

# Lesson #11: Solving Systems of Equations Story Problems

By the end of this lesson, you will be able to:

- ~ Solve story problems by elimination
- ~ Solve story problems by substitution

## Lesson #11: Systems Story Problems

### Mathematical operations in verbal expressions

Addition	Subtraction
plus more than the sum of increased by added to	minus less than the difference of decreased by subtracted from
Multiplication	Division
the product of multiplied by times twice	the quotient of divided by the ratio of half
Exponents	
squared cubed to the ____ power	

## Lesson #11: Systems Story Problems

# Words that mean "Equal"

- ~ is
- ~ was
- ~ is equivalent to
- ~ yields
- ~ gives
- ~ equals
- ~ are
- ~ results in
- ~ is equal to

## Lesson #11: Systems Story Problems

Translate each English Statement into a mathematical statement.

Ex 1: The product of 3 and y is equal to 21.

$$3y = 21$$

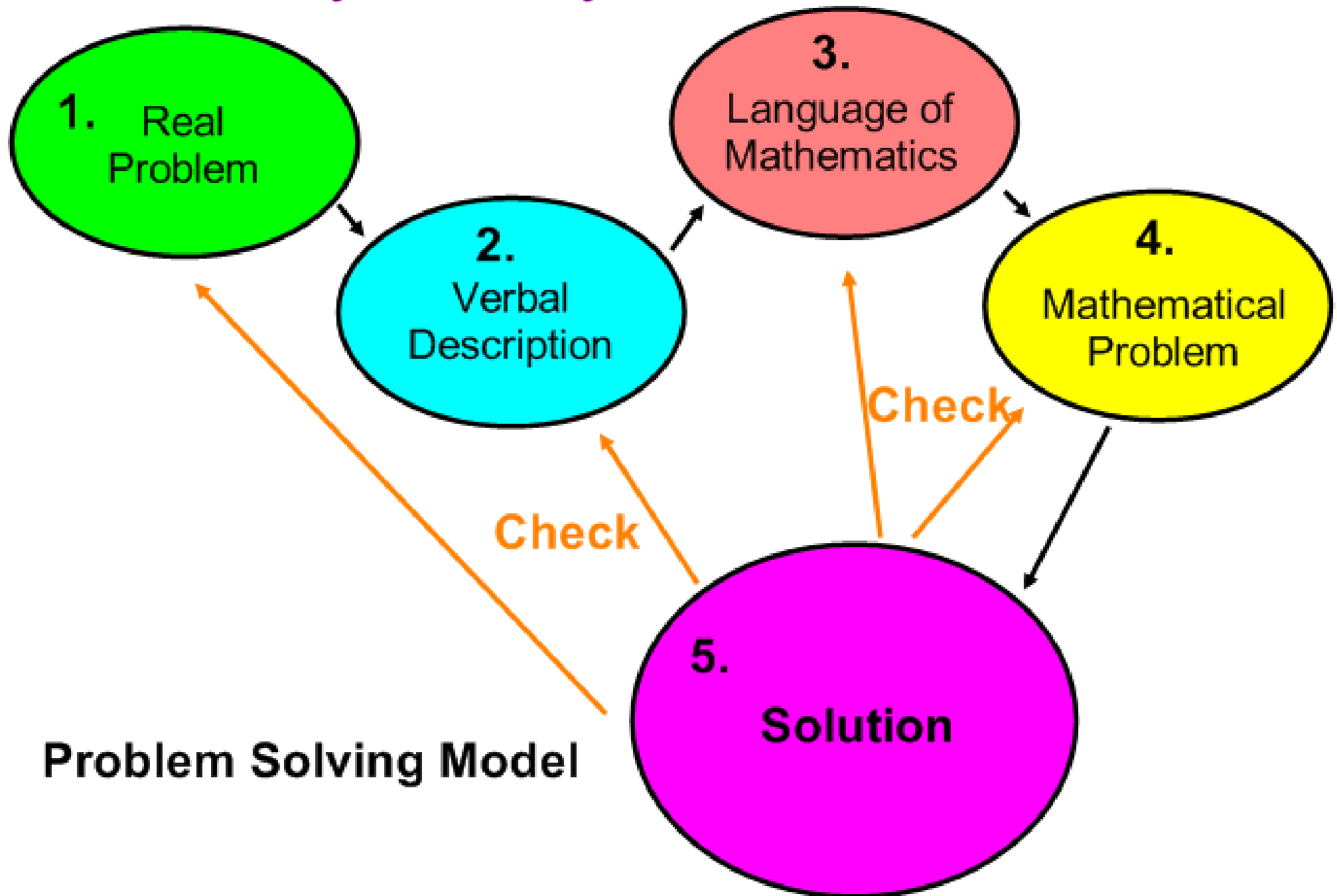
Ex 2: Two times the sum of 3 and X is equivalent to the product of 5 and X.

$$2(x + 3) = 5x$$

Ex 3: The difference of x and 10 equals the quotient of x and 2.

$$x - 10 = \frac{x}{2}$$

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### 5 Categories of Problems

1. **Direct Translation** - problems where we must translate from English into Mathematics by using key words in the verbal description.
2. **Mixture** - problems where two or more quantities are combined in some fashion.
3. **Geometry** - problems where the unknown quantities are related through geometric formulas.
4. **Uniform Motion** - problems where an object travels at a constant speed.
5. **Work Problems** - problems where two or more entities join forces to complete a job.

