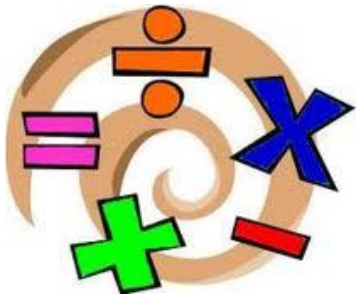
THE DISTRIBUTIVE PROPERTY AND EQUATIONS

❑ *INTRODUCTION*



You should now have all the tools you need to solve linear equations containing parentheses. These tools are as follows:

- *The Distributive Property*: $3(x + 7) = \mathbf{3x + 21}$
- *Combining Like Terms*: $4w + 7 - 3w - 13 = \mathbf{w - 6}$
- *Solving Equations*:

$$3n - 7 = n + 23$$
$$\Rightarrow \quad 3n - n = 23 + 7$$
$$\Rightarrow \quad 2n = 30$$
$$\Rightarrow \quad \mathbf{n = 15}$$

❑ *EXAMPLES*

EXAMPLE 1: **Solve for n: $8(n - 1) = -(3n + 7)$**

Solution: The variable n is locked up inside the parentheses, but the distributive property comes to our rescue:

	$8(n - 1) = -(3n + 7)$	(the original equation)
$\Rightarrow$	$8n - 8 = -3n - 7$	(distribute)
$\Rightarrow$	$8n + \mathbf{3n} - 8 = -3n + \mathbf{3n} - 7$	(add $3n$ to each side)
$\Rightarrow$	$11n - 8 = -7$	(simplify)
$\Rightarrow$	$11n - 8 + \mathbf{8} = -7 + \mathbf{8}$	(add 8 to each side)

$\Rightarrow \quad 11n = 1$ (simplify)

$\Rightarrow \quad \boxed{n = \frac{1}{11}}$ (divide each side by 11)

Homework

1. Solve each equation:

a. $2(2y - 3) = -8(2y - 9)$

b. $-6(-7b - 3) = -2(3b - 8)$

c. $-4(-2d + 9) = -5(2d - 9)$

d. $-4(-8j + 3) = 7(7j + 6)$

e. $3(3y - 5) = -(-y + 5)$

f. $-7(4t + 5) = -9(-5t + 3)$

g. $3(-2x + 8) = -3(-3x + 7)$

h. $7(2n + 3) = -6(3n + 7)$

EXAMPLE 2: **The Ultimate Challenge — Solve for x:**

$2(3x - 7) - 5(1 - 3x) = -(-4x + 1) + (x + 7)$

Solution: The steps are

1) Distribute
2) Combine like terms
3) Solve the simplified equation

$2(3x - 7) - 5(1 - 3x) = -(-4x + 1) + (x + 7)$

$\Rightarrow \quad 6x - 14 - 5 + 15x = 4x - 1 + x + 7$ (distribute)

$\Rightarrow \quad 21x - 19 = 5x + 6$ (combine like terms)

$\Rightarrow \quad 21x \mathbf{- 5x} - 19 = 5x \mathbf{- 5x} + 6$ (subtract $5x$ from each side)

$\Rightarrow \quad 16x - 19 = 6$ (simplify)

$\Rightarrow \quad 16x - 19 \mathbf{+ 19} = 6 \mathbf{+ 19}$ (add 19 to each side)

$\Rightarrow \quad 16x = 25$ (simplify)

$\Rightarrow \quad \frac{16x}{\mathbf{16}} = \frac{25}{\mathbf{16}}$ (divide each side by 16)

$\Rightarrow \quad \boxed{x = \frac{25}{16}}$ (simplify)

Homework

2. Solve each equation:

a. $-6(7u - 7) + 8(1 - 7u) = 4(4u + 2) + 5(8 - 9u)$

b. $7(-b - 9) - 2(-8 + 7b) = 8(-5b + 5) + 3(-5b + 3)$

c. $-6(4n + 5) - 10(-10 + 9n) = 7(-n) - (-7n + 4)$

d. $-10(-3g) + 3(2g) = (-8g - 5) + 8(-g + 5)$

e. $9(4 - k) - 8(-9k + 1) = 3(6 + k) - 3(8 - 5k)$

f. $8(5w - 1) - 6(-w - 5) = 5(8 - 4w) + 6(9 + 8w)$

Now CHECK your solution.

g. $-2(-4 - 2y) - 3(-9 + 8y) = 10(-3y - 8) - 2(-7 + 6y)$

h. $-4(a - 6) + (-5a - 3) = 6(2a + 1) - (5a + 4)$

Solutions

1. a. $y = \frac{39}{10}$ b. $b = -\frac{1}{24}$ c. $d = \frac{9}{2}$ d. $j = -\frac{54}{17}$

e. $y = \frac{5}{4}$ f. $t = -\frac{8}{73}$ g. $x = 3$ h. $n = -\frac{63}{32}$

2. a. $u = \frac{2}{69}$ b. $b = \frac{48}{17}$ c. $n = \frac{37}{57}$ d. $g = \frac{35}{52}$

e. $k = -\frac{34}{45}$

f. $w = 4$

Check:

Place $w = 4$ into the original equation, and then work the arithmetic on each side of the equation:

$8(5w - 1) - 6(-w - 5)$	$5(8 - 4w) + 6(9 + 8w)$
$8(5(4) - 1) - 6(-4 - 5)$	$5(8 - 4(4)) + 6(9 + 8(4))$
$8(20 - 1) - 6(-9)$	$5(8 - 16) + 6(9 + 32)$
$8(19) + 54$	$5(-8) + 6(41)$
$152 + 54$	$-40 + 246$
206	**206** ✓

g. $y = -\frac{101}{22}$ h. $a = \frac{19}{16}$

"*Opportunity* is missed by most people because it is dressed in overalls and looks like work."

– **Thomas Edison**