

Course 2 Unit 4  
Lesson 2 Investigation 1 Travel Times

**Lesson 2: Inverse Variation**  
**Investigation 1 page 250**

Many American take long car trips for business, vacations, and, sometimes, just commuting to work. While driving at slower speeds can save gas, driving at faster speeds can save time. For example, a 300-mile trip takes 6 hours at 50 mph, but only 5 hours at 60 mph. Think about how driving time would change if an average speed of 50 mph decreased to 40 mph.

Suppose that your family is planning a 250 mile trip by car to visit relatives. Your average speed could vary from as little as 20 mph to 60 mph or more. Your average speed depends on what roads you take, traffic, weather, speed limits, and the driver's preferred pace.

- How long will that 250 mile trip take if you average:
  - 20 mph **12.5 hrs**
  - 40 mph **6.25 hrs**
  - 60 mph **4.2 hrs**
- Write a rule that gives time of trip  $t$  as a function of the average driving speed  $s$ .

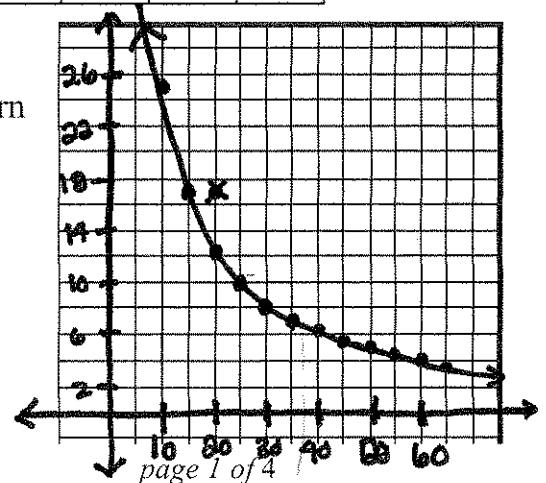
$$t = \frac{250}{s} = y = \frac{250}{x}$$

- Use your calculator to make a table showing (speed, time) data for the 250 mile trip. Graph the relation.

Speed (mph)	10	15	20	25	30	35	40	45	50	55	60	65
Time (hours)	25	16.7	12.5	10	8.3	7.1	6.25	5.6	5	4.5	4.2	3.8

- Describe as accurately as possible, the pattern relating average speed and time of your trip. How is that pattern shown in the table and graph?

As the speed increases, the time decreases



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3. How do each of the following increases in average speed affect the time for the 250 mile trip?

- Increase from 20mph to 30mph

Decreases the time by 5.4 hrs

- Increase from 35 mph to 45 mph

Decreases the time by 1.5 hrs

- Increase from 50 mph to 60 mph

Decreases the time by 1.2 hrs

4. Estimate the average speed necessary to complete the trip in 4.5 hours. How did you find the estimate?

$$4.5 = \frac{250}{s}$$

$$s = \frac{250}{4.5}$$

$$s = 55.6 \text{ mph}$$

$$4.5s = 250$$

5. Now think about the relation between speed and time for a 300 mile trip.

a. What equation relates driving time  $t$  and average speed  $s$  for such a trip?

$$t = \frac{300}{s}$$

b. Which will produce a greater change in driving time: an increase from 40 to 60 mph or a decrease from 40 to 20 mph?

Increase from 40 - 60:

time decreases

2.5 hrs

Decrease from 40 - 20:

time increases

7.5 hrs

Bigger change →

c. Estimate the average speed necessary to complete the trip in 4.5 hours.

$$4.5 = \frac{300}{s}$$

$$4.5s = 300$$

$$s = \frac{300}{4.5}$$

$$s = 66.7 \text{ mph}$$

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- a. What equation will relate distance  $d$ , average speed  $s$ , and driving time  $t$  for a trip?

$$t = \frac{d}{s}$$

- b. How does an increase in average speed change the expected driving time for a fixed distance?

The greater the speed, the less time it takes

- c. How is your answer to part b shown in the graphs of  $(\text{speed}, \text{time})$  relations for any fixed distance?

The graph is decreasing as ~~time~~  
speed ( $x$ ) is approaching  $\infty$ .

- d. How is your answer to part b related to the form of speed-time modeling equations for any fixed distance?

No matter what the distance is,  
the faster the speed, the less time  
it takes to cover the distance.

ON YOUR OWN page 252

The distance between New York and Los Angeles is approximately 3000 miles.

- a. How long will a trip from NY to LA take

- By airplane, averaging 450 mph
- By car, averaging 60 mph
- By bicycle, averaging 15 mph

- b. What equation gives the time  $t$  for the trip as a function of the average speed  $s$ ?

Do on your own!