

Instructions: Complete the following problems. You may work alone or in a group. Do not just copy answers from a group member, but be sure that you understand the problem. Similar questions will appear on exams. You may be asked to explain or present the answers to the class. This assignment is due at the end of the class period.

1. If the sum of two numbers is 78, and their difference is 22. Write the equations that determine the value of the two numbers.

$$\begin{array}{l} x = 1^{\text{st}} \# \\ y = 2^{\text{nd}} \# \end{array} \quad \begin{array}{l} x + y = 78 \\ x - y = 22 \end{array}$$

2. Suppose that you own a coffee company. You want to make a house blend of two types of coffee. The first type is a dark roast that sells at \$6.50 per pound. The second is a hazelnut flavoured coffee that sells for \$7.00 per pound.

- a. If you sold 10 pounds of the dark roast coffee how much would it be worth?

$$6.50(10) = \$65.00$$

- b. If you sold x pounds of the dark roast, write an expression for how much that would cost.

$$6.50x$$

- c. If you sold 10 pounds of the hazelnut coffee, how much would that cost?

$$7.00(10) = \$70.00$$

- d. If you sold y pounds of the hazelnut, write an expression for how much that would cost?

$$7y$$

- e. What is the total cost of coffee sold if you sell 10 pounds of each type?

$$65 + 70 = \$135$$

- f. What is the total cost of coffee solve if you sell x pounds of the dark roast, and y pounds of the hazelnut?

$$6.5x + 7y$$

- g. If you sell ten pounds of each type, how much coffee is being sold in pounds?

$$10 + 10 = 20$$

- h. If you sell x pounds of dark roast and y pounds of hazelnut, how many pounds of coffee did you sell?

$$x + y$$

- i. Suppose that you want to make a blend of the two coffees, 50 pounds of it, that will sell for \$6.25 per pound. How much should the total mixture cost?

$$6.75$$

$$6.75(50) = \$337.50$$

- j. Use the information from parts f, h, and i to write a system of equations to solve the problem.

$$\begin{aligned} x + y &= 50 \\ 6.5x + 7y &= 337.50 \end{aligned}$$

- k. Solve the system. How much coffee of each type is needed for the blend?

$$\begin{aligned} x &= 50 - y \\ 6.5(50 - y) + 7y &= 337.50 \\ 325 - 6.5y + 7y &= 337.50 \\ 325 + .5y &= 337.50 \\ \underline{-325} \quad \quad \quad \underline{-325.00} & \end{aligned}$$

25 lbs of each

$$\frac{.5y}{.5} = \frac{12.5}{.5} \Rightarrow y = 25$$

$$x = 50 - 25 = 25$$

3. Suppose that you cash out your retirement account to send your children to college. You receive \$50,000 from the account. You want to invest the money in two chunks, some that will be available immediately for this year's expenses and some that will be available in a year for next year. The short-term account you choose to be a savings account that receives only 1% interest per year, and the long-term bonds receive 4% per year. To keep pace with the cost of inflation, you want to earn at least \$1000 in interest on the two accounts. Write a system of equations to solve for the amount of money in each account. Be sure to clearly state all variables.

$$X = \text{amt in savings}$$

$$Y = \text{amt in bonds}$$

$$X + Y = 50,000$$

$$Y = 50,000 - X$$

$$.01X + .04Y = 1000$$

$$.01X + .04(50,000 - X) = 1000$$

$$.01X + 2000 - .04X = 1000$$

$$\frac{-.03X}{-.03} = \frac{-1000}{-.03} \Rightarrow X = 33,333.33$$

$$Y = 16,666.67$$

Since it's "at least" you can put more in bonds but not less.

4. Suppose you take a canoe down the river to the next park landing, 8 miles downstream. It takes you 2.5 hours to make it there. Then you decide to row back against the current to where you started to pick up your car. That takes 3.2 hours to get back. Write a system of equations, and solve for the speed of the canoe in Stillwater and the speed of the current.

$$d = 8 \quad t = 2.5 \quad r = b + c \quad \text{downstream} \quad b = \text{boat speed (canoe)} = 2.85$$

$$\frac{8}{2.5} = \frac{2.5(b+c)}{2.5} \Rightarrow 3.2 = b+c$$

$$c = \text{current speed} = .35$$

$$d = 8 \quad t = 3.2 \quad r = b - c \quad \text{upstream}$$

$$\frac{8}{3.2} = \frac{3.2(b-c)}{3.2} \Rightarrow 2.5 = b-c$$

$$b+c = 3.2$$

$$b-c = 2.5$$

$$\frac{2b}{2} = \frac{5.7}{2}$$

$$b = 2.85 \quad c = 3.2 - 2.85 = .35$$

5. How long would it take for the same canoe to cross a lake 12 miles wide with no current?

$$d = 12 \quad b = 2.85 = r$$

$$\frac{d}{r} = t = \frac{12}{2.85} = 4.2 \text{ hours}$$

6. The perimeter of a rectangular window is 162 inches. If the height of the window is 80% of the width, find the dimensions of the window.

$$P = 2l + 2w = 162$$

$$h = w = .8w$$

$$162 = 2(.8w) + 2w$$

$$162 = 1.6w + 2w$$

$$\frac{162}{3.6} = \frac{3.6w}{3.6}$$

$$w = 45$$

$$l = h = .8(45) = 36$$

$$36 \times 45$$

7. The average airspeed of a single-engine aircraft is 150 miles per hour. If the aircraft flew the same distance in two hours with the wind as it flew in 3 hours against the wind, what was the effect of the wind on the plane (i.e. what is the windspeed)?

$$p = 150 \quad t = 2$$

$$(150 + w)2 = d \Rightarrow \frac{d}{2} = 150 + w$$

$$(150 - w)3 = d \Rightarrow \frac{d}{3} = 150 - w$$

$$\left(\frac{1}{2} + \frac{1}{3}\right)d = 300$$

$$\frac{5}{6}d = 300 \Rightarrow d = 300 \cdot \frac{6}{5} = 360$$

$p =$ speed of plane in still air
 $w =$ wind speed

$$\frac{360}{2} = 150 + w$$

$$180 - 150 = w$$

$$w = 30 \text{ mph}$$

8. The sum of the digits of a two-digit number is 6. If the digits are reversed, the difference between the new number and the original number is 18. Find the original number using a system of equations.

$$\# \overline{xy} = 10x + y \quad \# \overline{yx} = 10y + x$$

$$x + y = 6$$

$$(10x + y) - (10y + x) = 18$$

$$10x + y - 10y - x = 18$$

$$(9x - 9y = 18) / 9$$

$$x - y = 2$$

$$x + y = 6$$

$$x - y = 2$$

$$2x = 8$$

$$x = 4$$

$$y = 2$$

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