Properties of Real Numbers

Property Name	Property form	Example
If a and b are real numbers, then …		
Commutative property of Addition - The order of two numbers around the addition sign does not affect the sum.	$a+b=b+a$	$5+4=4+5$
Commutative property of Multiplication - The order of two numbers around the multiplication sign does not affect the product.	$a\cdot b=b\cdot a$	$5\cdot 4=4\cdot 5$

If a, b, and c are real numbers, then …		
Associative property of Addition - The way in which several whole numbers are grouped when they are added, does not affect the final sum.	$(a+b)+c=a+(b+c)$	$(3+4)+5=3+(4+5)$
Associative property of Multiplication - The way in which several whole numbers are grouped when they are multiplied, does not affect the final product.	$(ab)c=a(bc)$	$(3\cdot 4)\cdot 5=3\cdot(4\cdot 5)$

If a is a real number, then …		
Identity property of Addition - When 0 is added to any number, the sum is 'identical' to the original number. 0 is the identity element for addition; it is also called the additive identity.	$a+0=0+a=a$	$4+0=0+4=4$
Identity property of Multiplication - When any number is multiplied by 1, the product is 'identical' to the original number. 1 is the identity element for multiplication; it is also called the multiplicative identity.	$a\cdot 1=1\cdot a=a$	$3\cdot 1=1\cdot 3=3$

If a and b are real numbers, then …		
Inverse property of Addition - The sum of a number and its additive inverse is zero (the identity element for addition). The additive inverse of a is $-a$. The additive inverse of $-a$ is a.	$a+(-a)=-a+a=0$	$5+(-5)=-5+5=0$
Inverse property of Multiplication - Multiplying a number and its reciprocal (its multiplicative inverse) gives 1 (the identity element for multiplication). The reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$.	$b\cdot\frac{1}{b}=\frac{1}{b}\cdot b=1$ when $b\neq 0$	$3\cdot\frac{1}{3}=\frac{1}{3}\cdot 3=1$

If a, b, and c are real numbers, then …		
Distributive property of Multiplication over Addition - To distribute a factor over a sum of two numbers within parentheses, multiply the factor by each number inside the parentheses then add the products. - The Distributive property also works over Subtraction.	$a(b+c)=ab+ac$ $a(b-c)=ab-ac$ $(b+c)a=ba+ca$ $(b-c)a=ba-ca$	$7(5+3)=7\cdot 5+7\cdot 3$ $7(5-3)=7\cdot 5-7\cdot 3$ $(7+2)3=7\cdot 3+2\cdot 3$ $(7-2)3=7\cdot 3-2\cdot 3$

TRY: What is the identity element for addition?
What is the identity element for multiplication?

What is the additive inverse of -5? What is the reciprocal of $\frac{3}{5}$?

Sometimes one must use the distributive property before combining like terms.

$3(x^2+8)-2(x^2-5)$ Use the Distributive Property

$3x^2+24-2x^2+10$ Did you distribute the – with the -5 to get +10?
This is one of the most COMMON ERRORS! Be very careful.

x^2+34 Like terms combined.

TRY: Combine like terms in the following:

$-4(x+3y)+5(2x-y)$ $-4(x-3y)-5(-2x-y)$