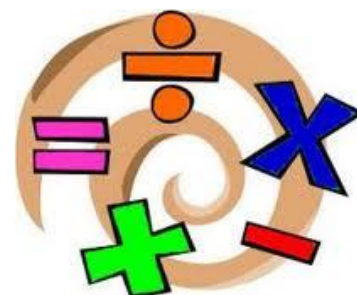

THE DISTRIBUTIVE PROPERTY AND EQUATIONS

□ INTRODUCTION

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



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

$$3n - 7 = n + 23$$

$$\Rightarrow 3n - n = 23 + 7$$

$$\Rightarrow 2n = 30$$

$$\Rightarrow n = 15$$

□ 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:

$$\begin{array}{ll}
 8(n - 1) = -(3n + 7) & \text{(the original equation)} \\
 \Rightarrow 8n - 8 = -3n - 7 & \text{(distribute)} \\
 \Rightarrow 8n + 3n - 8 = -3n + 3n - 7 & \text{(add } 3n \text{ to each side)} \\
 \Rightarrow 11n - 8 = -7 & \text{(simplify)} \\
 \Rightarrow 11n - 8 + 8 = -7 + 8 & \text{(add 8 to each side)}
 \end{array}$$

$$\Rightarrow 11n = 1$$

(simplify)

$$\Rightarrow \boxed{n = \frac{1}{11}}$$

(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

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

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

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

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

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

$$\begin{aligned} \Rightarrow 16x - 19 + 19 &= 6 + 19 && \text{(add 19 to each side)} \\ \Rightarrow 16x &= 25 && \text{(simplify)} \\ \Rightarrow \frac{16x}{16} &= \frac{25}{16} && \text{(divide each side by 16)} \\ \Rightarrow \boxed{x = \frac{25}{16}} &&& \text{(simplify)} \end{aligned}$$

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

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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**