

Relationships that are always true for real numbers are called *properties*, which are rules used to rewrite and compare expressions.

Two algebraic expressions are **<u>equivalent expressions</u>** if they have the same value for all values of the variable(s). The following properties show expressions that are equivalent for all real numbers

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Properties Properties of Real Num	bers		
Draw a line from each property in Column A to the equation that illustrates it in Column B.			
Column A	Column B		
6. Associative Property of Addition	15y + 0 = 15y		
7. Associative Property of Multiplication	$7b \cdot 2 = 2 \cdot 7b$		
8. Commutative Property of Addition	$(c\cdot 3)\cdot 5=c\cdot (3\cdot 5)$		
9. Commutative Property of Multiplication	6x + 5y = 5y + 6x		
10. Identity Property of Addition	$a \cdot 1 = a$		
11. Identity Property of Multiplication	(g + 11h) + 9h = g + (11h + 9h)		
12. Multiplication Property of -1	$7k \cdot 0 = 0$		
13. Zero Property of Multiplication	$15m \cdot (-1) = -15m$		

PROBLEM 1: IDENTIFYING PROPERTIES

What property is illustrated by each statement?a). $42^{-9} = 0$ b). (y + 25) + 28 = y + (25 + 28)c). 10x + 0 = 10x

d).
$$4x \cdot 1 = 4x$$
 e). $x + (\sqrt{y} + z) = x + (z + \sqrt{y})$

PROBLEM 2: USING PROPERTIES FOR MENTAL CALCULATIONS

a) A movie ticket costs \$7.75. A drink costs \$2.40. Popcorn costs \$1.25. What is the total cost for a ticket, a drink, and popcorn? Use mental math.

 b) The sign at the right shows the costs for a deep=sea fishing trip. How much will the total cost be for 1 adult, 2 children, and 1 senior citizen to go on a fishing trip? Use mental math.



PROBLEM 3: WRITING EQUIVALENT EXPRESSIONS

Simplify each expression.

a)	5(3 <i>n</i>)	b). $(4+7b)+8$	c). $\frac{62}{3}$	ку V
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d) 2.1(4.5x) e).
$$6 + (4h + 3)$$
 f). $\frac{8m}{12mn}$

In problem 3, reasoning and properties were used to show that two expressions are equivalent. This is an example of *deductive reasoning*. **Deductive reasoning** is the process of reasoning logically from given facts to a conclusion.

To show that a statement is NOT true, find an example for which it is not true. *An example showing that a statement is false is a <u>counterexample.</u> You need only one counterexample to prove that a statement is false.*

Give a counterexample that proves each statement is false.

- a) If you live near an ocean, you live near the Atlantic Ocean.
- b) If you live in North America, you live in the United States.
- c) If you live in Miami, you live in Florida.

PROBLEM 4: USING DEDUCTIVE REASONING AND COUNTEREXAMPLES

Is the statement true or false? If it is false, give a counterexample.

a) For all real numbers a and b, $a \cdot b = b + a$

b) For all real numbers a, b, and c, (a + b) + c = b + (a + c)

c) For all real numbers j and k, $j \cdot k = (k + 0) \cdot j$

d) For all real numbers m and n, m(n + 1) = mn + 1

e) Is the statement in part a) false for every pair of real numbers a and b? Explain.

Lesson Check • Do you UNDERSTAND? Justify each step to show that $3 \cdot (10 \cdot 12) = 360$. 29. The left side of the expression is simplified below. Write a reason for each step. $3 \cdot (10 \cdot 12) = 3 \cdot (12 \cdot 10)$ $= (3 \cdot 12) \cdot 10$ $= 36 \cdot 10$ = 360

Math Success				
Check off the vocabulary words that you understand.				
Commutative Properties	ciative Properties Identity Properties			
equivalent expressions	deductive reasoning 📃 counterexample			
Rate how well you can use the properties of addition and multiplication.				
Need to review 0 2 4 6 8	10 Now I get it!			