Chapter 3 Lesson 8

Solve Systems of Equations Algebraically

Vocabulary: Is an algebraic model that can be used to find the exact solution of a system of equations (SAT)

The Real World - Jewelry

Brooke sold 20 necklaces and bracelets at the craft fair. She sold 3 times as many necklaces as bracelets.

Step 1: The bar diagram represents the situation.

- Necklaces: 3
- Bracelets: 20

Continue
Step 2

The Eq. to Represent the Bar Diagram is \( x + y = 20 \)

Brooke sold 3 times as many (n) as (b). Divide the (n) bar into sections to represent this.

\[ x \]
\[ y = 3x \]

Now, make sure you write an Eq using only \( x \) to represent the total number of (n) & (b).

\[ x + 3x = 20 \]

Or

\[ 4x = 20 \]

Coming up on the next page is, Step 3.
Step 3

Solve the Eq from Step 2.
What Does the Solution Represent?

EQ #1: 

$x + 3x = 20 \Rightarrow 4x = 20 \Rightarrow x = \frac{20}{4} = x = 5$

-Solve for x-

EQ #2: 

$4x = 20 \Rightarrow x = \frac{20}{4} = 5$

Brooke sold 5 bracelets

$b = 5$

$N = 15$

Example: Solve the S.O.E Algebraically

$y = x - 3$

$y = 2x$

$y = \frac{x - 3}{2}$

Since $x = -3$ and $y = 2x$, then

$y = -6$ when $x = -3$. The solution of this S.O.E is $(-3, -6)$.
But why.

\[ y = x - 3 \]
\[ 2x = x - 3 \]
\[ -x - x \]
\[ x = -3 \]
So replace \( x \) with \(-3\) in the 2nd Eq.

\[ y = 2x \]
\[ y = 2(-3) \]
\[ y = -6 \]
And
\[ x = -3 \]
So our solution is \((-3, -6)\).

Graph it.

\[ y = x - 3 \]
\[ y = 2x \]
1) \( y = x + 4 \)
   \( y = 2 \)
   \( 2 = x + 4 \)
   \( -4 \)
   \( -2 = x \)
   \( SoE = (\frac{-2}{2}, \frac{2}{2}) \)

2) \( y = x - 6 \)
   \( y = 2x \)
   \( 3x = x - 6 \)
   \( -x \)
   \( 2x = -6 \)
   \( 2 \)
   \( x = 3 \)
   \( y = 3(3) \)
   \( y = -9 \)
   \( SoE = (-3, -9) \)
Example: Solve the system algebraically.

\[
\begin{align*}
Y &= 3x + 8 \\
18x + 4y &= 12 \\
8x + 4y &= 12 \\
8x + 4(3x + 8) &= 12 \\
8x + 12x + 32 &= 12 \\
20x + 32 &= 12 \\
-32 &= -32 \\
20x &= -20 \\
x &= -1 \\
Y &= 3x + 8 \\
Y &= 3(-1) + 8 \\
Y &= -3 + 8 \\
Y &= 5
\end{align*}
\]

Solution \((-1, 5)\)
1) \( y = 2x + 1 \)
   \( 3x + 4y = 26 \)

   \( 3x + 4(2x + 1) = 26 \)

   \( 3x + 8x + 4 = 26 \)

   \( 11x = 22 \)

   \( x = 2 \)

   \( y = 2(2) + 1 \)

   \( y = 4 + 1 \)

   \( y = 5 \)

Solution \((2, 5)\)
Example:

A total of 75 cookies and cakes were donated for a bake sale to raise money for the football team. There were four times as many cookies donated as cakes.

\[ y = 4x \]
\[ x + y = 75 \]

Write a system of equations to represent this situation.

Draw a bar diagram. Then write the system.

\[ y = 4x \]
\[ x + y = 75 \]

Yo-Lets Solve this

\[ y + x = 75 \]
\[ y = 4x \]

4x + x = 75
5x = 75
x = 15

y = 4(15)
y = 60

Solution (15, 60)

\[ 2x + 5y = 44 \]
\[ y = 6x - 4 \]

\[ 2x + (6x - 4) = 44 \]
\[ 2x + 30x - 20 = 44 \]
\[ 32x - 20 = 44 \]
\[ +20 +20 \]
\[ 32x = 64 \]
\[ \frac{32}{32} \]
\[ x = 2 \]

\[ y = 6(2) - 4 \]
\[ y = 12 - 4 \]
\[ y = 8 \]

Solution (2, 8)
Mr. Tee cooked 45 hamburgers & hot dogs at a cook-out. He cooked twice as many hot dogs as hamburgers.

1) Write a system to represent this situation.
2) Solve the system algebraically and interpret.

\[
\begin{align*}
x & \quad \text{Burgers} \\
y & \quad \text{Dogs} \\
y & = 2x \\
x + y & = 45 \\
x + 2x & = 45 \\
3x & = 45 \\
\frac{3x}{3} & = \frac{45}{3} \\
x & = 15 \\
y & = 2(15) \\
y & = 30
\end{align*}
\]

All this means Mr. Tee cooked 15 burgers and 30 dogs!