Properties of Real Numbers

ALGEBRA 2

Property	Definition	Addition	Multiplication
Commutative	Changing the order of the number will not change the result.	$a + b = b + a$ Ex: $2 + 3 = 3 + 2 = 5$	$a * b = b * a$ Ex: $2 * 3 = 3 * 2 = 6$
Associative	Changing the grouping of the numbers will not change the result.	$a + (b + c) = (a + b) + c$ Ex: $1 + (2 + 3) = (1 + 2) + 3 = 6$	$a * (b * c) = (a * b) * c$ Ex: $1 * (2 * 3) = (1 * 2) * 3 = 6$
Identity	**Zero** and **one** preserves identities under addition or multiplication respectively.	$a + 0 = 0 + a = a$ Ex: $2 + 0 = 0 + 2 = 2$	$1 * a = a * 1 = a$ Ex: $1 * 2 = 2 * 1 = 2$
Inverse	For each real number a, there exist a unique number - a and 1/a for additive or multiplicative inverse.	$a + (- a) = 0$ Ex: $2 + (- 2) = 0$	$a * 1/a = 1$ Ex: $2 * ½ = 1$
Distributive	Multiplication distributes over addition. $a(b + c) = ab + ac$	—	—

Operations on Positive and Negative Numbers

Addition

Positive + Positive = Positive

Negative + Negative = Negative

* Positive + Negative or Negative + Positive
  - subtract the smaller number from the larger number, then use the sign of the larger number in the answer

$5 + 3 = 8$

$(-5) + (-3) = -8$

$(-5) + 3 = -2$

$3 + (-5) = -2$

$(-3) + 5 = 2$

$5 + (-3) = 2$

Subtraction

Negative - Positive = Negative

Positive - Negative = Positive

* Negative - Negative = Negative + Positive
  - treat as Negative + Positive
  - subtract the smaller number from the larger number, then use the sign of the larger number in the answer

$(-5) - 3 = (-5) + (-3) = -8$

$5 - (-3) = 5 + 3 = 8$

$(-5) - (-3) = (-5) + 3 = -2$

$(-3) - (-5) = (-3) + 5 = 2$

ADDITION (+)

$2 + 3 = 5$

$(-2) + (-3) = (-5)$

$(-2) + 3 = 1$

SUBTRACTION (-)

$(-2) - 3 = (-5)$

$2 - (-3) = 5$

$(-2) - (-3) = (-2) + 3 = 1$

Operations on Positive and Negative Numbers

Multiplication

Positive x Positive = Positive	5 x 3 = 15
Negative x Negative = Positive	(- 3) x (- 5) = 15
Negative x Positive = Negative	(- 3) x 5 = - 15
Positive x Negative = Negative	3 x (- 5) = - 15

- change double negatives to a positive

Division

Positive ÷ Positive = Positive	15 ÷ 3 = 5
Negative ÷ Negative = Positive	(- 15) ÷ (- 3) = 5
Negative ÷ Positive = Negative	(- 15) ÷ 3 = - 5
Positive ÷ Negative = Negative	15 ÷ (- 3) = - 5

- change double negatives to a positive

MULTIPLICATION (X)	DIVISION (÷)
2 x 3 = 6	6 ÷ 3 = 2
(- 2) x (-3) = 6	(- 6) ÷ (-3) = 2
(- 2) x 3 = (- 6)	(- 6) ÷ 3 = (- 2)
2 x (- 3) = (- 6)	6 ÷ (-3) = (- 2)

ADDITION

Same Sign
1. Add the numbers.
2. Copy the sign.

Different Signs
1. Subtract the numbers.
2. Copy the sign of the larger number.

SUBTRACTION

1. Change the sign of the subtrahend.
2. Use the addition rule for integers.

MULTIPLICATION

Same Sign
- Product is positive

Different Signs
- Product is negative

DIVISION

Same Sign
- Quotient is positive

Different Signs
- Quotient is negative

The Order of Operations