

3.6 Applications

Solutions

1. One number is 18 more than a second number. If their sum is 62, find the two numbers.

Let first number = x

Let second number = y

$$\begin{cases} x = y + 18 \\ x + y = 62 \end{cases}$$

$$y + 18 + y = 62$$

$$2y + 18 = 62$$

$$\begin{array}{r} -18 \\ \hline \end{array}$$

$$2y = 44$$

$$\frac{2y}{2} = \frac{44}{2}$$

$$y = 22$$

$$x = y + 18 = 22 + 18 = 40$$

The two numbers are 22 and 40.

2. One number is 9 less than another number. If their sum is 47, find the two numbers.

3. Nancy is nine years older than Lisa. In two years she will be four times as old as Lisa. Find their present ages.

	now	in 2 yrs
Nancy	x	$x + 2$
Lisa	y	$y + 2$

$$\begin{cases} x = y + 9 \\ x + 2 = 4(y + 2) \end{cases}$$

$$y + 9 + 2 = 4(y + 2)$$

$$y + 11 = 4y + 8$$

$$\begin{array}{r} -y \\ \hline \end{array}$$

$$11 = 3y + 8$$

$$\begin{array}{r} -8 \\ \hline \end{array}$$

$$3 = 3y$$

$$\frac{3}{3} = \frac{3y}{3}$$

$$1 = y$$

$$x = y + 9 = 1 + 9 = 10$$

Nancy is 10 yrs old and Lisa is 1.

4. Sean is four years older than Stacy. In 5 years, the sum of their ages will be 38. Find their present ages.

Answers: **1.** 22 and 40; **3.** Nancy is 10, Lisa is 1

5. A collection of nickels and dimes contains 6 more dimes than nickels. The total value of the collection is \$1.95. How many nickels and how many dimes are in the collection?

	dimes	nickels	Total
No. of coins	x	y	
Value of coins	$.10x +$	$.05y$	$= 1.95$

$$\begin{cases} x = y + 6 \\ .10x + .05y = 1.95 \end{cases}$$

$$.10(y + 6) + .05y = 1.95$$

$$.10y + .6 + .05y = 1.95$$

$$.15y + .6 = 1.95$$

$$\underline{-.6} \quad \underline{-0.60}$$

$$.15y = 1.35$$

$$\frac{.15y}{.15} = \frac{1.35}{.15}$$

$$y = 9$$

$$x = y + 6 = 9 + 6 = 15$$

There are 9 nickels and 15 dimes.

6. A collection of nickels and dimes contains 3 fewer dimes than nickels. The total value of the collection is \$1.35. How many nickels and how many dimes are in the collection?

	dimes	nickels	Total
No. of coins			
Value of coins			

7. Dorothy invested her income tax return in two separate accounts. She invested part of it at 7% interest and triple that amount at 11% interest. The total first-year interest from the two investments was \$120. How much did she invest at each rate?

	7%	11%	Total
Amount invested	x	y	
Interest earned	$.07x +$	$.11y$	$= 120$

$$\begin{cases} 3x = y \\ .07x + .11y = 120 \end{cases}$$

$$.07x + .11(3x) = 120$$

$$.07x + .33x = 120$$

$$.40x = 120$$

$$\frac{.40x}{.40} = \frac{120}{.40}$$

$$x = 300$$

$$y = 3x = 3 \cdot 300 = 900$$

\$300 was invested at 7% and \$900 was invested at 11%.

8. Lee invested part of his inheritance at 6% interest and four times that amount at 11%. The total first year interest from the two investments was \$1000. How much did he invest at each rate?

	6%	11%	Total
Amount invested			
Interest earned			

Answers: 5. 9 nickels and 15 dimes; 7. \$300 at 7% and \$900 at 11%

9. How many grams of an alloy that is 90% gold should be melted with 40 grams of an alloy that is 30% gold to produce an alloy that is 50% gold?

	90%	30%	50%
Grams of alloy	$x +$	40	$= y$
Grams of gold	$.9x +$	$.3(40)$	$= .5y$

$$\begin{cases} x + 40 = y \\ .9x + .3(40) = .5y \end{cases}$$

$$.9x + .3(40) = .5(x + 40)$$

$$.9x + 12 = .5x + 20$$

$$\begin{array}{r} -.5x \quad \quad -.5x \\ .4x + 12 = \quad 20 \end{array}$$

$$\begin{array}{r} \quad \quad -.12 \quad \quad -.12 \\ .4x \quad \quad = \quad \quad 8 \end{array}$$

$$\begin{array}{r} .4x = 8 \\ .4 \quad .4 \\ x = 20 \end{array}$$

20 grams of 90% alloy is needed.

10. How many grams of an alloy that is 70% silver should be melted with 60 grams of an alloy that is 20% silver to produce an alloy that is 30% silver?

	70%	20%	30%
Grams of alloy			
Grams of silver			

11. How many liters of a 44% saline solution and of 2% saline solution should be mixed to obtain 30 liters of the doctor's recommended 30% saline solution?

	44%	2%	30%
Liters of solution	$x +$	y	$= 30$
Liters of salt	$.44x +$	$.02y$	$= .3(30)$

$$\begin{cases} x + y = 30 \\ .44x + .02y = .3(30) \end{cases} \Rightarrow \begin{cases} -.44(x + y) = -.44(30) \\ -.44x + -.44y = -13.2 \end{cases}$$

$$-.44x + -.44y = -13.2$$

$$.44x + .02y = 9$$

$$-.42y = -4.2$$

$$\frac{-.42y}{-.42} = \frac{-4.2}{-.42}$$

$$y = 10$$

$$x + y = 30$$

$$x + 10 = 30$$

$$\frac{-10}{-10} \quad \frac{-10}{-10}$$

$$x = 20$$

20 gallons of 44% solution and 10 gallons of 2% solution are needed.

12. A farmer needs to mix a 20% nitrogen solution with a 50% solution to obtain 45 gallons of a recommended 40% solution. How many gallons of each solution should he use?

	20%	50%	40%
Gallons of solution			
Gallons of nitrogen			

Answers: **9.** 20 grams of 90% alloy; **11.** 20 gallons of 44% solution and 10 gallons of 2% solution