Name: _____ Period: _____ Date: _____

Properties of Real Numbers Guide Notes

PROPERTIES OF REAL NUMBERS

Let a, b, and c be any real numbers

1. **IDENTITY PROPERTIES**
   A. **Additive Identity**
   The sum of any number and 0 is equal to the number. Thus, 0 is called the **additive identity**.

   For any number a, the sum of a and 0 is a.

   B. **Multiplicative Identity**
   The product of any number and 1 is equal to the number. Thus, 1 is called the **multiplicative identity**.

   For any number a, the product of a and 1 is a.

2. **INVERSE PROPERTIES**
   A. **Additive Inverse**
   The sum of any number and its opposite number (its negation) is equal to 0. Thus, 0 is called the **additive inverse**.

   For any number a, the sum of a and $-a$ is 0.

   B. **Multiplicative Property of Zero**
   For any number a, the product of a and 0 is 0.

   C. **Multiplicative Inverse**
   The product of any number and its reciprocal is equal to 1. Thus, the number's reciprocal is called the **multiplicative inverse**.

   For any number a, the product of a and its reciprocal $\frac{1}{a}$ is 1.

   For any numbers $\frac{a}{b}$, where $b \neq 0$, the product of $\frac{a}{b}$ and its reciprocal $\frac{b}{a}$ is 1.

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Sample Problem 1: Name the property in each equation. Then find the value of x.

a. $24 \cdot x = 24$

b. $x + 0 = 51$

c. $x \cdot 6 = 1$

d. $x + 19 = 0$

e. $x \cdot 7 = 0$

f. $\frac{3}{5} \cdot x = 1$

3. EQUALITY PROPERTIES

A. **Reflexive**

Any quantity is equal to itself.

For any number a, $a = a$.

B. **Symmetric**

If one quantity equals a second quantity, then the second quantity equals the first quantity.

For any numbers a *and* b, *if* $a = b$ *then* $b = a$.

C. **Transitive**

If one quantity equals a second quantity and the second quantity equals a third quantity, then the first quantity equals the third quantity.

For any numbers a, b, *and* c, *if* $a = b$ *and* $b = c$, *then* $a = c$.

D. **Substitution**

A quantity may be substituted for its equal in any expression.

If $a = b$, *then* a *may be replaced by* b *in any expression.*

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Sample Problem 2: Evaluate $x(xy-5)+y\cdot\frac{1}{y}$, if $x=2$ and $y=3$. Name the property of equality used in each step.

4. COMMUTATIVE PROPERTIES

A. **Addition**

The order in which two numbers are added does not change their sum.

For any numbers a *and* b, $a+b$ *is equal to* $b+a$.

B. **Multiplication**

The order in which two numbers are multiplied does not change their product.

For any numbers a *and* b, $a\cdot b$ *is equal to* $b\cdot a$.

5. ASSOCIATIVE PROPERTIES

A. **Addition**

The way three or more numbers are grouped when adding does not change their sum.

For any numbers a, b, *and* c, $(a+b)+c$ *is equal to* $a+(b+c)$.

B. **Multiplication**

The way three or more numbers are grouped when multiplying does not change their product.

For any numbers a, b, *and* c, $(a\cdot b)\cdot c$ *is equal to* $a\cdot(b\cdot c)$.

Sample Problem 3: Simplify variable expressions. Show all possible answers.

a. $6+(x+3)$

b. $(1+x)+2$

c. $5\cdot 7x$

d. $(x+4)+8$

e. $(6)(3x)$