

### Classic Puzzles for Systems of Equations

Age Puzzles: in the future = add, in the past = subtract  
 five years ago =  $x-5$ , five years from now =  $x + 5$

EX: June is 16 years older than Sam. In four years, June will be twice as old as Sam. How old are they now?

$x = \text{June}$      $y = \text{Sam}$

$$\begin{cases} x = y + 16 \\ x + 4 = 2(y + 16) \end{cases}$$

$$\begin{cases} \text{Sam} = 12 \\ \text{June} = 28 \end{cases}$$

$$\begin{aligned} y + 16 + 4 &= 2y + 32 \\ y + 20 &= 2y + 32 \\ -y & \quad -32 \\ \hline -12 &= y \end{aligned}$$

Wind/Current Puzzles: with the wind/current = add,  
 against the wind/current = subtract  
 rate \* time = distance

EX: Chris can row a boat 20 miles in 2.5 hours with the current.  
 It takes three hours to row the same distance against the  
 current. What is the rate of the current?

$x$  = boat's rate     $y$  = current's rate

$$2.5(x+y) = 20 \quad \xrightarrow{\div 2.5} \quad (2.5x + 2.5y = 20)$$

$$3(x-y) = 20 \quad \xrightarrow{\div 3} \quad (3x - 3y = 20)$$

$$3\left(7\frac{1}{3} - y\right) = 20$$

$$22 - 3y = 20$$

$$-3y = -2$$

$$y = \frac{2}{3} \text{ mph}$$

$$\begin{array}{r} 7.5x + 7.5y = 60 \\ + 7.5x - 7.5y = 50 \\ \hline \end{array}$$

$$15x = 110$$

$$x = 7\frac{1}{3} \text{ mph}$$

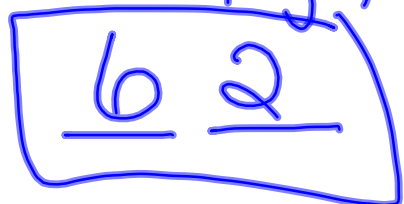
Number/Digit Puzzles: write the value of the number in expanded form ex:  $52 = 5(10) + 2(1)$   $25 = 2(10) + 5(1)$

EX: The sum of the digits of a two-digit number is 8. If 16 is added to the original number, the result is three times the original number with its digits reversed. What is the original number?

$x = \#$  in tens place  
 $y = \#$  in ones place

$10x + y = \text{original } \#$

$10y + x = \#$  w/reversed digits



$$\begin{array}{r} 1 \\ \times 26 \\ 3 \\ \hline 78 \end{array}$$

$x + y = 8$   $x = 8 - y$

$10x + y + 16 = 3(10y + x)$

$10(8 - y) + y + 16 = 3(10y + 8 - y)$

$86 - 10y + y + 16 = 30y + 24 - 3y$

$96 - 9y = 27y + 24$

$96 = 36y + 24$

$72 = 36y$

$y = 2$

Coin Puzzles: one equation for the number of coins  
 one equation for the value of the coins in cents

EX: When Jim cleaned out the reflecting pool at the library, he found 20 nickels and quarters. The collection totaled \$2.60. How many quarters did Jim find?

$x = \text{nickels}$      $y = \text{quarters}$

$$x + y = 20$$

$$.05x + .25y = 2.60$$

$$.25(x + y = 20)$$

Sub

$$\begin{array}{r} x = 20 - y \\ .05(20 - y) + .25y = 2.60 \\ | - .05y + .25y = 2.60 \\ | \phantom{.05y} \phantom{+} \phantom{.25y} \phantom{=} \phantom{2.60} \\ | \phantom{.05y} \phantom{+} \phantom{.25y} \phantom{=} \phantom{2.60} \end{array}$$

Slim

$$\begin{array}{r} .25x + .25y = 5 \\ - .05x + .25y = 2.60 \\ \hline .2x = 2.40 \\ \frac{.2x}{.2} = \frac{2.40}{.2} \end{array}$$

8 quarters  
12 nickels  
 $y = 8$

12 nickels  
8 quarters  
 $x = 12$

Chemical -Solution Puzzles: keep track of the total amount of acid (or solution) in ounces or grams in the original and final solutions

EX: Janet is mixing 15% glucose solution with 35% glucose solution. This produces 35 liters with 19% glucose. How many liters of each solution is she using in the mixture?

$x = \# \text{ liters of } 15\% \text{ glucose}$   
 $y = \# \text{ liters of } 35\% \text{ glucose}$

$$x + y = 35 \rightarrow y = 35 - x$$

$$.15x + .35y = .19(35)$$

$$\rightarrow .15x + .35y = 6.65$$

28 liters 15%  
 7 liters 35%

$$.15x + .35(35 - x) = 6.65$$

$$100(.15x + 12.25 - .35x = 6.65)$$

$$15x + 1225 - 35x = 665$$

$$\begin{array}{r} 15x + 1225 - 35x = 665 \\ -1225 \phantom{=} \\ \hline -20x = -560 \\ \phantom{-20x} \phantom{=} \phantom{=} \\ -20 \phantom{=} \phantom{=} \phantom{=} \\ \hline \phantom{-20x} = -28 \end{array}$$

$$x = 28$$