

## M8 - 10.1 - " $\pm x \pm a = b$ " Notes

**Solve for  $x$ , by subtracting to both sides. Answer should say  $x = \underline{\hspace{1cm}}$**

$$x + 5 = 9$$

$$\begin{array}{r} x + 5 = 9 \\ -5 \quad -5 \end{array}$$

Subtract 5 from both sides

$$\begin{array}{r} x + \cancel{5} = 9 \\ -\cancel{5} \quad -5 \end{array}$$

Cross it off

$$x = 9 - 5$$

$$x = 4$$

**Solve for  $x$ , by adding to both sides. Answer should say  $x = \underline{\hspace{1cm}}$**

$$x - 3 = 7$$

$$\begin{array}{r} x - 3 = 7 \\ +3 \quad +3 \end{array}$$

Add 3 to both sides

$$\begin{array}{r} x - \cancel{3} = 7 \\ +\cancel{3} \quad +3 \end{array}$$

Cross it off

$$x = 7 + 3$$

$$x = 10$$

**Solve for  $x$ , by subtracting to both sides. Then Dividing by negative one. Answer should say  $x = \underline{\hspace{1cm}}$**

$$-x + 2 = 5$$

$$\begin{array}{r} -x + \cancel{2} = 5 \\ -\cancel{2} \quad -2 \\ -x = 3 \end{array}$$

Subtract 2 from both sides

$$\begin{array}{r} \cancel{-1}x = 3 \\ -1 \quad -1 \end{array}$$

Divide both sides by negative one.

$$x = -3$$

## M8 - 10.2 - " $ax = b$ " " $\frac{x}{a} = b$ " " $\frac{ax}{b} = c$ " Notes

**Solve for  $x$ , by dividing to both sides. Answer should say  $x = \underline{\hspace{2cm}}$**

$$2x = 4$$

$$\frac{2x}{2} = \frac{4}{2}$$

Divide both sides by the coefficient on  $x$ .

$$\cancel{2}x = \frac{4}{2}$$

The 2's on the left cancel

$$x = \frac{4}{2}$$

Divide the numbers on the right side.

$$x = 2$$

**Solve for  $x$ , by multiplying to both sides. Answer should say  $x = \underline{\hspace{2cm}}$**

$$\frac{x}{3} = 6$$

$$3 \times \frac{x}{3} = 6 \times 3$$

Multiply both sides by 3

$$\cancel{3} \times \frac{x}{\cancel{3}} = 6 \times 3$$

The 3s on the left cancel

$$x = 6 \times 3$$

Multiply the numbers on the right

$$x = 18$$

**Solve for  $x$ , by multiplying to both sides, then dividing to both sides. Answer should say  $x = \underline{\hspace{2cm}}$**

$$\frac{5}{4}x = 10$$

$$4 \times \frac{5}{4}x = 10 \times 4$$

Multiply both sides by 4

$$\cancel{4} \times \frac{5}{\cancel{4}}x = 10 \times 4$$

The 4s on the left cancel

$$5x = 40$$

$$\frac{5x}{5} = \frac{40}{5}$$

Divide both sides by 5

$$\cancel{5}x = \frac{40}{5}$$

The 5s on the left cancel

$$x = \frac{40}{5}$$

Divide the numbers on the right

$$x = 8$$

# M8 - 10.3 - " $\frac{a}{x} = b$ " " $\frac{a}{bx} = c$ " Notes

Solve for  $x$ , by multiplying to both sides by  $ax$ . Then dividing. Answer should say  $x = \underline{\hspace{2cm}}$

$$\frac{8}{x} = 4$$

$$x \times \frac{8}{x} = 4 \times x \quad \text{Multiply } x \text{ to both sides}$$

$$\cancel{x \times \frac{8}{x}} = 4 \times x \quad \text{Cross it off}$$

$$8 = 4x \quad \text{Divide both sides by 4}$$

$$\frac{8}{4} = \frac{4x}{4}$$

$$2 = x$$

Solve for  $x$ , by multiplying to both sides by  $ax$ . Then dividing. Answer should say  $x = \underline{\hspace{2cm}}$

