Name: ______________________ Date: ____________

INTRODUCTION TO EQUIVALENT EXPRESSIONS

The idea of **equivalent expressions**, or **equivalency**, is extremely important. It is the basis of many if not most of our **algebraic manipulations**. The definition of equivalent expressions is given below.

EQUIVALENT EXPRESSIONS

Two (or more) algebraic expressions are **equivalent** if they have the same value for every value of the substitution variable (or variables). In other words, no matter what value you stick in for x (or y or z) the two expressions come out equal.

***Exercise* #1:** Consider the three expressions below. By substituting in the values of x given, determine which two expressions are **equivalent**. Show your calculations of the expressions' values and circle your final answers.

	$\boxed{5(x-3)}$	$\boxed{5x-3}$	$\boxed{5x-15}$
$x=7$	$5(7-3)$ $5(4)=20$ ✓	$5(7)-3$ $35-3=32$	$5(7)-15$ ✓ $35-15=20$
$x=0$	$5(0-3)$ ✓ $5(-3)=-15$	$5(0)-3$ $0-3=-3$	$5(0)-15$ ✓ $0-15=-15$
$x=1$	$5(1-3)$ ✓ $5(-2)=-10$	$5(1)-3$ $5-3=2$	$5(1)-15$ ✓ $5-15=-10$

***Exercise* #2:** Which property, the commutative, associative, or distributive, justifies the **equivalency** of the two expressions you determined to be equivalent above?

$5(x-3)=5x-15$

Distributive Property

***Exercise* #3:** Which of the following expressions is equivalent to $5(2x+1)-4$? Show your work to justify your response. Test at least one value of x to check your answer.

(1) $10x-3$

(3) $10x+1$

(2) $7x-3$

(4) $7x+1$

$5(2x+1)-4$

$10x+5-4$

$10x+1$

***Exercise* #4:** Which of the following expressions is equivalent to $\frac{4(3x+1)-2}{2}-5$? Again, show your work by thinking carefully about order of operations and the properties we have learned about. Finally, check your answer by substituting a value of x. Show this check.

(1) $4x-3$ (3) $6x+3$

(2) $4x+1$ (4) $6x-4$

$$\frac{4(3x+1)-2}{2}-5$$

$$\frac{12x+4-2}{2}-5$$

$$\frac{12x+2}{2}-5 = 6x+1-5$$

$$\boxed{6x-4}$$

The last exercise is an example of an expression with a fair number of operations within it. Sometimes, it is just as important to recognize more simple equivalencies.

***Exercise* #5:** Which of the following expressions is equivalent to $\boxed{10x}+15$? Explain how you made your choice in the space provided.

(1) $2(8x+13)$ (3) $5(5x+3)$

(2) $5(2x+3)$ ~~(4)~~ $10(x+5)$

$10x+15$

The last problem is an example of what is known as **factoring.**

FACTORING EXPRESSIONS
Factoring is the process of writing an **equivalent expression** as purely the product of other expressions.

Factoring will be one of the most important skills that we want to reach **fluency** with, but for now we will do some fairly easy factoring by simply applying the **distributive property** in "reverse" if you will.

***Exercise* #6:** Factor each of the following expressions by writing an equivalent expression that is in the form of a product. Check your work by using the distributive property.

(a) $6x+21$ (b) $-2x+10$ (c) $14x+14$

$$\frac{12x+2}{2}$$

$6x+1$

$$\frac{12x+4-2}{2}$$

$6x+2-1$

$6x+1$

$$\frac{12x}{2}+\frac{4}{2}-\frac{2}{2}$$

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EQUIVALENT EXPRESSIONS
HOMEWORK

1. Use the Associative, Commutative and Distributive properties to write the expression given as an equivalent expression in simplest form.

(a) $2x + 8 + 3x - 3$

$\boxed{5x + 5}$

(b) $3x + (5x + 2x)$

(c) $(3x - 4) + (2x + 1)$

$3x - 4 + 2x + 1$

(d) $6(2 - 3x) + 1$

(e) $x + 4 - 2\left(\frac{1}{2}x + 3\right)$

$+4 - 6 = -2$

(f) $3(x + 2) - 2(x + 1)$

(g) $\dfrac{12x + 18}{6}$

(h) $\dfrac{2(5x + 3) - 4}{2} + 1$

(i) $\dfrac{\frac{1}{2}(4x + 8) - 8}{2}$