

How Do We Use Two Variables To Solve Word Problems?

1) The manager of a student bowling team bought 3 shirts and 4 caps for \$66. At another time, he bought 7 shirts and 3 caps for \$116 at the same unit prices as for the first purchase. What is the cost of a shirt and a cap?

All Variable

let $x =$ the cost of 1 shirt $y =$ the cost of 1 cap	E	S	C
	$\begin{aligned} 3x + 4y &= 66 \\ 7x + 3y &= 116 \end{aligned}$ $\begin{aligned} 21x + 28y &= 462 \\ -21x - 9y &= -348 \\ \hline 19y &= 114 \\ y &= 6 \end{aligned}$ $\begin{aligned} 3x + 4(6) &= 66 \\ 3x + 24 &= 66 \\ -24 & \quad -24 \\ \hline 3x &= 42 \\ x &= 14 \end{aligned}$	The cost of 1 shirt is \$14 + the cost of 1 cap is \$6	$\begin{aligned} 3(14) &= 42 \\ 4(6) &= 24 \\ \hline &= 66 \checkmark \\ 7(14) &= 98 \\ 3(6) &= 18 \\ \hline &= 116 \checkmark \end{aligned}$

2) The sum of two numbers is 187. The larger number is 9 more than the smaller number. Find both numbers.

let $x =$ the larger # $y =$ the smaller #	E	S	C
	$\begin{aligned} x + y &= 187 \\ x &= 9 + y \end{aligned}$ $\begin{aligned} 9 + y + y &= 187 \\ 9 + 2y &= 187 \\ -9 & \quad -9 \\ \hline 2y &= 178 \\ y &= 89 \end{aligned}$ $\begin{aligned} x &= 9 + y \\ x &= 9 + 89 \\ x &= 98 \end{aligned}$	The larger # is 98 + the smaller # is 89	$\begin{aligned} 98 + 89 &= 187 \checkmark \\ 89 + 9 &= 98 \checkmark \end{aligned}$

3) If purchased before the game, tickets to a pre-season high school baseball game cost \$1.00. If purchased at the gate, the tickets cost \$1.50. For a particular game, 500 tickets were sold and the total receipts were \$587.50. How many tickets were purchased before the game and how many tickets were purchased at the gate?

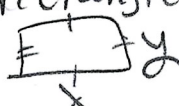
let $x =$ the # of tickets purchased before the game $y =$ the # of tickets purchased at the game	E	S	C
	$\begin{aligned} 1x + 1.50y &= 587.50 \\ x + y &= 500 \end{aligned}$ $\begin{aligned} 1x + 1.50y &= 587.50 \\ -1x - 1y &= -500 \\ \hline .5y &= 87.50 \\ y &= 175 \end{aligned}$ $\begin{aligned} x + y &= 500 \\ x + 175 &= 500 \\ -175 & \quad -175 \\ \hline x &= 325 \end{aligned}$	there were 325 tickets purchased before the game & 175 tickets purchased at the gate.	$\begin{aligned} 325(1) &= 325 \\ 175(1.5) &= 262.5 \\ \hline &= 587.50 \end{aligned}$

$$2L + 2W = P$$

4) The perimeter of a rectangle is 50 centimeters. The length is 9 centimeters more than the width. Find the length and the width of the rectangle.

$$x = 9 + y$$

Let
 x = the length of the rectangle
 y = the width of the rectangle



$$2x + 2y = 50$$

$$x = 9 + y$$

$$2(9 + y) + 2y = 50$$

$$18 + 2y + 2y = 50$$

$$18 + 4y = 50$$

$$\begin{array}{r} 18 + 4y = 50 \\ -18 \quad -18 \\ \hline 4y = 32 \\ \frac{4y}{4} = \frac{32}{4} \\ y = 8 \end{array}$$

$$x = 9 + 8$$

$$x = 17$$

The length of the rectangle is 17 cm
 +
 the width of the rectangle is 8 cm

$$2(17) = 34$$

$$2(8) = 16$$

$$\begin{array}{r} 34 \\ + 16 \\ \hline 50 \end{array}$$

$$8 + 9 = 17 \checkmark$$

5) Two angles are supplementary. The larger angle measures 15° less than twice the smaller. Find the degree of each angle.

