UNIT 4 NOTES: PROPERTIES & EXPRESSIONS

Vocabulary

Mathematics: (from Greek mathema, "knowledge, study, learning") Is the study of quantity, structure, space, and change.

Algebra: Is the branch of mathematics concerning the study of the rules of operations and relations, and the constructions and concepts arising from them.

Real Numbers: The set of all rational and irrational numbers

Rational Numbers: A number that can be written as a fraction.

Irrational Numbers: A number that cannot be written as the quotient of two integers. The decimal form of an irrational number neither terminates nor repeats.
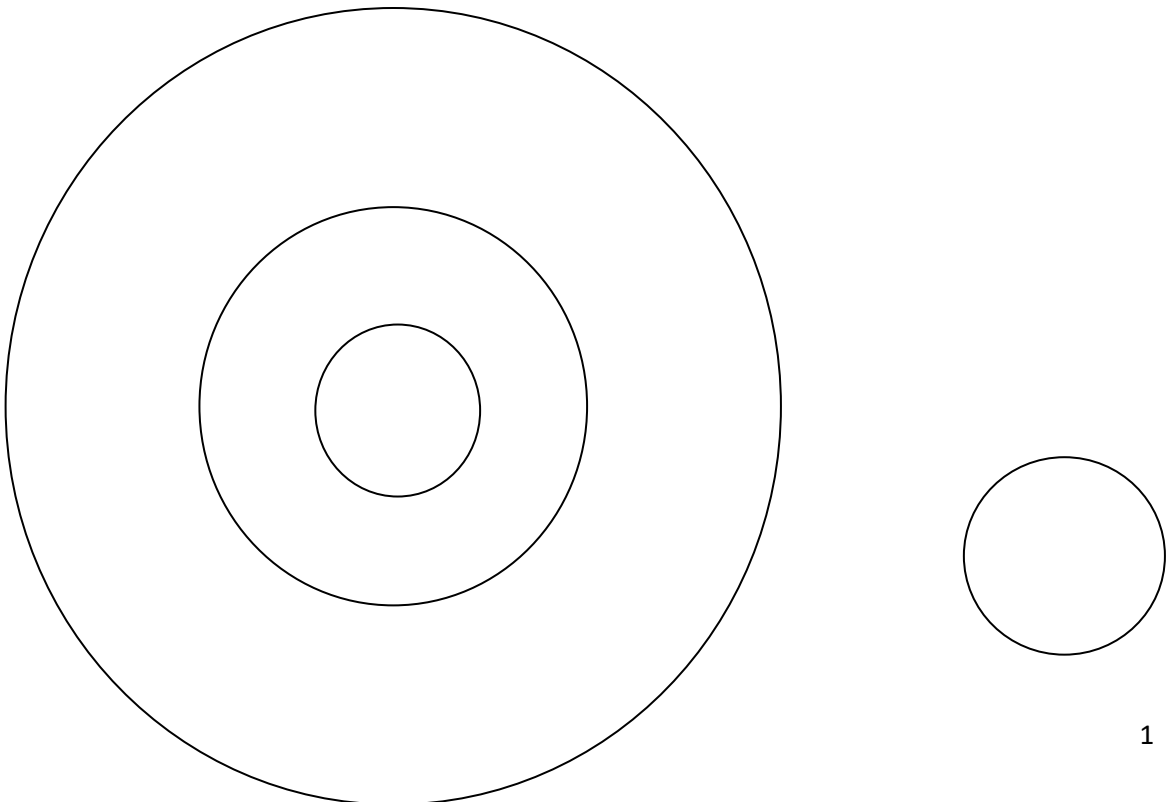
Composite Numbers: A whole number that is greater than 1 and has more than two whole number factors.

Prime Numbers: A whole number that is greater than 1 and has exactly two whole number factors, 1 and itself.

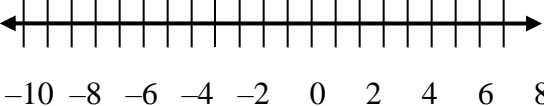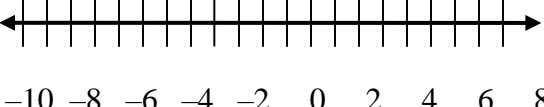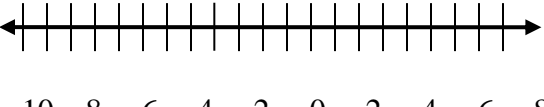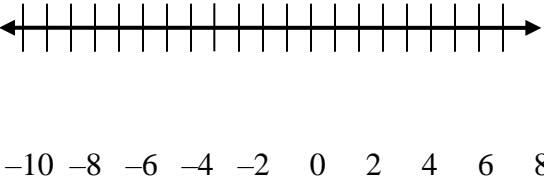Expression: A mathematical sentence with no equal (=) sign.

Equation: A mathematical sentence formed by placing the symbol = between two expressions.

