**PROPERTIES OF REAL NUMBERS**

Let, , and be any real numbers

1. **IDENTITY PROPERTIES**

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|  | **Additive Identity** |  |
|  | The sum of any number and is equal to the number. Thus, is called the **additive** **identity**. |
|  | *For any number , the sum of and is .* |  |
|  | **Multiplicative Identity** |  |
|  | The product of any number and is equal to the number. Thus, is called the **multiplicative identity**. |
|  | *For any number , the product of and is .* |  |

1. **INVERSE PROPERTIES**

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|  | **Additive Inverse** |  |
|  | The sum of any number and its opposite number (its negation) is equal to . Thus, is called the **additive** **inverse**. |
|  | *For any number , the sum of and is .* |  |
|  | **Multiplicative Property of Zero** |  |
|  | *For any number , the product of and is .* |  |
|  | **Multiplicative Inverse** |  |
|  | The product of any number andits reciprocal is equal to . Thus, the number’s reciprocal is called the **multiplicative inverse**. |  |
|  | *For any number , the product of and its reciprocal is .* |  |
|  | *For any numbers, where , the product of* *and its reciprocal**is .* |  |

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

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|  |  | **Multiplicative identity** |  |
|  |  | **Additive identity** |  |
|  |  | **Multiplicative inverse** |  |
|  |  | **Additive inverse** |  |
|  |  | **Multiplicative product of zero** |  |
|  |  | **Multiplicative inverse** |  |

1. **EQUALITY PROPERTIES**

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|  | **Reflexive** |  |
|  | Any quantity is equal to itself. |
|  | *For any number , .* |  |
|  | **Symmetric** |  |
|  | If one quantity equals a second quantity, then the second quantity equals the first quantity. |
|  | *For any numbers and , if then .* |  |
|  | **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 , , and , if and , then.* |  |
|  | **Substitution** |  |
|  | A quantity may be substituted for its equal in any expression. |
|  | *If , then may be replaced by in any expression.* |  |

**Sample Problem 2**: Evaluate, if and . Name the property of equality used in each step.

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|  |  |  | Substitution: and |
|  |  |  | Multiplicative inverse: |
|  |  |  | Substitution: |
|  |  |  | Substitution: |
|  |  |  | Multiplicative identity: |
|  |  |  | Substitution: |

1. **COMMUTATIVE PROPERTIES**

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|  | **Addition** |  |
|  | The order in which two numbers are added does not change their sum. |
|  | *For any numbers and , is equal to .* |  |
|  | **Multiplication** |  |
|  | The order in which two numbers are multiplied does not change their product. |
|  | *For any numbers and , is equal to .* |  |

1. **ASSOCIATIVE PROPERTIES**

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|  | **Addition** |  |
|  | The way three or more numbers are grouped when adding does not change their sum. |
|  | *For any numbers , , and , is equal to .* |  |
|  | **Multiplication** |  |
|  | The way three or more numbers are grouped when multiplying does not change their product. |
|  | *For any numbers , , and , is equal to .* |  |

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

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