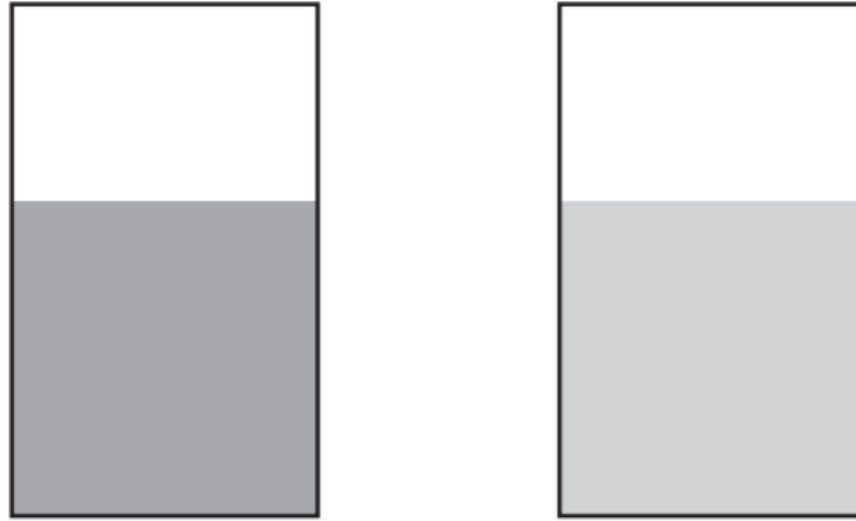# Warm Up

Solve for x.

1. $32 = \dfrac{x}{2}$

2. $\dfrac{3}{4} + \dfrac{4}{x} = 1$

3. $\dfrac{x}{10} + \dfrac{x}{20} = 1$

You have two containers—one holds cranberry juice and one holds ginger ale. The volume of liquid is the same in each container.

Suppose you do the following:

- Take exactly one cup of cranberry juice and pour it into the ginger ale container. Assume that the cranberry juice mixes perfectly into the ginger ale.
- Take exactly one cup from the cranberry juice and ginger ale mixture and pour it back into the cranberry juice container.

1. **Is there more cranberry juice in the ginger ale or more ginger ale in the cranberry juice? Write a paragraph to make your argument.**

Think about:

Suppose the containers were full of marbles–100 red for cranberry juice and 100 yellow for ginger ale.

This can help you solve the original problem.

It takes Anita's team 20 hours to attach all of the rink boards, and it takes Martin's team 30 hours to attach all of the rink boards. This year, however, their boss has asked them to work together to get the job done faster.

1. **Determine the portion of the rink each team completes in the given number of hours.**

<u>**Anita's Team**</u>

1 hour:

5 hours:

10 hours:

<u>**Martin's Team**</u>

1 hour:

5 hours:

10 hours:

2. Consider the amount of the rink that each team can complete in *x* hours.

   a. Write an expression to represent the portion of the rink that Anita's team can complete in *x* hours.

   $$\frac{x}{20}$$

   b. Write an expression that represents the portion of the rink that Martin's team can complete in *x* hours.

   $$\frac{x}{30}$$

3. Each team's rate of work is defined as the number of jobs completed per hour. In this case, the rate of work is the number of rinks completed per hour.

   a. Determine Anita's team's rate of work. $\dfrac{1}{20}$

   b. Determine Martin's team's rate of work. $\dfrac{1}{30}$

4. Complete the table.

	Portion of the Rink Completed	Time Spent Working	Rate of Work
	Rinks	Hours	$\dfrac{\text{Rinks}}{\text{Hour}}$
Anita's Team	$\dfrac{x}{20}$	x	$\dfrac{1}{20}$
Martin's Team	$\dfrac{x}{30}$	x	$\dfrac{1}{30}$
Entire Job, or 1 Rink	$\dfrac{x}{20} + \dfrac{x}{30}$	x	

5. Consider the expression from the table that represents the portion of the rink that Anita's and Martin's teams can complete when working together. If you want to determine the total time it takes the two teams to complete one rink while working together, what should you set this expression equal to?

$$\frac{x}{20} + \frac{x}{30} = 1$$

6. Write and solve an equation to determine the total time it takes the two teams to complete the rink.

$$\frac{x}{20} + \frac{x}{30} = 1$$

7. Suppose that the two teams work together attaching rink board ads for 4 hours each day. How many days will it take them to complete the job?

Maureen is a community volunteer. She volunteers by watering the large vegetable garden in her neighborhood. Sometimes, Maureen's friend Sandra Jane also volunteers.

8. **It takes Maureen 90 minutes to water the garden. When Maureen and Sandra Jane work together, they can complete the job in 40 minutes.**

   a. **Complete the table. Let x represent the time it takes Sandra to water the garden if she works alone.**

	Portion of the Garden Watered	Time Spent Watering	Rate of Watering
	Gardens	Minutes	$\dfrac{\text{Gardens}}{\text{Minute}}$
Maureen	$\dfrac{40}{90}$	40	$\dfrac{1}{90}$
Sandra Jane	$\dfrac{40}{x}$	40	$\dfrac{1}{x}$
Entire Job, or 1 Garden	$\dfrac{40}{x} + \dfrac{4}{9}$	40	

b. **Write and solve an equation to determine the total time it would take Sandra Jane to water the garden if she were working alone.**

$$\frac{40}{x} + \frac{4}{9} = 1$$

A mixture problem involves the combination of two or more substances and the concentration, or density, of one substance relative to the other.

Manuel is a taking a college chemistry course, and some of his time is spent in the chemistry lab. He is conducting an experiment for which he needs a 2% salt solution. However, all he can find in the lab is 120 milliliters (mL) of 10% salt solution.

1. **How many milliliters of salt and how many milliliters of water are in 120 mL of 10% salt solution?**

$$0.10(120) = 12ml \qquad\qquad 0.90(120) = 108ml$$

2. **What would the concentration of the salt solution be if Manuel added 80 mL of water? 180 mL of water?**

$$\frac{12ml}{200ml} = 0.06 \qquad\qquad \frac{12ml}{300ml} = 0.04$$

3. **Write and solve an equation to calculate the amount of water Manuel needs to add to the 120 mL of 10% salt solution to make a 2% salt solution. Let x represent the amount of water Manuel needs to add.**

$$\frac{12}{x+120} = 0.02$$

Toni is working on a chemistry experiment. She has 20 mL of a 20% sulfuric acid solution that she is mixing with a 5% sulfuric acid solution.

4. **Describe the range of possible concentrations for the new solution.**

5. **Suppose that the 20 mL of 20% sulfuric acid solution is mixed with 10 mL of the 5% sulfuric acid solution. What is the concentration of the resulting solution? Explain your reasoning.**

$$\frac{0.20(20)+0.05(10)}{20+10} =$$

6. **Write and solve an equation to calculate the amount of 5% sulfuric acid solution Toni added if the resulting solution is a 12% sulfuric acid solution. Let *x* represent the amount of 5% sulfuric acid that Toni added.**

$$\frac{0.05(x) + 0.20(20)}{x + 20} = 0.12$$

$$\frac{0.05(x) + 4}{x + 20} = 0.12$$