

Word Problems

- (a) You have some 4% and 10% saline solution (water mixed with salt). How much of each concentration do you need in order to make 500 ml (1 ml = 1 cc (cubic centimeter)) of a 6% solution?

Step 1
define variables

let x = volume of 4% saline solution in ml
 y = volume of 10% saline solution in ml

Step 2
write equations for
the two aspects of
the problem

total volume $x + y = 500$

saline part

salt content of 4% solution + salt content of 10% solution = salt content of 6% solution

$$.04x + .10y = .06(500)$$

$$.04x + .10y = 30$$

Step 3
solve the system

$$x + y = 500$$

$$y = -x + 500$$

$$y = -\left(333\frac{1}{3}\right) + 500$$

$$y = 166\frac{2}{3} \text{ ml}$$

of 10% saline solution

$$100 \cdot (.04x + .10y) = (30) \cdot 100$$

$$4x + 10y = 3000$$

$$4x + 10(-x + 500) = 3000$$

$$4x - 10x + 5000 = 3000$$

$$-6x = -2000$$

$$x = \frac{2000}{6} = \frac{1000}{3} = 333\frac{1}{3} \text{ ml}$$

of 4% saline solution

- (b) You have some 20% and 45% HCl solution (hydrochloric acid in water). How much of each concentration do you need in order to make 800 ml of a 30% solution?

Step 1
define variables

let x = volume of 20% HCl solution in ml
 y = volume of 45% HCl solution in ml

Step 2
write equations for
the two aspects of
the problem

total volume $x + y = 800$

acid part

acid content of 20% solution + acid content of 45% solution = acid content of 30% solution

$$.20x + .45y = .30(800)$$

$$.20x + .45y = 240$$

(480, 320)

(c) Small picture frames cost \$5.50 to produce and sell for \$7.50. Large frames cost \$12.00 and sell for \$15.00. If the production budget is \$940 and the desired revenue from sales is \$1200, how many of each frame should be made?

let x = quantity of small frames made/sold
 y = quantity of large frames made/sold

	small frames	+	large frames	=	total
production cost	$5.50x$		$12y$		940
revenue	$7.50x$		$15y$		1200

(40, 60)

(d) The swim team is holding a fundraiser. They buy cards for \$2/each and bouquets for \$3.50/each. They sell the cards for \$6/each and the bouquets for \$8/each. They have \$360 and need \$900 in revenue. How many of each should they get?

let x = quantity of cards bought/sold
 y = quantity of bouquets bought/sold

	cards	+	bouquets	=	total
cost to buy items	$2x$		$3.50y$		360
revenue from sales	$6x$		$8y$		900

(54, 72)

(e) Fred has saved \$25000 and would like to earn \$1300/year by investing his money. He has two ways to invest his money: a high-yield bond fund which earns 6%/year, and a mortgage bond fund which earns 2%/year. How much should he invest in each fund to realize his goal?

let x = amount invested in the HYBF
 y = amount invested in the MBF

	HYBF	+	MBF	=	total
total invested	x		y		25000
earnings	$.06x$		$.02y$		1300

(20000, 5000)

(f) Sue has saved \$40000 and would like to earn \$2340/year by investing her money. She has two ways to invest her money: a high-risk stock fund which earns 9%/year, and a dividend stock fund which earns 4.5%/year. How much should she invest in each fund to realize her goal?

let x = amount invested in the HRSF
 y = amount invested in the DSF

	HRSF	+	DSF	=	total
total invested	x		y		40000
earnings	$.09x$		$.045y$		2340

(12000, 28000)

(g) One unit of chocolate has 9 grams of fat and 12 grams of carbohydrates. One unit of whole milk has 7 grams of fat and 2 grams of carbs. How many units of each mixed together would give you chocolate milk that has 97 grams of fat and 56 grams of carbohydrates?

let x = units of chocolate
 y = units of whole milk

	chocolate	+	whole milk	=	total
fat	$9x$		$7y$		97
carbs	$12x$		$2y$		56

(3, 10)

(h) Tam's football team scored 9 times in one game for a total of 43 points. They scored touchdowns worth 7 points each, and field goals worth 3 points each. How many TDs and FGs did they score?

let x = number of TDs scored
 y = number of FGs scored

	TDs	+	FGs	=	total
total scores	x		y		9
points	$7x$		$3y$		43

(4, 5)