## Lesson #11: Systems Story Problems

### Steps for Solving Problems with Mathematical Models

**Step 1: Identify what you are looking for.**

**Step 2: Give Names to the Unknowns.**  
(variables)

**Step 3: Translate the Problem into the Language of Mathematics.**

**Step 4: Solve the Equation(s) Found in Step 3.**

**Step 5: Check the Reasonableness of your Answer.**

**Step 6: Answer the Question (in a complete sentence).**

## Lesson #11: Systems Story Problems

**Ex 4:** Two numbers total 23 and their difference is 3.  
Find the numbers.

Step 1: looking for 2 #'s

Step 2:  $x = 1^{\text{st}}$  number  
 $y = 2^{\text{nd}}$  number

Step 3:

$$\begin{array}{r} x + y = 23 \\ x - y = 3 \end{array}$$
$$\begin{array}{r} 13 + y = 23 \\ -13 \quad -13 \\ \hline y = 10 \end{array}$$

Step 4:

$$\frac{2x}{2} = \frac{26}{2}$$
$$x = 13$$

Step 6:

The two #'s are  
13 and 10.



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**Ex 5:** There are 13 animals in the barn. Some are chickens and some are pigs. There are 40 legs in all. How many of each animal are there?

$C$  = chicken (# of)

$P$  = pigs (# of)

$$(C + P = 13) \cdot 2 \rightarrow -2C - 2P = -26$$

$$2C + 4P = 40 \rightarrow \underline{2C + 4P = 40}$$

$$\begin{array}{r} C + P = 13 \\ -P \quad -P \\ \hline \end{array}$$

$$C = 6$$

$$\frac{2P = 14}{2} \quad \frac{2}{2}$$

$$P = 7$$

There are 6 chickens and 7 pigs in the barn.

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**Ex 6:** Bobby has been saving quarters and dimes. He opened up his piggy bank and determined that it contained 47 coins worth \$9.50. Determine how many dimes and quarters were in the piggy bank.

$x = \text{quarters (\# of)}$

$y = \text{dimes (\# of)}$

$$x + y = 47 \rightarrow y = 47 - x$$

$$.25x + .10y = 9.50$$

$$.25x + .10(47 - x) = 9.50$$

$$.25x + 4.7 - .10x = 9.50$$

$$\begin{array}{r} .15x + 4.7 = 9.50 \\ -4.7 \quad -4.70 \\ \hline \end{array}$$

$$\begin{array}{r} .15x = 4.8 \\ \hline .15 \quad .15 \end{array}$$

$$x = 32$$

$$y = 47 - 32$$

$$y = 15$$

Bobby has 32 quarters and 15 dimes.

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**Ex 7:** The school that Lisa goes to is selling tickets to the annual talent show. On the first day of ticket sales the school sold 4 senior citizen tickets and 5 student tickets for a total of \$102. The school took in \$126 on the second day by selling 7 senior citizen tickets and 5 student tickets. What is the price each of one senior citizen ticket and one student ticket?

$x$  = price of Sr. citizen ticket

$y$  = price of student ticket

$$\begin{aligned} 4x + 5y &= 102 \\ 7x + 5y &= 126 \end{aligned} \quad (\text{solve w/ elimination})$$

## Lesson #11: Systems Story Problems

**Ex 7:** cont.

## Lesson #11: Systems Story Problems

**We need to know a formula when dealing with interest rates and money:**

$$I = Prt$$

I = Interest

P = Principal (What we start with)

r = rate (yearly)

t = time (years)

You will normally find an equation for each: total principal and total interest.

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**Ex 8:** Paul wants to invest his \$25,000 bonus check. His investment advisor has recommended that he put some of the money in Bonds that yeild 5% per annum and the rest in Stocks that yields 9% per annum. If Paul wants to earn \$1875 each year from his investments, how much should be placed in each?

$x$  = amount in Bonds

$y$  = amount in Stocks

	Principal	Rate	Time	Interest
$x$	$x$	.05	1	$.05x$
$y$	$y$	.09	1	$.09y$
Total	25000			1875

total principal equation:

$$x + y = 25000$$

total interest equation:

$$.05x + .09y = 1875$$

## Lesson #11: Systems Story Problems

**Ex 8:** cont.

$$\begin{aligned}x + y &= 25000 \rightarrow x = 25000 - y & x &= 25000 - 15625 \\& & x &= 9375 \\0.05x + 0.09y &= 1875\end{aligned}$$

$$0.05(25000 - y) + 0.09y = 1875$$

$$1250 - 0.05y + 0.09y = 1875$$

$$\begin{array}{r}1250 + 0.04y = 1875 \\-1250 \qquad \qquad -1250 \\ \hline\end{array}$$

$$\begin{array}{r}0.04y = 625 \\ \cdot 0.04 \qquad \cdot 0.04\end{array}$$

$$y = 15625$$

He should invest \$9375 in  
bonds and \$15625 in  
stocks.

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By the end of this lesson, you will be able to:

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Can you?



# Assignment #11

Due at the beginning of class

Read instructions to know when you can and cannot use a calculator!