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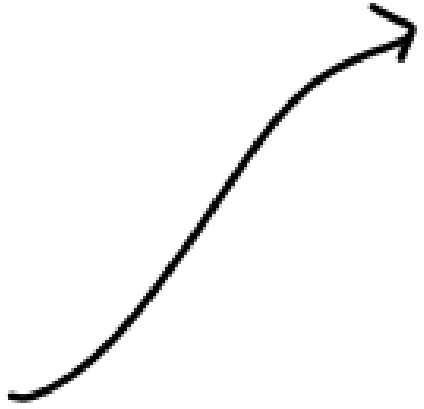
$$\frac{2}{3}x + 12 = 4x - 28 + 4$$

$$\frac{2}{3}x + 12 = 4x - 24$$

$$\frac{2}{3}x - 4x = -24 - 12$$

$$\frac{2}{3}x - \frac{12}{3}x = -36$$

$$-\frac{10}{3}x = -36$$


$$\frac{-3}{10} \div \frac{10}{3}x = \frac{-36}{1} \cdot \frac{-3}{10}$$

$$x = \frac{54}{5} \text{ or } 10\frac{4}{5}$$

## Solving Linear Systems using Algebra

**Substitution:** the act of replacing.

Steps:

- 1) Isolate a variable in one of the equations if necessary. If an equation already has a variable isolated, skip step 1.
- 2) Use the value of the isolated variable and **SUBSTITUTE** it into the other equation.
- 3) Now you have an equation with only one variable, solve this equation.
- 4) Use the solution from step 3 to find the value of the other variable by **SUBSTITUTING** its value.
- 5) Solution is an ordered pair (  $x$  ,  $y$  )

Using substitution, solve the linear system.

$$1) x = 1$$

$$y = -3x + 1$$

$$\left( \overset{x}{1}, \overset{y}{-2} \right)$$

$$y = -3(\overset{x}{1}) + 1$$

$$y = -3 + 1$$

$$= -2$$

Using substitution, solve the linear system.

$$2) \ y = 4x + 2$$

$$y = x + 2$$

Solve for "x" first, then substitute and solve for "y".

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

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

$$0 = 3x$$

$$0 = x$$

$$y = x + 2$$

$$y = 0 + 2$$

$$y = 2$$

$$(0, 2)$$

Using substitution, solve the linear system.

$$\begin{aligned} 3) \quad & 4x + 5y = 10 \\ & x + y = 7 \end{aligned}$$

$$x = 7 - y$$

or

$$y = 7 - x$$

$$4(7 - y) + 5y = 10$$

$$28 - 4y + 5y = 10$$

$$\begin{array}{r} 28 + 1y = 10 \\ -28 \qquad -28 \end{array}$$

$$x = 7 - 18$$

$$y = -18$$

$$x = 25 \quad (25, -18)$$

Isolate either "x" or "y" in the second equation. Then, substitute into the first equation and solve. Then substitute AGAIN to solve for the remaining variable.

Using substitution, solve the linear system.

$$4) \begin{cases} 2x + y = -1 \\ 2x + y = 5 \end{cases}$$

$$2x + y = 5$$

No Solution

No solution because " $2x + 1$ " cannot equal two different numbers.

## Solving Linear System Story Problems

Steps:

- 1) Define the variables.
- 2) Write 2 different equations using both variables.
- 3) Solve the linear systems algebraically.
- 4) Write a statement that explains the solution.



5) One number is three times larger than another number. The numbers also sum to 24. Find both numbers.

$x = \text{first number}$

$y = \text{second number}$

Substitute "3y" for x in the second equation and solve for "y".

Then, plug in 6 for "y" and solve for x.

$$x = 3y$$

$$x + y = 24$$

$$3y + y = 24$$

$$4y = 24$$

$$y = 6$$

$$x = 3(6)$$

$$x = 18$$

6) Your next math test will be worth 20 points and contain 12 problems. Standard problems will be worth 1 point and story problems worth 3 points. Find the number of each type of problems on the test.

$$1x + 3y = 20$$

$$x + y = 12$$

$$x = 12 - y$$

$$1(12 - y) + 3y = 20$$

$$12 - y + 3y = 20$$

$$12 + 2y = 20$$

$$2y = 8$$

$$y = 4$$

$$x = 12 - y$$

$$x = 12 - 4$$

$$x = 8$$

There are 8 standard problems and 4 story problems.