Name: Key Date: ______

Variables, Terms, and Expressions
Common Core Algebra II

Mathematics has developed a language all to itself in order to clarify concepts and remove ambiguity from the analysis of problems. To achieve this, though, we have to agree on basic definitions so that we can all speak this same language. So, we start our course in Algebra II with some basic review of concepts that you saw in Algebra I.

Some Basic Definitions

Variable: A quantity that is that is unknown, unspecified, or can change within the context of a problem. Most often variables are represented by a letter or symbol.

Terms: A single number or combination of numbers and variables using exclusively multiplication or division. This definition will expand when we introduce higher-level functions.

Expression: A combination of terms using addition and subtraction.

***Exercise* #1:** Consider the expression $2x^2+3x-7$.

(a) How many terms does this expression contain?

$\boxed{3}$; $2x^2$, $3x$, ~~&~~ -7

(b) Evaluate this expression, without your calculator, when $x=-3$. Show your calculations.

$2(-3)^2+3(-3)-7$

$\Rightarrow 2(9)-9-7$

$\Rightarrow 18-16$

$\Rightarrow \boxed{2}$

(c) What is the sum of this expression with the expression $5x^2-12x+2$?

$+\ 2x^2+3x-7$

$\boxed{7x^2-9x-5}$

Like Terms

Like Terms: Two or more terms that have the same variables raised to the same powers. In like terms, only the coefficients (the numbers multiplying the variables) can differ.

***Exercise* #2:** Most students learn that to add two like terms they simply add the coefficients and leave the variables and powers unchanged. But, why does this work? Below is an example of the technical steps to combine two like terms. What real number property justifies the first step?

$4x^2y+6x^2y=x^2y(4+6)$ ⟸ Justification?

$=x^2y(10)=10x^2y$

REAL NUMBER PROPERTIES

If a, b, and c are any real numbers then the following properties are always true:

1. The Commutative Properties of Addition and Multiplication:

$$a+b=b+a \text{ and } a\cdot b=b\cdot a$$

2. The Associative Properties of Addition and Multiplication:

$$(a+b)+c=a+(b+c) \text{ and } (a\cdot b)\cdot c=a\cdot(b\cdot c)$$

3. The Distributive Property of Multiplication and Division Over Addition and Subtraction:

$$c(a\pm b)=c\cdot a\pm c\cdot b \text{ and } \frac{a\pm b}{c}=\frac{a}{c}\pm\frac{b}{c}$$

***Exercise* #3:** The procedure for simplifying the linear expression $8(2x+3)+5(3x+1)$ is shown below. State the real number property that justifies each step.

$8(2x+3)+5(3x+1)=8\cdot 2x+8\cdot 3+5\cdot 3x+5\cdot 1$ Distributive

$=(8\cdot 2)x+24+(5\cdot 3)x+5=16x+24+15x+5$ Associative

$=16x+15x+24+5$ Commutative

$=x(16+15)+24+5$ Distributive

$=31x+(24+5)$ Associative

$=31x+29$

***Exercise* #4:** Because we used real number properties to transform the expression $8(2x+3)+5(3x+1)$ into a simpler form $31x+29$, these two expressions are **equivalent**. How can you test this equivalency? Show work for your test.

You could plug in any value for x & simplify each expression. If you get the same number for each expression, this proves they are equivalent.

For example, we will substitute 1.

$8(2(1)+3)+5(3(1)+1) \Rightarrow 8(5)+5(4) \Rightarrow 40+20=60$ ✓

$31(1)+29 \Rightarrow 31+29 \Rightarrow 60$ ✓