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# USING THE DISTRIBUTIVE PROPERTY TO SOLVE EQUATIONS

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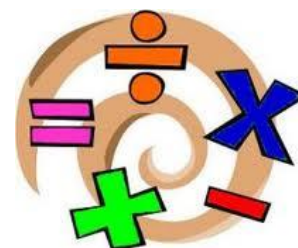
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## □ INTRODUCTION

Now we have all the tools we 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:*      $3n + 7 = 22 \Rightarrow 3n = 15 \Rightarrow n = 5$



## □ EXAMPLES

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

**Solution:**     The distributive law comes to our rescue:

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

## 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

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

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

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

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

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

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

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

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

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

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## Homework

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

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

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

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## 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.  $w = 4$       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**