Let
 x = the measure of the larger angle
 y = the measure of the smaller angle

$$x + y = 180$$

$$x = 2y - 15$$

$$x + y = 180$$

$$2y - 15 + y = 180$$

$$3y - 15 = 180$$

$$\begin{array}{r} 3y - 15 = 180 \\ +15 \quad +15 \\ \hline 3y = 195 \\ \frac{3y}{3} = \frac{195}{3} \\ y = 65 \end{array}$$

$$x + y = 180$$

$$x + 65 = 180$$

$$\begin{array}{r} x + 65 = 180 \\ -65 \quad -65 \\ \hline x = 115 \end{array}$$

The larger angle is 115°
 +
 the smaller angle is 65°

$$65 + 115 = 180 \checkmark$$

$$2(65) = 130$$

$$130 - 15 = 115 \checkmark$$

6) Linda spent \$4.50 for stamps to mail packages. Some were 39-cent stamps and the rest were 24-cent stamps. The number of 39-cent stamps was 3 less than the number of 24-cent stamps. How many of each kind did Linda buy?

Let
 x = # of 39¢ stamps bought
 y = # of 24¢ stamps bought

$$.39x + .24y = 4.50$$

$$x = y - 3$$

$$.39x + .24y = 4.50$$

$$.39(y - 3) + .24y = 4.50$$

$$.39y - 1.17 + .24y = 4.50$$

$$.63y - 1.17 = 4.50$$

$$\begin{array}{r} .63y - 1.17 = 4.50 \\ +1.17 \quad +1.17 \\ \hline .63y = 5.67 \\ \frac{.63y}{.63} = \frac{5.67}{.63} \\ y = 9 \end{array}$$

$$x = y - 3$$

$$x = 9 - 3$$

$$x = 6$$

Linda bought
 6, 39¢ stamps
 9, 24¢ stamps

$$.39(6) = 2.34$$

$$.24(9) = 2.16$$

$$\begin{array}{r} 2.34 \\ + 2.16 \\ \hline 4.50 \end{array}$$

$$9 - 3 = 6 \checkmark$$

7) At a fast-food restaurant, a family bought 4 hamburgers and 3 bags of french fries for \$8.40. At the same time, a family traveling with them bought 5 hamburgers and 2 bags of french fries for \$9.10. What was the cost of one hamburger and what was the cost of one bag of french fries?

L	E	S	C
<p>let x = the cost of 1 hamburger</p> <p>y = the cost of 1 bag of french fries</p>	$5(4x + 3y = 8.40) \rightarrow 20x + 15y = 42$ $-4(5x + 2y = 9.10) \rightarrow -20x - 8y = -36.4$ <hr/> $7y = 5.6$ $y = 0.8$ $4x + 3y = 8.40$ $4x + 3(0.8) = 8.40$ $4x + 2.4 = 8.4$ $-2.4 \quad -2.4$ <hr/> $4x = 6$ $\frac{4x}{4} = \frac{6}{4}$ $x = 1.5$	<p>the cost of 1 hamburger is \$1.50 +</p> <p>the cost of 1 bag of french fries is \$0.80</p>	$4(1.5) = 6$ $3(0.8) = 2.40$ <hr/> 8.40 $5(1.50) = 7.50$ $2(0.80) = 1.60$ <hr/> 9.10

8) A silver medal sold for \$75 and a bronze medal for \$55. The total cost for 120 medals was \$8,600. How many medals of each kind were bought?