$$\frac{24}{2x} = 3$$

$$\cancel{2x \times \frac{24}{2x}} = 3 \times 2x$$

$$24 = 6x$$

$$\frac{24}{6} = \frac{6x}{6}$$

$$4 = x$$

---

$$\frac{2}{3x} = 5$$

$$\cancel{3x \times \frac{2}{3x}} = 5 \times 3x$$

$$2 = 15x$$

$$\frac{2}{15} = \frac{15x}{15}$$

$$\frac{2}{15} = x$$

$$x = \frac{2}{15}$$

# M8 - 10.2 - Cross Multiplication / Reciprocal Notes

**Solve for x, by multiplying both sides by the opposite denominator. Answer should say  $x = \underline{\hspace{2cm}}$**

$$\frac{4x}{6} = \frac{4}{3}$$

$$3 \times \frac{4x}{\cancel{6}} = \frac{4}{\cancel{3}} \times 6$$

Multiply both sides by the opposite denominator  
Cross off denominators

$$3 \times 4x = 4 \times 6$$

$$12x = 24$$

$$\frac{\cancel{12}x}{\cancel{12}} = \frac{24}{12}$$

$$x = 2$$

$$\frac{4x}{6} = \frac{4}{3}$$

$$3 \times \frac{4x}{\cancel{6}} = \frac{4}{\cancel{3}} \times 6$$

$$\frac{12x}{12} = \frac{24}{12}$$

Multiply both sides by the opposite denominator  
Cross off the denominators

$$x = 2$$

**Solve for x, by multiplying both sides by the reciprocal. Answer should say  $x = \underline{\hspace{2cm}}$**

$$\frac{4x}{6} = \frac{4}{3}$$

$\frac{a}{b} : \text{reciprocal} = \frac{b}{a}$	$\frac{2}{3} : \text{reciprocal} = \frac{3}{2}$
---	---

$$\frac{6}{\cancel{4}} \times \frac{4x}{\cancel{6}} = \frac{4}{3} \times \frac{6}{\cancel{4}}$$

$$x = \frac{24}{12}$$

$$x = 2$$

## M8 - 10.4 - " $ax + b = c$ " Notes

***Solve for  $x$ , by subtracting from both sides then dividing to both sides. Answer should say  $x = \underline{\hspace{1cm}}$***

$$6x + 8 = 50$$

$$\begin{array}{r} \cancel{6x + 8} = 50 \\ -8 \quad -8 \end{array}$$

Minus 8 from both sides

$$6x = 42$$

$$\frac{6x}{6} = \frac{42}{6}$$

Divide both sides by 6

$$\cancel{\frac{6x}{6}} = \frac{42}{6}$$

Cross it off

$$x = \frac{42}{6}$$

$$\boxed{x = 7}$$

***Solve for  $x$ , by adding to both sides then dividing to both sides. Answer should say  $x = \underline{\hspace{1cm}}$***

$$5x - 4 = 21$$

$$\begin{array}{r} \cancel{5x - 4} = 21 \\ +4 \quad +4 \end{array}$$

Add 4 to both sides

$$5x = 25$$

$$\frac{5x}{5} = \frac{25}{5}$$

Divide both sides by 5

$$\cancel{\frac{5x}{5}} = \frac{25}{5}$$

Cross it off

$$x = \frac{25}{5}$$

$$\boxed{x = 5}$$

## M8 - 10.4 - " $\frac{x}{a} + b = c$ " Notes

*Solve for x, by subtracting from both sides then multiplying to both sides. Answer should say  $x = \underline{\hspace{2cm}}$*

$$\frac{x}{4} + 7 = 16$$

$$\begin{array}{r} \frac{x}{4} + 7 = 16 \\ -7 \quad -7 \\ \hline \end{array}$$

Subtract 7 from both sides, cross it off.

$$\frac{x}{4} = 9$$

$$\cancel{4} \times \frac{x}{\cancel{4}} = 9 \times 4$$

Multiply both sides by 4, cross it off.

$$x = 9 \times 4$$

$$\boxed{x = 36}$$

*Solve for x, by adding to both sides then multiplying to both sides. Answer should say  $x = \underline{\hspace{2cm}}$*

$$\frac{x}{3} - 8 = -3$$

$$\begin{array}{r} \frac{x}{3} - 8 = -3 \\ +8 \quad +8 \\ \hline \end{array}$$

Add 8 to both sides, cross it off.

