Properties of Real Numbers

Property	**Rule**	**Example**
Commutative Property of Addition	$a+b=b+a$	$2+3=3+2$
Commutative Property of Multiplication	$a\cdot b=b\cdot a$	$2\cdot 3=3\cdot 2$
Associative Property of Addition	$(a+b)+c=a+(b+c)$	$2+(3+4)=(2+3)+4$
Associative Property of Multiplication	$(a\cdot b)\cdot c=a\cdot(b\cdot c)$	$2\cdot(3\cdot 4)=(2\cdot 3)\cdot 4$
Distributive Property	$a(b+c)=ab+ac$	$2(3+4)=2\cdot 3+2\cdot 4$
Additive Identity Property	$a+0=a$	$3+0=3$
Multiplicative Identity Property	$a\cdot 1=a$	$3\cdot 1=3$
Additive Inverse Property	$a+(-a)=0$	$3+(-3)=0$
Multiplicative Inverse Property	$a\cdot\left(\frac{1}{a}\right)=1,\quad a\neq 0$	$3\cdot\left(\frac{1}{3}\right)=1$

Identify the property of real numbers that is illustrated by each statement.

1. $3\frac{1}{2}+7=7+3\frac{1}{2}$ ____

2. $\frac{2}{3}\cdot\frac{3}{2}=1$ ____

3. $\left(17\cdot\frac{1}{2}\right)\cdot 4=17\cdot\left(\frac{1}{2}\cdot 4\right)$ ____

4. $-40+0=-40$ ____

5. $3\pi+(-3\pi)=0$ ____

A **binary operation**, such as addition or subtraction, works on exactly two elements of a set at a time. The elements may be the same.

If the outcome of the binary operation is always a member of the original set, then the set is said to be **closed** under the operation. (If an element outside the set is produced, then the operation is *not closed*.)

Under which of the four basic arithmetic operations (addition, subtraction, multiplication, and division) is each of the following sets closed?

1. the integers ______________________________
2. $\{0, \frac{1}{2}, 1, 2\}$ ______________________________
3. $\{1, 3, 5, 7, ...\}$ ______________________________
4. $\{-1, 0, 1\}$ ______________________________
5. $\{1\}$ ______________________________
6. $\{\text{all rational numbers except } 0\}$ ______________________________
7. $\{0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}, ...\}$ ______________________________