 10: ***Use distributive property to simplify an expression. Keep fractions as simplified improper fractions.***

a) $\frac{48y-8}{8} = \frac{48y}{8} + \frac{-8}{8} = 6y - 1$

b) $\frac{12x-8}{-4} = \frac{12x}{-4} + \frac{-8}{-4} = -3x + 2$

c) $\frac{3a+4}{2} = \frac{3a}{2} + \frac{4}{2}$

$\frac{3a}{2} + 2$

2.7 Find Square Roots Goal •. *Find square roots and compare real numbers.*

VOCABULARY

SQUARE ROOT OF A NUMBER

Words If $b^2 = a$, then **b** is a square root of **a**.

Numbers a) $5^2 = 25$, so 5 is a square root of 25.

a) $(-5)^2 = 25$, so −5 is a square root of 25.

> All positive real numbers have two square roots, a positive and a negative square root. The positive square root is called the ***principal* square root**.

EXAMPLE 11: *Evaluate the expressions.*

Evaluate	In words...
a) $\sqrt{100} = 10$	The positive square root of 100 is 10
b) $-\sqrt{16} = -4$	The negative square root of 16 is −4
c) $\pm\sqrt{64} = \pm 8$	The positive and negative square roots of 64 are −8 and 8. *Or can be written* ±8

Perfect squares

- Is $\sqrt{144}$ a Perfect Square? Explain. Yes $12 \cdot 12 = 144$ ✓
- Is $\sqrt{1.44}$ a Perfect Square? Explain. Yes $1.2 \cdot 1.2 = 1.44$ ✓
- Is $\sqrt{5}$ a Perfect Square? Explain. No $(2.24)(2.24) = 5.0176 \neq 5$
- List the Perfect Square from 1 to 144:

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, **144**