MA 15200 Lesson 12 Appendices B, C, and D

This lesson continues with applied problems that result in linear equations of one variable.

I Mixture Problems

Suppose a chemist needs 25 mL of 25% sulfuric acid, but only has 40% and 10% concentrations available. How much of each would be needed to achieve the desired result?

A grocer want to mix almonds that sell for \$3.70 a pound with 16 pounds of peanuts that sell for \$2.20 a pound. How many pounds would be needed to get a mix of that would sell for \$2.90 a pound?

The above problems are examples of mixture problems. Two concentrations are mixed together to get a required concentration. Or, two quantities worth different amounts per unit are mixed to get a total worth a certain amount per unit.

I use the following types of diagrams to find the equations for these types of problems. For the first example above, this would be my diagram.

concentration 40%	+	concentration 10%	=	concentration 25%
amount x		amount 25 - x		amount 25

The equation would be found using this sentence:

amount of acid in first + amount of acid in 2^{nd} = amount of acid in mix

and the equation is $0.40x + 0.10(25 - x) = 0.25(25)$.

For the second example above, this would be my diagram.

price/pound \$3.70	+	price/pound \$2.20	=	price/pound \$2.90
amount x		amount 16		amount $(x + 16)$

The equation would be found using this sentence:

value of the almonds + value of the peanuts = value of the mix

and the equation is $3.7x + 2.2(16) = 2.9(x + 16)$

Ex 1: A small truck has a radiator that holds 20 liters total. A mechanic needs to fill the radiator with a solution that is 60% antifreeze. How many liters of a solution that is 70% antifreeze should she mix with a solution that is 30% antifreeze to achieve the desired mix?

Ex 2: How many gallons of distilled water must be mixed with 50 gallons of 30% alcohol solution to obtain a 25% solution?

Ex 3: How many gallons of pure alcohol must be mixed with 50 gallons of 30% alcohol solution to obtain a 45% solution? (Round to the nearest tenth, if needed.)

Ex 4: How many pounds of an a cheaper candy worth \$2.50 per pound must be mixed with 30 pounds of more expensive candy worth \$3.00 per pound to get a mix that sells for \$2.80 per pound?

Ex 5: Karen wants to make 100 cartons of a punch that will sell for \$2.80 a carton. She is mixing an orange-aide mix that sells for \$3.20 a carton and a berry mix that sells for \$2.20 a carton. How many cartons of each type should she use?

II Uniform Motion Problems

Several applied problems relate distance, rate, and time. Every one of these problems uses the formula $d = rt$ somewhere in the problem. It is also helpful to make a table with distance, rate, and time as the headings of 3 columns and the categories compared in rows below. **Always let the variable equal what you are asked to find in these problems.**

Ex 6: Suzi drove home at 60 mph, but her brother Jim, who left at the **same** time, could drive only 48 mph. When Suzi arrived, Jim still had 60 miles to go. How far did Suzi drive?

	distance	rate	time
Suzi	x	60	
Jim	x - 60	48	

Ex 7: One morning, John drove 5 hours before stopping to eat. After lunch, he increased his speed by 10 mph. If he completed a 430-mile trip in 8 hours of driving time, how fast did he drive in the morning?

	distance	rate	time
1st part of trip			
2nd part of trip			

For the following problem you need to remember that a current (or wind) can vary rate of a boat (or plane). If a boat ordinarily travels at 20 mph in still water and the current is flowing at 3 mph, the rate going downriver is (20 + 3) mph and the rate going upriver is (20 - 3) mph.

Ex 9: Nigel travels 36 miles upriver in 2 hours and turns around and travels back to his starting point in 1 ½ hours. If the current is flowing at 3 mph and Nigel drove the boat at a constant rate, what is the rate of the boat?

	distance	rate	time
upriver			
downriver			

If person or machine *A* can complete a job in *a* hours and person or machine *B* can complete the same job in *b* hours, the part of the job each does in one hour is represented by $\frac{1}{a}$ and $\frac{1}{b}$. If both work at the same time (*x* hours) until the job is done, the work is represented by $\frac{1}{a}(x)+\frac{1}{b}(x)=1\text{ job}$. In other words (rate)(time) + (rate)(time) = 1 job

Ex 10: An old computer can do the weekly payroll in 5 hours. A newer computer can do the same payroll in 3 hours. How long will it take both computers working together to finish the job? (Round to the nearest tenth of an hour, if necessary.)

Ex 11: One pump can fill a gasoline storage tank in 8 hours. With a second pump working simultaneously, the tank can be filled in 3 hours. How long would it take the second pump to fill the tank operating alone?

Ex 12: Lynn can mow a large community lawn in 2 hours alone and Lisa can mow the same lawn with the same type of mower in 3 hours alone. Lynn has already been mowing for 1 hour when Lisa joins her. How long would it take them to finish mowing the lawn?

Ex 13: A conservationist is trying to estimate the number of fish in a small lake. He removes 100 fish from the lake and tags them. Three weeks later, he returns and collects 500 fish, 25 which had been previously tagged. Approximately, how many fish are in the lake?