1-9 Properties of Real Numbers

Name _____ Date _____

Simplify: $4x + 7(x - 9) - 11$

$4x + 7[x + (-9)] + (-11)$ ← Definition of Subtraction

$4x + (7)(x) + (7)(-9) + (-11)$ ← Use the Distributive Property.

$4x + 7x + (-63) + (-11)$ ← Multiply.

$(4x + 7x) + [(-63) + (-11)]$ ← Use the Associative Property to group like terms.

$(4 + 7)x + (-74)$ ← Use the Distributive Property to combine like terms.

$11x + (-74)$ ← Add the coefficients of like terms.

$11x - 74$ ← Definition of Subtraction

Commutative Property
$a + b = b + a$ $a \bullet b = b \bullet a$

Associative Property
$(a + b) + c = a + (b + c)$
$(a \bullet b) \bullet c = a \bullet (b \bullet c)$

Distributive Property of Multiplication over Addition $a \bullet (b + c) = a \bullet b + a \bullet c$

Additive Identity Property $a + 0 = a$

Multiplicative Identity Property $a \bullet 1 = a$

Additive Inverse Property $a + (-a) = 0$

Multiplicative Inverse Property $a \bullet \frac{1}{a} = 1$

Substitute a number for *n* to make each statement true. Identify the property or definition that is illustrated.

1. $(-4 \bullet n) \bullet 13 = -4 \bullet (19 \bullet 13)$

19; Associative Property

2. $22 + n = 22$

_____

3. $n \bullet 1 = 9$

_____

4. $n \bullet (5 + 7) = 8 \bullet 5 + 8 \bullet 7$

_____

5. $2 + (n) = 0$

_____

6. $3 \bullet \frac{1}{3} = n$

_____

Write a justification for each step of the given simplification process.

7. $3x + 8y + 11x + 4y$

a. $3x + 11x + 8y + 4y$ **Commutative Prop.**

b. $(3 + 11)x + (8 + 4)y$ **Distributive Prop.**

c. $14x + 12y$ **Combine like terms.**

8. $2x + 9y + 15x + 7y$

a. $2x + 15x + 9y + 7y$ _____

b. $(2 + 15)x + (9 + 7)y$ _____

c. $17x + 16y$ _____

9. $4x - 8y + 9x - 7y$

a. $4x + (-8y) + 9x + (-7y)$ _____

b. $4x + 9x + (-8y) + (-7y)$ _____

c. $(4 + 9)x + [-8 + (-7)]y$ _____

d. $13x + (-15)y$ _____

e. $13x - 15y$ _____

10. $2x + 3y + 5y - 6x$

a. $2x + 3y + 5y + (-6x)$ _____

b. $2x + 3y + (-6x) + 5y$ _____

c. $2x + (-6x) + 3y + 5y$ _____

d. $[2 + (-6)]x + (3 + 5)y$ _____

e. $-4x + 8y$ _____

Simplify each expression. Write a justification for each step.

11. $11t - 4(2t - 9)$

$11t + (-4)[2t + (-9)]$; Def. of Subtraction
$11t + (-4)(2t) + (-4)(-9)$; Distributive Prop.
$11t + (-8)t + 36$; Multiply.
$[11t + (-8)t] + 36$; Associative Prop.
$[11 + (-8)]t + 36$; Distributive Prop.
$3t + 36$; Add coefficients.

12. $20d - 6(3d - 2)$

13. $15a + 3(4 + 5a)$

14. $13b + 4(5 + 7b)$

15. $x - (1 - 3x)$

16. $2v - (3 - 4v)$

17. $4[3c + 9 - 4c] + 8$

18. $5[2d + 3 - 4d] + 2$

Problem Solving

19. Is there a Commutative Property for subtraction or division? Give an example for each. Then find an exception for each.

20. A new operation ♣ is defined as $a \clubsuit b = a + b + ab$. For example, $3 \clubsuit 2 = 3 + 2 + 3(2) = 5 + 6 = 11$. Is the operation ♣ commutative? Give an example.

WRITE ABOUT IT

21. Use examples to explain why the Associative Property does not work for subtraction and division. Give the exceptions.