Handout #1

Rocio, what's a rate?

Rates are used to describe how much or how fast something happens **per** some unit of time. The word 'per' means 'every'. So, one way to think of a rate is "a rate is the rate of something happening **per** unit of time".

We use rates to describe:

1. How fast or slowly something is moving. For example, a train travels 1000 miles **every** day or 1000 miles **per** day.
2. How fast or slowly somebody is doing something. For example, Rocio can type 50 words **every** minute or **per** minute.
3. How fast or slowly something is growing or shrinking. For example, the bathtub filled by 1 inch **every** minute.

Let's take an example. Below is a speedometer. You find them in cars and they report **how fast your car is going.**

Now, it's a good thing we know about **decimals**, **fractions**, **percents**, and **ratios** because they are necessary when working with rates.

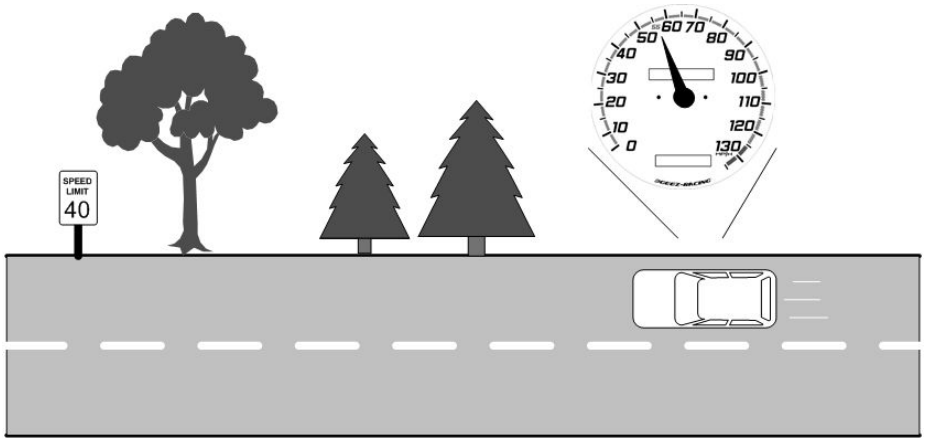
In America, speedometers report speed in miles **per** hour. The key word is **per**. That tells you this is a rate. You can write this rate as a ratio like this:

 # miles : 1 hour

You can also write it as a fraction like this:

$$\frac{\#\text{ miles}}{1\text{ hour}}$$

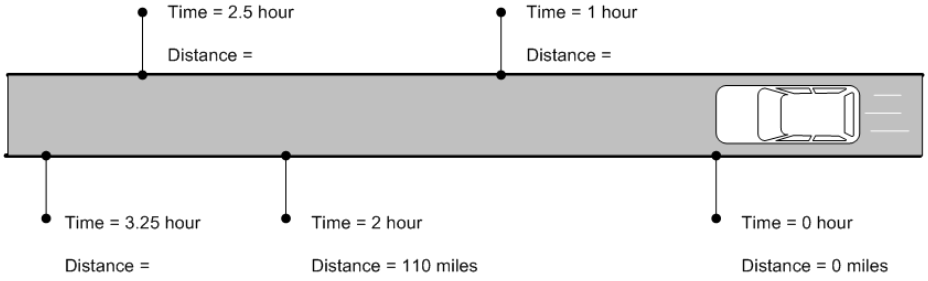
A car is traveling at 55 miles per hour (mph) in a 40 miles per hour (mph) zone:



So how far as the car gone in 2 hours? Well, it goes 55 miles every hour, so we set the problem up like this:

$$\frac{55\text{ miles}}{1\text{ hour}} \times \frac{2\text{ hours}}{1} = \frac{55\text{ miles}}{1\ \cancel{\text{hour}}} \times \frac{2\ \cancel{\text{hours}}}{1} = 55\text{ miles} \times 2 = 110\text{ miles}$$

With you tutor, fill in the rest of this chart:



*If the driver **was going the speed limit**, how far would he have gone in 3.25 hours?*

How much further did he go in 3.25 hours by going 55 mph instead of 40 mph (assuming he didn't get a ticket for speeding!?):

1 9 out of 10 Dentists Agree . . .

Sometimes the rate won't be given to you as an **integer**, a **percent**, or a **decimal** number. Sometimes the problem will express the rate as a **fraction** or a **ratio**.

Let's say that a problem says: "9 out of 10 dentists agree that ScrubScrub toothpaste is the best toothpaste on the market".

