

Name: _____

Date: _____

Notes: Properties of Real Numbers

Do Now: Solve the following equation for x .

$$6 + 5(7 + 2x) = 8x - 13$$

Match the properties on the left with their corresponding math on the right.

_____ Commutative Property of Addition

A) $a \cdot 0 = 0$

_____ Associative Property of Addition

B) $a + (b + c) = (a + b) + c$

_____ Commutative Property of Multiplication

C) $a(b + c) = ab + ac$

_____ Associative Property of Multiplication

D) $a + b = b + a$

_____ Distributive Property

E) $a \cdot 1 = a$

_____ Identity Property of Addition

F) $a + 0 = a$

_____ Identity Property of Multiplication

G) $(ab)c = a(bc)$

_____ Zero Property of Multiplication

H) $ab = ba$

What Should I Be Able to Do?

- I can explain the commutative property and give one addition and one multiplication example.
- I can explain the associative property and give one addition and one multiplication example.
- I can explain the distributive property and give an example.
- I can explain the identity property and give one addition and one multiplication example.
- I can explain the inverse property and give one addition and one multiplication example.
- I can explain the zero property and give an example.
- I can explain the addition property of equality and give an example.
- I can explain the subtraction property of equality and give an example.
- I can explain the multiplication property of equality and give an example.
- I can explain the division property of equality and give an example.

Properties of Real Numbers

1) **Commutative:** Numbers can be added or multiplied in any order.

+

×

2) **Associative:** Add or multiply regardless of how the numbers are grouped.

+

×

3) **Identity:** When you add/multiply to obtain the same number.

+

×

4) **Inverse:** When you add/multiply to obtain the identity.

+

×

- 5) **Distributive:** Multiply a sum or difference by multiplying each addend separately and then add the products.
- 6) **Zero Property:** Any value multiplied by 0 has a product of 0.
- 7) **Addition Property of Equality:** Add the same quantity to both sides of the equation.
- 8) **Subtraction Property of Equality:** Subtract the same quantity to both sides of the equation.
- 9) **Multiplication Property of Equality:** Multiply the same quantity to both sides of the equation.
- 10) **Division Property of Equality:** Divide the same quantity to both sides of the equation.

Checkpoint:

1 When solving the equation $5(x - 6) + 5 = 9$, Mary wrote $5(x - 6) = 4$ as her first step. Which property justifies Mary's first step?

- (1) subtraction property of equality
- (2) distributive property of multiplication over subtraction
- (3) associative property
- (4) multiplication property of equality

2 A part of Bianca's work to solve the equation $3(7x^2 - 10) = 15x^2 - 8x$ is shown below

$$\text{Given: } 3(7x^2 - 10) = 15x^2 - 8x$$

$$\text{Step 1: } 21x^2 - 30 = 15x^2 - 8x$$

What property did Bianca use to obtain step 1?

- (1) addition property of equality
- (2) distributive property of multiplication over subtraction
- (3) associative property
- (4) multiplication property of equality

3 Given $\blacksquare \neq 0$, the equation where $\nabla(\blacksquare) = \blacksquare$ is an example of the

- (1) associative property
- (2) inverse property
- (3) identity property
- (4) zero property

4 When solving for the value of x in the equation $-5(3x - 9) + 5 = 65$, Guillermo wrote the following lines on his paper.

$$\text{[line 1] } \quad -5(3x - 9) + 5 = 65$$

$$\text{[line 2] } \quad -5(3x - 9) = 60$$

$$\text{[line 3] } \quad -15x - 45 = 60$$

$$\text{[line 4] } \quad -15x = 105$$

$$\text{[line 5] } \quad x = -7$$

Between which two lines did Guillermo make a mistake using a property, which resulted in the incorrect answer?

- (1) line 1 – line 2
- (2) line 2 – line 3
- (3) line 3 – line 4
- (4) line 4 – line 5

Success Criteria

- I can explain the commutative property and give one addition and one multiplication example.

- I can explain the associative property and give one addition and one multiplication example.

- I can explain the distributive property and give an example.

- I can explain the identity property and give one addition and one multiplication example.

- I can explain the inverse property and give one addition and one multiplication example.

- I can explain the zero property and give an example.

- I can explain the addition property of equality and give an example.

- I can explain the subtraction property of equality and give an example.

- I can explain the multiplication property of equality and give an example.

- I can explain the division property of equality and give an example.

