## Concept



Work = Rate 
$$\cdot$$
 Time

Work = the number of jobs to be completed (1 job = 1 work)



Rate = how fast the work can be done (always a ratio)

Time = how long someone is working to complete the job(s)

\*\*Solving the equation Work = Rate · Time for Rate yields the following definition:

$$Rate = \frac{Work}{Time} = \frac{1 \ job \ completed}{time \ to \ complete \ the \ job}$$

We will use this definition to write expressions for Rate in what are often called "Work Problems."

## Concept

First, we are going to learn how to write expressions for Rate.

1. If Carlos can mow the back lawn in 30 minutes, what is his rate?

$$Rate = \frac{1 \ lawn \ mown}{30 \ minutes}$$

This also means: an average of  $\frac{1}{30}$  of the lawn is moved each minute

2. Samantha can paint a new shed in 5 hours. What is the rate at which she paints the shed?

$$Rate = \frac{1 \ shed \ painted}{5 \ hours}$$

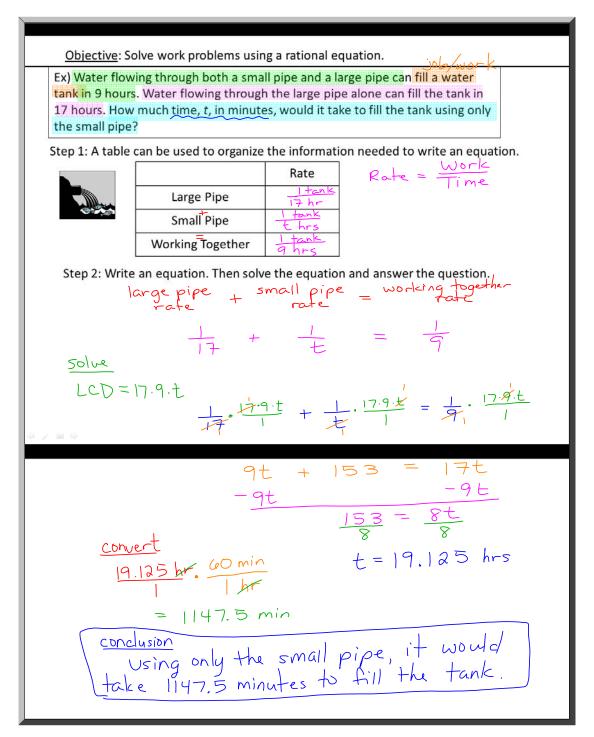
This also means: an average of  $\frac{1}{5}$  of the shed is painted each hour

3. If Thomas can run a mile in 7.2 minutes, what is his rate?

$$Rate = \frac{1 \ mile \ run}{7.2 \ minutes}$$

This also means: an average of about 0.14 of the mile is run each minute





Practice) Kevin can clean a large aquarium tank in about 7 hours. When Kevin and Lara work together, they can clean the tank in 4 hours. How long would it take, in hours and minutes, for Lara to clean the tank if she worked by herself?

	Rate
Kevin	$\frac{1}{7}$
Lara	$\frac{1}{t}$
Working Together	$\frac{1}{4}$



Kevin's work + Lara's work = 1 clean tank

$$\frac{1}{7} + \frac{1}{t} = \frac{1}{4}$$

$$\frac{1}{7} \cdot (28t) + \frac{1}{t} \cdot (28t) = \frac{1}{4} \cdot (28t)$$

$$4t + 28 = 7t$$

$$28 = 3t$$

$$t = \frac{28}{3} = 9\frac{1}{3} \text{ hours} = 9 \text{ hours } 20 \text{ minutes}$$
$$\left(\frac{1}{3} \text{ hour} \cdot \frac{60 \text{ min}}{1 \text{ hour}} = 20 \text{ min}\right)$$

If Lara worked by herself, it would take her 9 hours and 20 minutes to clean the tank.

Objective: Solve work problems using a rational equation.  Ex) Nathan can paint a room in 8 hours. His brother John would need 12 hours to paint the same room. If they work together, how long will it take, in hours and minutes, to paint the room?					
	Rate <sub>Nathan</sub>   room   8 hr	Rate <sub>John</sub>	=Rate <sub>together</sub>		
<u>solve</u> .	184.2	+ <del>1</del> <del>12</del> 4.3	= +		
LCD = 4.		1.34t	+ 12. 21+	= 1.24/	
If the work toget	brothers her, it	3+	+ 2t $5t = 2t$	<b>.</b>	
will take 48 minutes	4 hours			or 4.8 hr omin = 48 min	

Practice) One incinerator can process a day's garbage in 14 hours. When the first incinerator is broken, a second incinerator can process a day's garbage in 20 hours. If both incinerators are working, how many hours, to the nearest tenth, will it take to process a day's garbage?

$Rate_{Incinerator 1}$	Rate <sub>Incinerator 2</sub>	Rate <sub>together</sub>	
1	1	1	
14	20	$\overline{t}$	

Incinerator 1's rate + Incinerator 2's rate = rate together

$$\frac{1}{14} + \frac{1}{20} = \frac{1}{t}$$

$$\frac{1}{14} \cdot (140t) + \frac{1}{20} \cdot (140t) = \frac{1}{t} \cdot (140t)$$

$$10t + 7t = 140$$

$$17t = 140$$

$$t \approx 8.2 \text{ hours}$$

If both incinerators are working it will take about 8.2 hours to process a day's garbage.

## Closure

Explain how you can recognize when you are reading a "Work Problem."

A "Work Problem" can be recognized because the situation describes an activity being completed by two or more people/objects in a certain amount of time.