We can express this as a **unit rate** or **base rate**. That is we can write this as fraction like this:

$$\frac{\text{\# dentists who like ScrubScrub}}{\text{total \# of dentists}}$$

For this problem we can write:

$$\frac{\text{9 dentists who like ScrubScrub}}{\text{10 dentists}}$$

Which equals:

9 ÷ 10 = 0.9 dentists like ScrubScrub per dentist

Now let's take this problem:

9 out of 10 dentists agree that ScrubScrub toothpaste is the best toothpaste on the market. Out of 2000 dentists, how many prefer ScrubScrub?

How do we solve this? Well, just like before. We already found our rate -- it's **.9**!

So now we just **apply our rate**:

2000 dentists × 0.9 = 1800 dentists

Please take note! We could also multiply by the **fraction** instead of the decimal (called **setting up a proportion**).

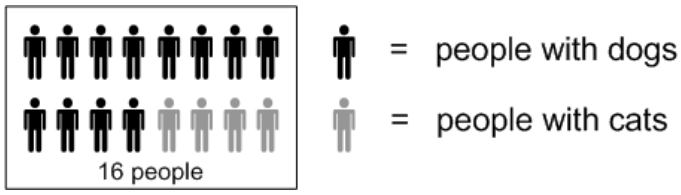
We set this up like this:

$$\frac{9 \text{ dentists}}{10 \text{ dentists}} \times \frac{2000 \text{ dentists}}{1}$$

And we solve it like this:

$$\frac{9 \text{ dentists}}{10 \text{ dentists}} \times \frac{2000 \text{ dentists}}{1} = 1800 \text{ dentists}$$

Let's take a problem: *In the town of Dogsburg 4 out of 16 people have cats. 12 out of 16 people have dogs. If the population of the town is 48 people, how many have cats and how many have dogs.*



Here's two good ways to solve the problem. Let's start by finding the number of cats:

1 ***First, find the unit rate (rate per person) and then apply the rate to the entire population.***

Step 1: ***find*** *the unit rate*

$$\frac{4 \text{ cats}}{16 \text{ people}} = 4 \text{ cats} \div 16 \text{ people} = 0.25 \text{ cats } \textbf{\textit{per}} \text{ person}$$

Step 2: ***apply*** *the rate*

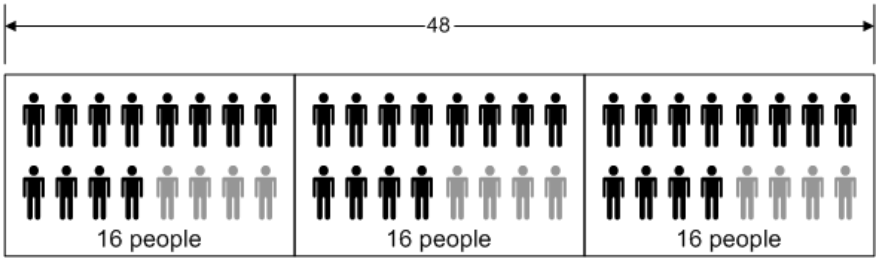
48 people x 0.25 cats per person = 48 x 0.25 = 12 cats

2 ***Set up a proportion.***

For example, we have:

$$\frac{4 \text{ cats}}{16 \text{ people}} \times \frac{48 \text{ people}}{1} = \frac{4 \text{ cats}}{\cancel{16 \text{ people}}\ {}_{1}} \times \frac{\cancel{48 \text{ people}}\ {}^{3}}{1} = 4 \text{ cats} \times 3 = 12 \text{ cats}$$

You can picture this visually like this:



Use the method ***find the unit rate per person and then apply the rate to the entire population*** *to find the number of dogs in Dogsburg:*

Use the method ***set up a proportion*** *to find the number of dogs in Dogsburg:*

Questions

Find the *unit rate* or *amount per unit* for each problem:

Q1 A company can build 120 houses every 3 months *(how many houses can they build in 1 month):*

Q2 Xi drove 1023 miles and used 40.75 gallons of gas. *(what's his miles per gallon or mpg):*

Q3 John can type 240 words in 4 minutes: *(how many words can he type in 1 minute):*

Q4 A train can travel from Chicago to Minneapolis (a distance of 600 miles) in ten hours: *(on average, how fast is the train going in miles per hour):*

Solve the following problems with your tutor:

Q5 John can type 240 words in 4 minutes. How many works can he type in 20 minutes?

Q6 Rocio is making cupcakes for school. The recipe calls for 3 cups of flour for every 12 cupcakes. How much flour does Rocio need to make 60 cupcakes?

Q7 On average, John makes 3 out of every 8 free throws. If he shoots 72 free throws, how many will he make on average?

Q8 9 out of 10 dentists prefer the taste of ScrubScrub toothpaste. In a room of 3,432 dentists, how many will like ScrubScrub?

Q9 Xi drove 1023 miles and used 40.75 gallons of gas. How far can he drive if he has 3.25 gallons of gas?

Handout #1

-- scratch paper --