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Classwork: Properties of Real Numbers

1 State whether each statement is *true* or *false*. If *true*, state the property of real numbers that proves the statement true. If *false*, give a counterexample.

a For all real numbers x , $x(1) = x$.

b For all real numbers a , b , and c , $(ab)c = a(bc)$.

c For all real numbers g and h , $-2(g - h) = -2g - 2h$.

2 Which equation illustrates the additive inverse property?

(1) $\Omega \left(\frac{1}{\Omega}\right) = 1$

(2) $\Omega + (-\Omega) = 0$

(3) $\Omega + \Omega = 2\Omega$

(4) $\Omega(\Omega) = \Omega^2$

3 The equation $\vartheta(\blacksquare + \blacktriangle) = \vartheta\blacksquare + \vartheta\blacktriangle$ is an example of the

(1) associative property

(2) commutative property

(3) distributive property

(4) identify property of multiplication

4 Juliane is solving the equation $2(3x - 9) = -6$ is shown below. Identify the property used to obtain each of the steps.

$$2(3x - 9) = -6$$

$$6x - 18 = -6$$

$$6x = 12$$

$$x = 2$$

5 When solving the equation $(5 + 7) + 10 = x$, Ben rewrote the equation $5 + (7 + 10) = x$ as his first step. Which property justifies Ben's first step?

- (1) addition property of equality
- (2) distributive property of multiplication over addition
- (3) associative property
- (4) commutative property

6 A part of Hank's work to solve the equation $5(2x^2 - 10x) = 35x^2 - 25$ is shown below

Given: $5(2x^2 - 10x) = 35x^2 - 25$

Step 1: $2x^2 - 10x = 7x^2 - 5$

What property did Hank use to obtain step 1?

- (1) division property of equality
- (2) distributive property of multiplication over subtraction
- (3) associative property
- (4) subtraction property of equality

7 When solving for the value of x in the equation $-6(x - 5) + 2(4x + 3) = 12$, Layla wrote the following lines on his paper.

[line 1] $-6x + 30 + 8x + 6 = 12$

[line 2] $2x + 36 = 12$

[line 3] $2x = 48$

[line 4] $x = 24$

Which property did Layla perform incorrectly, which resulted in the incorrect answer?

- (1) line 1 – line 2
- (2) line 2 – line 3
- (3) line 3 – line 4
- (4) Laya did not make a mistake.

8 Write an equation that displays the commutative property.

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Homework: Properties of Real Numbers

1 Janita simplified an equation to $-b + b = 0$. Which property of real numbers is shown by this equation?

- (1) additive identity property
- (2) multiplicative identity property
- (3) additive inverse property
- (4) multiplicative inverse property

2 Given the following equations:

I. $a + b = b + a$

II. $a + (b + c) = (a + b) + c$

III. $5a(8a^2) = 8a^2(5a)$

IV. $ab = ba$

Which equation(s) represent the commutative property?

- (1) I and IV, only
- (2) II, only
- (3) I, II, III, and IV
- (4) I, III, and IV

3 Brittany is solving the equation $(7 - 4x)2 = -34$ is shown below. Identify the property used to obtain each of the steps.

$(7 - 4x)2 = -34$

$2(7 - 4x) = -34$

$14 - 8x = -34$

$-8x = -48$

$x = 6$

4 When solving the equation $7(2x^2 - 4) - 11 = 5x^2 - 2$, Emilia rewrote the equation $7(2x^2 - 4) = 5x^2 + 9$ as her first step. Which property justifies Emilia's first step?

- (1) distributive property of multiplication over subtraction
- (2) addition property of equality
- (3) associative property
- (4) division property of equality

5 State whether each statement is *true* or *false*. If *true*, state the property of real numbers that proves the statement true. If *false*, give a counterexample.

a For all real numbers x and y , $x(y) = y + x$.

b For all real numbers a , $a + 0 = a$.

c For all real numbers x , y , and z , $x(y + z) = xy + xz$.

6 The equation $\square\square = \square\square$ is an example of the

- (1) associative property
- (2) commutative property
- (3) distributive property
- (4) identity property of multiplication

7 Which equation correctly illustrates the distributive property?

- (1) $w(x) = x(w)$
- (2) $-w(x - y) = -wx - wy$
- (3) $w(x + y) = wx - wy$
- (4) $-w(-x - y) = wx + wy$