

Solving Equations Containing Parentheses

I. Goal: To first remove the parentheses using the distributive property and then solve the remaining equation by isolating the variable.

\*\*To distribute means to multiply

Examples: Simplify the following

1)  $7(x-4)$   
 $7x-28$

2)  $-2(n-6)$   
 $-2n+12$

3)  $-(4x-2)$   
 $-1 \cdot (4x-2)$   
 $-4x+2$

II Steps:

① 1) Distribute (multiply) the # and sign in front of the parentheses to each term inside the parentheses.

② 2) Combine the like terms on the same side of the equal sign (using the same operation)

③ 3) Move the smaller variable to the larger across the equal sign. (using the opposite operation)

④ 4) Solve the remaining equation.

III. Examples: Solve for the missing variable.

D  
C  
M  
S

1)  $4(x-4) = 20$   
 $4x-16 = 20$  Distributive Property  
 $+16 +16$  Addition Property of Equality  
 $\frac{4x}{4} = \frac{36}{4}$  Division Property of Equality  
 $x=9$

D  
C  
M  
S

2)  $-3(x-6) = 3x$   
 $-3x+18 = 3x$   
 $+3x +3x$   
 $\frac{18}{6} = \frac{6x}{6}$   
 $3 = x$   
 $x=3$

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

$$3) 2 + 3(m - 6) = 14$$

D  
C  
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S

$$\begin{aligned} 2 + 3m - 18 &= 14 && \text{Distributive Property} \\ -16 + 3m &= 14 && \text{Combine like terms} \\ +16 & \quad +16 && \text{Addition Prop. of Equal} \\ \hline 3m &= 30 && \text{Division Prop. of Equal} \\ \frac{3m}{3} &= \frac{30}{3} && \\ \boxed{m=10} & && \end{aligned}$$

$$4) 10 = 5y - 2(y + 1)$$

D  
C  
M  
S

$$\begin{aligned} 10 &= 5y - 2y - 2 \\ 10 &= 3y - 2 \\ +2 & \quad +2 \\ \hline 12 &= 3y \\ \frac{12}{3} &= \frac{3y}{3} \\ \boxed{4=y} & \text{ or } \boxed{y=4} \end{aligned}$$

check

$$\begin{aligned} 10 &= 5y - 2(y + 1) \\ 10 &= 5(4) - 2(4 + 1) \\ 10 &= 5(4) - 2(5) \\ 10 &= 20 - 10 \\ 10 &= 10 \end{aligned}$$

Don't distribute in the check. there is no distribution in PEMDAS

$$5) 13 + c + 2 = 3(c - 5)$$

D  
C  
M  
S

$$\begin{aligned} 13 + c + 2 &= 3c - 15 && \text{Distributive Prop.} \\ 15 + c &= 3c - 15 && \text{Combine like terms} \\ -c & \quad -c && \text{Sub. Prop. of Equalit} \\ \hline 15 &= 2c - 15 && \\ +15 & \quad +15 && \text{Add Prop. of Equality} \\ \hline 30 &= 2c && \text{Division Prop. of Equality} \\ \frac{30}{2} &= \frac{2c}{2} && \text{ or } \boxed{c=15} \end{aligned}$$

$$6) \frac{1}{2}(2n + 6) = 5n - 12 - n$$

D  
C  
M  
S

$$\begin{aligned} n + 3 &= 5n - 12 - n \\ n + 3 &= 4n - 12 \\ -n & \quad -n \\ \hline 3 &= 3n - 12 \\ +12 & \quad +12 \\ \hline 15 &= 3n \\ \frac{15}{3} &= \frac{3n}{3} && \text{ or } \boxed{n=5} \end{aligned}$$

check

$$\begin{aligned} \frac{1}{2}(2n + 6) &= 5n - 12 - n \\ \frac{1}{2}(2(5) + 6) &= 5(5) - 12 - 5 \\ \frac{1}{2}(10 + 6) &= 25 - 12 - 5 \\ \frac{1}{2}(16) &= 8 \\ 8 &= 8 \end{aligned}$$

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

D  
C  
M  
S

$$\begin{aligned} 4x - 20 + 2 &= x + 3 && \text{Distributive Property} \\ 4x - 18 &= x + 3 && \text{Combine like terms} \\ -x & \quad -x && \text{Subtraction Prop. of Equality} \\ \hline 3x - 18 &= 3 && \\ +18 & \quad +18 && \text{Addition Prop. of Equality} \\ \hline 3x &= 21 && \text{Division Prop. of Equality} \\ \frac{3x}{3} &= \frac{21}{3} && \\ \boxed{x=7} & && \end{aligned}$$

$$8) 2(m + 10) = 4(m - 15)$$

D  
C  
M  
S

$$\begin{aligned} 2m + 20 &= 4m - 60 && \text{check} \\ -2m & \quad -2m && \\ \hline 20 &= 2m - 60 && \\ +60 & \quad +60 && \\ \hline 80 &= 2m && \\ \frac{80}{2} &= \frac{2m}{2} && \\ \boxed{40=m} & && \\ \boxed{m=40} & && \end{aligned}$$

$$\begin{aligned} 2(m + 10) &= 4(m - 15) \\ 2(40 + 10) &= 4(40 - 15) \\ 2(50) &= 4(25) \\ 100 &= 100 \end{aligned}$$

$$*9) 7(2x - 3) + 6 = -3(-6x - 20) - 1$$

D  
C  
M  
S

$$\begin{aligned} 14x - 21 + 6 &= 12x + 40 - 1 \\ 14x - 15 &= 12x + 39 \\ -12x & \quad -12x \\ \hline 2x - 15 &= 39 \\ +15 & \quad +15 \\ \hline 2x &= 54 \\ \frac{2x}{2} &= \frac{54}{2} \\ \boxed{x=27} & && \end{aligned}$$

$$*10) 3(4b - 7) = 2(3b + 11) + 5$$

D  
C  
M  
S

$$\begin{aligned} 12b - 21 &= 6b + 22 + 5 \\ 12b - 21 &= 6b + 27 \\ -6b & \quad -6b \\ \hline 6b - 21 &= 27 \\ +21 & \quad +21 \\ \hline 6b &= 48 \\ \frac{6b}{6} &= \frac{48}{6} \\ \boxed{b=8} & && \end{aligned}$$