L	E	S	C
<p>let x = the # of silver medals bought</p> <p>y = the # of bronze medals bought</p>	$1(75x + 55y = 8600) \rightarrow 75x + 55y = 8600$ $-75(x + y = 120) \rightarrow -75x - 75y = -9000$ <hr/> $-20y = -400$ $\frac{-20y}{-20} = \frac{-400}{-20}$ $y = 20$ $x + y = 120$ $x + 20 = 120$ $-20 \quad -20$ <hr/> $x = 100$	<p>there were 100 silver medals bought + 20 bronze medals bought</p>	$100(75) = 7500$ $20(55) = 1100$ <hr/> 8600 $100 + 20 = 120$

9) David bought 7 shirts of equal value and 4 ties of equal value at a store and paid \$150. At the same store, Tom bought 3 of the same shirts and 5 of the same ties and paid \$84. What was the price of each shirt and tie?

L	E	S	C
<p>let x = the price of 1 shirt +</p> <p>y = the price of 1 tie</p>	$3(7x + 4y = 150) \rightarrow 21x + 12y = 450$ $-7(3x + 5y = 84) \rightarrow -21x - 35y = -588$ <hr/> $-23y = -138$ $\frac{-23y}{-23} = \frac{-138}{-23}$ $y = 6$ $7x + 4y = 150$ $7x + 4(6) = 150$ $7x + 24 = 150$ $-24 \quad -24$ <hr/> $7x = 126$ $\frac{7x}{7} = \frac{126}{7}$ $x = 18$	<p>the price of 1 shirt is \$18 + the price of 1 tie is \$6</p>	$7(18) = 126$ $4(6) = 24$ <hr/> 150 $3(18) = 54$ $5(6) = 30$ <hr/> 84

10) Two angles are complementary. The measure of the larger angle is 30° more than the measure of the smaller angle. Find the measure of each angle.

Let
 x = the measure of the larger #
 y = the measure of the smaller #

$$\begin{aligned} x + y &= 90 \\ x &= y + 30 \end{aligned}$$

$$\begin{aligned} x + y &= 90 \\ y + 30 + y &= 90 \\ 2y + 30 &= 90 \\ \underline{-30 \quad -30} & \\ 2y &= 60 \\ \underline{\quad \quad 2} & \\ y &= 30 \end{aligned}$$

$$\begin{aligned} x + y &= 90 \\ x + 30 &= 90 \\ \underline{-30 \quad -30} & \\ x &= 60 \end{aligned}$$

the smaller # is 30°
 +
 the larger # is 60°

$$\begin{aligned} 30 + 60 &= 90 \\ \underline{\quad \quad} & \\ 30 + 30 &= 60 \checkmark \end{aligned}$$

****Challenge****

11) The sum of two number is 13. If twice the larger number is increased by 2, the result is equal to 5 times the smaller number. Find the numbers.

Let
 x = the larger #
 y = the smaller #

$$\begin{aligned} x + y &= 13 \\ 2x + 2 = 5y \end{aligned}$$

$$\begin{aligned} 2x + 2 &= 5y \\ -5y & \quad -5y \\ \hline 2x - 5y + 2 &= 0 \\ \underline{-2 \quad -2} & \\ 2x - 5y &= -2 \end{aligned}$$

$$\begin{aligned} 2(x + y = 13) &\rightarrow 2x + 2y = 26 \\ -1(2x - 5y = -2) &\rightarrow \underline{-2x + 5y = 2} \\ \hline & 7y = 28 \\ & \underline{\quad \quad 7} \\ & y = 4 \end{aligned}$$

$$\begin{aligned} x + y &= 13 \\ x + 4 &= 13 \\ \underline{-4 \quad -4} & \\ x &= 9 \end{aligned}$$

the smaller # is 4
 +
 the larger # is 9

$$\begin{aligned} 9 + 4 &= 13 \checkmark \\ \hline 2(9) &= 18 \\ 18 + 2 &= 20 \\ \hline 5(4) &= 20 \checkmark \end{aligned}$$