ST. JEAN DE BREBEUF

MATHEMATICS

CHAPTER 4.2

SOLVE A MULTI-STEP LINEAR EQUATION

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KEY CONCEPTS

Multi-step linear equations can be solved using **opposite** operations, algebra tiles, or a computer algebra system.

When a linear equation involves fractions, it is useful to **multiply each term by the least common multiple** of the denominators.

CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

EXAMPLE 1

Identifying the Steps Required to Solve a Multi-Step Linear Equation

For each linear equation, solve for *x* and write down the necessary steps

(a) $\dfrac{2x+7}{5}=3$

$5\left(\dfrac{2x+7}{5}\right)=5(3)$

$2x+7=15$

$2x=15-7$

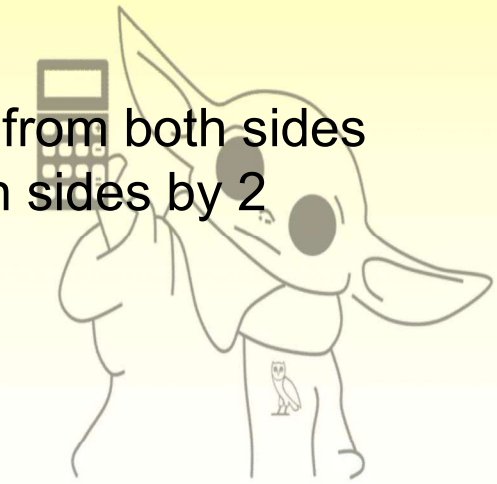
$\dfrac{2x}{2}=\dfrac{8}{2}$

$\boxed{x=4}$

STEPS:

* Get rid of fraction
→Multiply both sides by **5**

* Isolate *x*
→Subtract 7 from both sides
→Divide both sides by 2



CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

EXAMPLE 1

Identifying the Steps Required to Solve a Multi-Step Linear Equation

For each linear equation, solve for *x* and write down the necessary steps

(b) $\dfrac{7x-23}{-4}=11$

$$-4\left(\frac{7x-23}{-4}\right)=-4(11)$$

$$7x-23=-44$$

$$7x=-44+23$$

$$\frac{7x}{7}=\frac{-21}{7}$$

$$\boxed{x=-3}$$

STEPS:

* Get rid of fraction
→Multiply both sides by **– 4**

* Isolate *x*
→Add **23** to both sides
→Divide both sides by **7**

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EXAMPLE 2

Solve a Linear Equation with a Variable Term on Each Side

*** Key idea is to gather all variables to one side of the equal sign and numbers on the *opposite* side of the equal sign

Solve for *x* for the equation **5x + 21 = – 15 – 7x**

$5x + 21 = -15 - 7x$

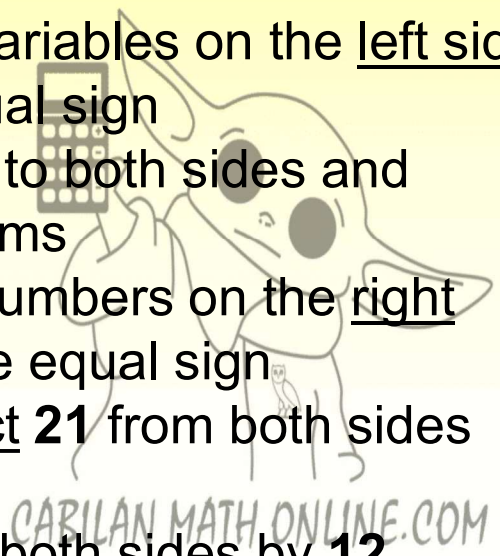
$5x + 7x = -15 - 21$

$\frac{12x}{12} = \frac{-36}{12}$

x = – 3

STEPS:

*Gather variables on the left side of the equal sign
→Add **7x** to both sides and gather terms
*Gather numbers on the right side of the equal sign
→Subtract **21** from both sides
*Isolate *x*
→ Divide both sides by **12**



CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

EXAMPLE 3 *Solving Linear Equations with Brackets*

Solve the following equations for *x*

(a) $2(x-4)=28$

$$2x-8=28$$

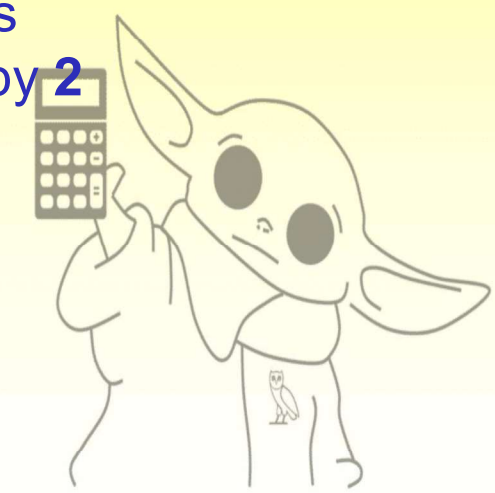
$$2x=28+8$$

$$\frac{2x}{2}=\frac{36}{2}$$

$$x=18$$

* When brackets are present, you have to perform the **distributive property**
→ Multiply each term in the brackets by **2**

* Isolate *x*
→Add **8** to both sides
→Divide both sides by **2**



CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

EXAMPLE 3 *Solving Linear Equations with Brackets*

Solve the following equations for *x*

(b) $-3(x-5)+4=8x+52$

$$-3x+15+4=8x+52$$

$$-3x+19=8x+52$$

$$-3x-8x=52-19$$

$$\frac{-11x}{-11}=\frac{33}{-11}$$

$$x=-3$$

* When brackets are present, you have to perform the **distributive property**
→ Multiply each term by the number *in front* of the brackets

* Gather *variables* to the left
→Subtract **8x** from both sides and gather terms
* Gather *numbers* to the right
→Subtract **19** from both sides
* Isolate *x*
→ Divide both sides by **– 11**

END OF DAY 1

CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

EXAMPLE 4 *Solving Multi-Step Linear Equations with Fractions*

*** Key idea is to *eliminate* the fraction by multiplying each term by the **least common multiple**.

The **least common multiple** is a number in which *both* denominators (bottom number of fraction) can evenly multiply into

For each equation, identify the **least common multiple** and solve each equation for *x*.

(a) $\frac{3x}{10}+\frac{x}{5}=7$

Least common multiple = 10

$\overset{1}{\cancel{10}}\left(\frac{3x}{\cancel{10}}\right)+\overset{2}{\cancel{10}}\left(\frac{x}{\cancel{5}}\right)=10(7)$

* Multiply each term by 10

$3x+2x=70$

$\frac{\cancel{5}x}{\cancel{5}}=\frac{70}{5}$

$x=14$

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For each equation, identify the **least common multiple** and solve each equation for *x*.

(b) $\frac{x+1}{6}+\frac{x-2}{8}=6$

$24\left(\frac{x+1}{6}\right)+24\left(\frac{x-2}{8}\right)=24(6)$

$4(x+1)+3(x-2)=144$

$4x+4+3x-6=144$

$4x+3x+4-6=144$

$7x-2=144$

$7x=144+2$

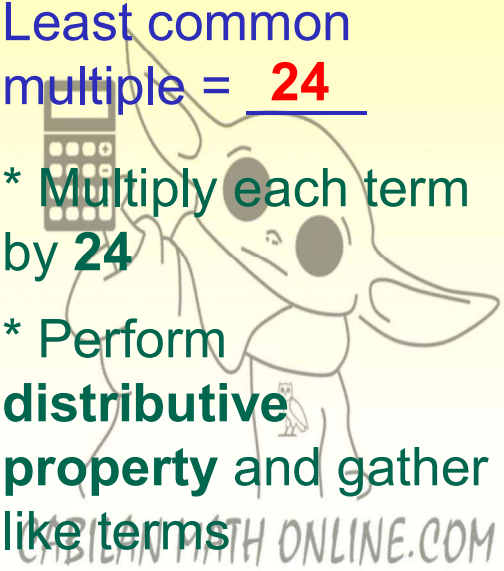
$\frac{7x}{7}=\frac{146}{7}$

$x=\frac{146}{7}$

Least common multiple = **24**

* Multiply each term by **24**

* Perform **distributive property** and gather like terms



CHAPTER 4.2 SOLVE A MULTI-STEP LINEAR EQUATION

Homework:

Page 169 – 173

(Day 1)#1 and 2abcf, 3 – 5h

(Day 2) #5ij, 6, 8 – 14