$$\frac{x}{3} = 5$$

$$\cancel{3} \times \frac{x}{\cancel{3}} = 5 \times 3$$

Multiply both sides by 3, cross it off.

$$x = 5 \times 3$$

$$\boxed{x = 15}$$

# M8 - 10.5 - LCD " $\frac{x}{a} + \frac{b}{c} = \frac{d}{e}$ " Notes

Solve for  $x$  by multiplying each term by the LCD

$$\begin{aligned}
 x - 1 &= \frac{1}{2} \\
 2 \times (x - 1) &= \frac{1}{2} \times 2 && \text{Multiply both sides by 2} \\
 2x - 2 &= 1 \\
 +2 &+2 \\
 2x &= 3 \\
 \frac{2x}{2} &= \frac{3}{2} && \text{Add 2 to both sides} \\
 x &= \frac{3}{2}
 \end{aligned}$$


---

$$\begin{aligned}
 x - \frac{1}{4} &= \frac{1}{2} \\
 4 \times \left(x - \frac{1}{4}\right) &= \frac{1}{2} \times 4 && \text{Multiply both sides by 4} \\
 4x - \frac{4}{4} &= \frac{4}{2} \\
 4x - 1 &= 2 \\
 +1 &+1 \\
 4x &= 3 \\
 \frac{4x}{4} &= \frac{3}{4} && \text{Divide both sides by 4} \\
 x &= \frac{3}{4}
 \end{aligned}$$


---

$$\begin{aligned}
 \frac{x}{2} + \frac{1}{4} &= \frac{1}{2} \\
 \left(\frac{x}{2} + \frac{1}{4} = \frac{1}{2}\right) \times LCD & \\
 \frac{4x}{2} + \frac{4}{4} &= \frac{4}{2} \\
 2x + 1 &= 2 \\
 2x &= 1 \\
 x &= \frac{1}{2}
 \end{aligned}$$

$LCD = 4$

$$\begin{aligned}
 \left(\frac{x}{2} + \frac{1}{4} = \frac{1}{2}\right) \times LCD & \\
 2x + 1 &= 2 \\
 2x &= 1 \\
 x &= \frac{1}{2}
 \end{aligned}$$

Instead of actually multiplying by the LCD we are going to multiply and simplify at the same time.

# M8 - 10.6 - Distribution/Equations Notes

$$2 \times x = 2x$$

$$2(x + 4) =$$

$$\overset{\times}{\curvearrowright} 2(x + 4) =$$

$$2x + 8$$

Multiply the number in front of the brackets into both numbers inside the brackets.

$$-3(x - 4) =$$

$$\overset{\times}{\curvearrowright} -3(x - 4) =$$

$$-3x + 12$$

$$\overset{\times}{\curvearrowright} 2(x + y + z)$$

$$2(x + y + z) = 2x + 2y + 2z$$

$$4(x - 3) = 8$$

**Method 1: Distribute first**

$$\overset{\times}{\curvearrowright} 4(x - 3) = 8$$

Multiply the outside by all of the inside.

$$4x - 12 = 8$$

$$4x - \cancel{12} = 8$$
  

$$+ \cancel{12} + 12$$

Add to both sides.  
Cross it off.

$$4x = 20$$

$$\cancel{4x} = \frac{20}{4}$$

Divide both sides.  
Cross it off.

$$x = \frac{20}{4}$$

$$x = 5$$

$$4(x - 3) = 8$$

**Method 2: Divide first**

$$\cancel{4(x - 3)} = \frac{8}{4}$$

Divide both sides by the outside

Cross off

$$x - 3 = 2$$

$$\cancel{x - 3} = 2$$
  

$$+ 3 + 3$$

Add to both sides  
Cross off

$$x = 5$$

$$\overset{\times}{\curvearrowright} \frac{1}{2}(x + 4) = 6$$

$$\frac{x}{2} + \frac{4}{2} = 6$$

$$\frac{x}{2} + \frac{4}{2} = 6$$

$$\cancel{\frac{x}{2}} - 2$$

$$\frac{x}{2} = 4$$

$$\cancel{2 \times \frac{x}{2}} = 4 \times 2$$

$$x = 8$$

**Method 1: Distribute first**

Multiply the outside by all of the inside.