Real Numbers

4-1 Exploring Real Numbers

Classifying Numbers

Natural Numbers (N)	$\{1, 2, 3, 4...\}$	
Whole Numbers (W)	$\{0, 1, 2, 3, 4...\}$	
Integers (Z or J)	$\{...-2, -1, 0, 1, 2...\}$	
Rational Numbers (Q)	$\left\{... -5, -\dfrac{5}{2}, -1.6, 0, \dfrac{1}{3}, 7.8, 10, ...\right\}$	
Irrational Numbers (I)	$\left\{..., \pi, \sqrt{20}, 0.23746, ...\right\}$	
Real Numbers $(\mathfrak{R})$	All Irrational & Rational Numbers	

Name the set(s) of numbers to which each belongs:

1. –9

2. 0.101101110…

3. $\sqrt{16}$

4. 0.33333

4-2 Using Variables

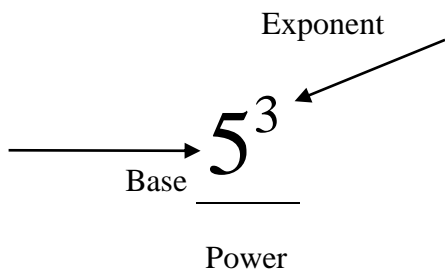|	
<u>Variable</u> – a symbol, usually a letter, that represents one or more numbers.	*Write an algebraic expression for each phrase.*
	1. The sum of *n* and 8
<u>Algebraic Expression</u> – a mathematical phrase that can include numbers, variables, and operation symbols	2. Six less than twice *b*
<u>Equation</u> – a mathematical sentence that uses an equal sign	3. Ten more than the quotient of *m* and 5
<u>Open Sentence</u> – an equation that contains one or more variables	4. Three times the sum of *g* and six
	Write a phrase for each expression.
	5. $7x - 3$
	6. $\frac{x}{2} + 10$

4-3 Exponents & Order of Operations Notes

Order of Operations	*Simplify.*
1. **P**arenthesis	
	1. $3(8+6) \div (4^2 - 10)$
2. **E**xponents (including fraction bar)	
Exponent 5^3 Base ___ Power	
	2. $27[5^2 \div (4^2 + 3^2) + 2]$
3. **M**ultiplication & **D**ivision	
4. **A**ddition & **S**ubtraction (left to right)	*Evaluate if $x = 2$ and $p = 3$* 3. $(xp)^2$
	4. xp^2
	5. $(p - x)^2$

4-4 Adding Real Numbers & Subtracting Real Numbers

<u>Adding & Subtracting Integers</u>	1. $3 + (-5)$
	2. $-6 - (-4)$
<u>Adding & Subtracting Decimals:</u> Line up the decimal points & fill in any zeros needed.	3. $-8.007 + -5.75$
<u>Adding & Subtracting Fractions</u>: Find a common denominator.	4. $\frac{3}{4} + (-1\frac{1}{4})$
	5. $-\frac{1}{3} - \frac{1}{2}$
	6. $5\frac{1}{2} + (-6\frac{3}{7})$

4-5 Multiplying and Dividing Real Numbers

<u>Rational Numbers</u>	1. $(-\frac{8}{9})(\frac{9}{16})$

<u>Multiplying</u>   <u>Dividing</u>

$+\cdot+=+$ $+\div+=+$

$+\cdot-=-$ $+\div-=-$

$-\cdot+=-$ $-\div+=-$

$-\cdot-=+$ $-\div-=+$

2. $(-1\frac{3}{4}) \div -12$

<u>Complex Fractions:</u>
A fraction with fractions in the numerator or denominator.

3. $\dfrac{-6}{\frac{3}{2}}$

Simplify by rewriting as a division sentence

Evaluate each expression if $x = -4$, $y = \frac{2}{3}$ and $z = -1\frac{1}{6}$

<u>Substitution:</u>

Replace an unknown with a given value.

4. $\dfrac{y}{z}$

5. $\dfrac{xz}{y}$

4-6 Combining Like Terms and The Distributive Property

Term – A number, variable or product of numbers and variables.

Constant – A term that has no variables (just a number).

Coefficient – The number next to the variable.

Like Terms – Terms with the same variable and power.

The Distributive Property -
$$a(b + c) = ab + ac$$

Combine Like Terms -
Add or Subtract like terms.

Combine like Terms

1. $13a^2 + 8a^2 + 6b$

2. $5 - 7x + 13 + x + w^2$

3. $a + \frac{1}{3} + \frac{4}{3}a + \frac{1}{2}$

Distribute and Combine like terms

4. $3(5 + 2h)$

5. $3(r + 2x) - 3r$

6. $-(4m - 8) + m + 2$

7. $\frac{2}{5}(5x + 10) + (3x - 8)$

4-7 Properties of Numbers

Property	Description	Example
Distributive Property	a(b + c) = ab + ac	
Additive Identity	Any number plus zero is that number.	
Multiplicative Identity	Any number times one is that number.	
Multiplicative Property of Zero	Any number times zero is zero.	
Additive Inverse	When you add two numbers to get zero.	
Multiplicative Inverse	Two numbers whose product is one. ** RECIPROCAL**	
Reflexive Property of Equality	Any quantity is equal to itself.	
Symmetric Property of Equality	Both sides of an equation are equal to each other.	
Transitive Property of Equality	If a = b and b = c, then a = c	
Substitution Property of Equality	A quantity may be substituted for something equal.	
Commutative Property of Addition	In addition, order does not matter.	

Commutative Property of Multiplication	In multiplication, order does not matter.	
Associative Property of Addition	The way you group numbers when adding does not change their sum.	
Associative Property of Multiplication	The way you group numbers when multiplying does not change their product.	

<u>Algebra Proofs</u>

Name the property used in each step:

1. $26 \cdot 1 - 6 + 5(12 \div 4 - 3) = 26 \cdot 1 - 6 + 5(3 - 3)$ _____

$$= 26 \cdot 1 - 6 + 5(0)$$ _____

$$= 26 - 6 + 5(0)$$ _____

$$= 26 - 6 + 0$$ _____

$$= 20 + 0$$ _____

$$= 20$$ _____

2. $3c + 5(2 + c) = 3c + 5(2) + 5c$ _____

$$= 3c + 5c + 5(2)$$ _____

$$= (3c + 5c) + 5(2)$$ _____

$$= (3 + 5)c + 5(2)$$ _____

$$= 8c + 10$$ _____