

## 2.2 Equation Solving

### Equality Properties

Addition:  $a = b$

$$a + c = b + c \quad \text{or because } x - y = x + (-y)$$
$$a - c = a - c$$

Multiplication:  $a = b$

$$a \cdot c = b \cdot c \quad \text{or because } \frac{x}{y} = x \cdot \frac{1}{y}$$
$$\frac{a}{c} = \frac{b}{c}$$

There are 3 possible solutions

Linear equations in one variable

1.  $x$  is a real number.  $\rightarrow$  ONE solution  
(3, 5, -8, 2.675,  $\frac{1}{3}$ ,  $-\frac{5}{8}$ , etc)
2.  $x$  has no answer  $\rightarrow$  no solution  
 $32 \neq -15$
- 3.) all real numbers or infinitely many solutions  
 $x = x, \quad 0 = 0$

# Good Solving Principles

1. Simplify: (a) - Take care of distributive  
(b) combine like terms on both sides

Result no more than one variable term & one number term per side.

- (2) Solving: Use Addition Property to get  
(a) variables on one side and numbers on the other.

- (b) Use Multiplication Property to get the coefficient of the variable to be one.

$$\frac{3x}{3} = \frac{9}{3}$$

$$x = 3$$



- (3) Check: plug in values  
ask if it is reasonable

Basic solving  
examples

$$\begin{array}{r} 5 - 6x = 21 \\ +5 \qquad \qquad +5 \\ \hline \end{array}$$

$$-6x = 26$$

$$\frac{-6x}{-6} = \frac{26}{-6}$$

$$x = -\frac{13}{3} \text{ (must be reduced)}$$

$$-7 + \frac{2}{3}x = 1$$

$$\begin{array}{r} +7 \qquad \qquad +7 \\ \hline \end{array}$$

$$\frac{2}{3}x = 8$$

multiply by reciprocal

$$\frac{3}{2} \cdot \frac{2}{3}x = 8 \cdot \frac{3}{2}$$

$$1x = \frac{24}{2}$$

$$x = 12$$

w/variable on Both sides

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w/ distributive

$$4(x+5) = 8 + 6(2x-2)$$

$$4x+20 = 8 + 12x - 12$$

$$4x+20 = 12x - 4$$

$$\begin{array}{r} -4x \qquad \qquad -4x \\ \hline \end{array}$$

$$\begin{array}{r} 20 = 8x - 4 \\ +4 \qquad \qquad +4 \\ \hline \end{array}$$

$$\frac{24}{8} = \frac{8x}{8}; 3 = x$$

then try d

$$-(x-4) - 5x = 4(-8-3x)$$

$$-x+4-5x = -32-12x$$

$$-6x+4 = -32-12x$$

$$+12x$$

$$\begin{array}{r} 6x+4 = -32 \\ -4 \qquad \qquad -4 \\ \hline \end{array}$$

$$\begin{array}{r} 6x = -36 \\ \underline{6} \qquad \underline{6} \end{array}$$

$$x = -6$$

then try

$$-7x+3 = 4x-19$$

$$\begin{array}{r} +7x \qquad \qquad +7x \\ \hline \end{array}$$

$$3 = 11x-19$$

$$\begin{array}{r} +19 \qquad \qquad +19 \\ \hline \end{array}$$

$$\begin{array}{r} 22 = 11x \\ \underline{11} \qquad \underline{11} \end{array}$$

$$2 = x$$

# Fractions

Clear fractions when there is more than one fraction and denominators are different

Use the LCD!

#1

$$\frac{1}{6}x + \frac{5}{2} = \frac{1}{3}$$

find LCD

LCD is 6

Multiply by LCD on ~~Both~~ sides

$$\frac{6}{1} \left[ \frac{1}{6}x + \frac{5}{2} \right] = \left( \frac{1}{3} \right) \cdot \frac{6}{1} \quad \text{do the math}$$

$$\frac{6}{1} \cdot \frac{1}{6}x + \frac{6}{1} \cdot \frac{5}{2} = \frac{1}{3} \cdot \frac{6}{1}$$

$$x + 15 = 2$$

Solve

$$\begin{array}{r} x + 15 = 2 \\ -15 \quad -15 \\ \hline x = -13 \end{array}$$

2

$$\frac{1}{6}x + \frac{5}{2} = \frac{1}{3}$$

$$\frac{1}{6}x + \frac{5 \cdot 3}{2 \cdot 3} = \frac{1}{3} \cdot \frac{2}{2} \quad \text{change fractions to LCD}$$

$$\frac{1}{6}x + \frac{15}{6} = \frac{2}{6}$$

Multiply by LCD

$$\frac{1}{6}x \cdot \frac{6}{1} + \frac{15}{6} \cdot \frac{6}{1} = \frac{2}{6} \cdot \frac{6}{1}$$

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$$\frac{2}{3} = -\frac{2}{3}x + \frac{3}{4}$$

# Examples for Clearing Fractions

①  $-\frac{2}{9} = \frac{5}{6}x - \frac{1}{3}$  LCD is 18

multiply by LCD on both sides

$$\frac{18}{1} \left( -\frac{2}{9} \right) = \frac{18}{1} \left( \frac{5}{6}x \right) - \frac{18}{1} \left( \frac{1}{3} \right)$$

do the math

$$-4 = 15x - 6$$

YAY!  
NO FRACTIONS

$$\begin{array}{r} +6 \qquad \qquad +6 \\ \hline \end{array}$$

Solve

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

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

②  $-2 - \frac{1}{2}y = \frac{1}{3}y$  LCD is 6

$$6(-2) - \frac{6}{1} \left( \frac{1}{2}y \right) = \frac{6}{1} \cdot \left( \frac{1}{3}y \right)$$

$$\begin{array}{r} 12 - 3y = 2y \\ +3y \qquad +3y \\ \hline 12 = \frac{5y}{5} \end{array}$$

$$12/5 = y$$