Subtract to both sides.  
Cross it off.

Times both sides.  
Cross it off.

$$\frac{1}{2}(x + 4) = 6$$
  

$$\cancel{2 \times \frac{1}{2}}(x + 4) = 6 \times 2$$

$$x + \cancel{4} = 12$$
  

$$\cancel{-4} - 4$$

**Method 2: Times first**

Times both sides by the denominator on the outside

Cross off

Subtract to both sides

Cross off

$$x = 8$$



# M8 - 10.7 - Combining Like Terms Notes

Combine the like terms

$$x + x = \textcircled{2x}$$

$$x + 2x = \textcircled{3x}$$

$$x - x = \textcircled{0}$$

$$2x + 4x = 6x$$

$$3x - 4x = -1x$$

$$2x - 5x = -3x$$

$$\begin{aligned} x &= 1 + 2 \\ x &= 3 \end{aligned}$$

$$\begin{aligned} x + x &= 4 \\ 2x &= 4 \\ \cancel{2x} \quad \cancel{4} \\ \hline 2 &= 2 \\ \textcircled{x} &= \textcircled{2} \end{aligned}$$

$$\begin{aligned} 4 + 1 &= 5x \\ 5 &= 5x \\ \cancel{5} \quad \cancel{5x} \\ \hline 1 &= x \\ \textcircled{x} &= \textcircled{1} \end{aligned}$$

$$\begin{aligned} 3x + 3x &= 4 + 8 \\ 6x &= 12 \\ \cancel{6x} \quad \cancel{12} \\ \hline 6 &= 6 \\ x &= 2 \end{aligned}$$

Add like Terms

**Solve for  $x$ , by combining like terms by M10 – 10.1 and adding and subtracting  $x$  to both sides**

$$\begin{aligned} 2x &= 4 + x \\ 2x &= 4 + x \\ -x \quad -x \\ \hline x &= 4 \end{aligned}$$

Subtract  $x$  from both sides

*Not Optimal*

$$\begin{aligned} 2x &= 4 + x \\ -4 \quad -4 \\ 2x - 4 &= x \\ -x \quad -x \\ x - 4 &= 0 \\ +4 \quad +4 \\ x &= 4 \end{aligned}$$

$$\begin{aligned} x + 1 &= 0 \\ -1 \quad -1 \\ \hline x &= -1 \end{aligned}$$

$$4 = 2 + x$$

$$\begin{aligned} 4 &= 2 + x \\ -2 \quad -2 \\ \hline 2 &= x \end{aligned}$$

**Solve for  $x$ , by combining like terms by adding and subtracting  $\pm ax$  to both sides**

$$3x + 2 = 2x + 6$$

$$\begin{aligned} 3x + 2 &= 2x + 6 \\ -2 \quad -2 \\ 3x &= 2x + 4 \\ -2x \quad -2x \\ \hline x &= 4 \end{aligned}$$

Subtract 2 from both sides

Subtract  $2x$  from both sides

## M8 - 10.7 - " $ax + b = cx + d$ " Notes

**Solve for  $x$ , by combining like terms by adding and subtracting  $\pm ax$  to both sides**

$$\begin{array}{r}
 2x + 1 = x + 4 \\
 -1 \quad -1 \\
 \hline
 2x = x + 3 \\
 -x \quad -x \\
 \hline
 x = 3
 \end{array}$$

$$\begin{array}{r}
 4x - 2 = 2x + 6 \\
 +2 \quad +2 \\
 \hline
 4x = 2x + 8 \\
 -2x \quad -2x \\
 \hline
 2x = 8 \\
 \frac{2x}{2} = \frac{8}{2} \\
 x = 4
 \end{array}$$

$$\begin{array}{r}
 2x + 3x = 4 + 1 \\
 5x = 5 \\
 \frac{5x}{5} = \frac{5}{5} \\
 x = 1
 \end{array}$$

$$\begin{array}{r}
 3x - 1 + 4x = x + 11 \\
 3x + 4x - 1 = x + 11 \\
 7x - 1 = x + 11 \\
 +1 \quad +1 \\
 \hline
 7x = x + 12 \\
 -x \quad -x \\
 \hline
 6x = 12 \\
 \frac{6x}{6} = \frac{12}{6} \\
 x = 2
 \end{array}$$