## Going Round-Trip with the World’s Fastest Land Animal

**According to the *Travel Almanac*, the world’s fastest land animal is the cheetah. It can travel at up to 70 mph. Think of this scenario: A cheetah sitting under a tree sprints toward its prey at 70 mph. It runs back to its initial spot by the tree at a modest 40 mph. The cheetah has embarked on a round-trip. Going from point A to point B, the cheetah traveled at an average rate of 70 mph. Returning to point A, the cheetah traveled at an average rate of 40 mph.**

**Can we say that this cheetah’s average rate was 55 mph?**

**That’s one of the things you’ll determine as you work to complete this task. Make a conjecture. What do you think the answer will be?**

## Directions:

Complete each of the following tasks, reading the directions carefully as you go. Be sure to show all work where indicated and to insert images of graphs when needed. Make sure that all graphs or screenshots include appropriate information, such as titles and labeled axes. If your word processing program has an equation editor, you can insert your equations here. Otherwise, print this activity sheet and write your answers by hand.

You will be graded on the work you show, or your solution process, in addition to your answers. Make sure to show all of your work and to answer each question as you complete the task. Type all of your work into this document so you can submit it to your teacher for a grade. You will be given partial credit based on the work you show and the completeness and accuracy of your explanations.

Your teacher will give you further directions as to how to submit your work. You may be asked to upload the document, e-mail it to your teacher, or hand in a hard copy.

**Before you begin, recall the formula that relates distance, rate, and time.**

The distance formula is given by *d* = *rt*, where:

 *d* represents distance. Common units are miles or feet.

 *t* represents time. Common units are hours or seconds.

 *r* represents rate or velocity. Common units are miles per hour or feet per second.

You can calculate distance by finding the product of an average rate of an object traveling and the duration of time for which it travels. Remember, units for distance and time must agree with the units for rate.

## Now let’s get started!

Step 1: Calculating distance at maximum speed

If the cheetah sprinted at maximum speed, how far would the cheetah have traveled?

1. Set up an equation to represent the distance the cheetah covered in terms of *t* minutes running at maximum speed. Remember, units of distance and time must agree. Use the conversion information from the warm-up to write a rate in miles per minute.
2. Let *t* = 10 and solve for the distance the cheetah covered in 10 minutes.

Step 2: Calculating distance using varied speeds

Suppose the cheetah sprinted at maximum speed for 8 minutes and then slowed to 40 mph for the next 8 minutes.

1. How far would the cheetah have traveled in the first 8 minutes? Show how you arrived at your answer.
2. How far would the cheetah have traveled in the next 8 minutes? Show how you arrived at your answer.
3. How much farther did the cheetah travel in the first 8 minutes than in the second 8 minutes?
4. The cheetah traveled 1.75 times faster for the first 8 minutes than it did for the second 8 minutes. Was the distance traveled during the first 8 minutes 1.75 times greater than the distance traveled during the second 8 minutes? Show the calculation to justify your answer.
5. If the cheetah made a round-trip and took half the amount of time on the return trip as on the front end of the trip, what would be the relationship between the average rates on each leg of the trip? Using a complete sentence, explain how you arrived at this conclusion.

Step 3: Calculating time

Assume that the cheetah travels an average of 40 mph to go from its resting place to a rock near a river. On the return trip to its resting place, the cheetah travels an average of 70 mph. If the cheetah traveled for 15 minutes, how many minutes did the return trip take to the nearest minute and second?

1. Set up the table as follows. Label the rows “To the River” and “From the River.” Label the columns “Distance,” “Rate,” and “Time (in Hours).” Let *t* represent the unknown quantity in the problem. Fill in the table.
2. From the table, set up an equation relating the distances.
3. Solve the problem. Write the answer in a complete sentence, stating it in terms of minutes and seconds.

**Now it’s time to tackle the original question.**

Going from point A to point B, the cheetah traveled at an average rate of 70 mph. Returning to point A, the cheetah traveled at an average rate of 40 mph.

Can we say that this cheetah’s average rate was 55 mph?

1. The average rate for the trip is equal to the total distance traveled divided by the total time traveled. The following equations represent the distance traveled on each leg of the trip.

First leg of trip: $d=r\_{1}t\_{1}$

Second leg of trip: $d=r\_{2}t\_{2}$

Write an equation for the average rate for the trip. Remember, the cheetah runs from point A to point B and back to point A.

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1. The following equation represents the average rate for the trip. Is this equation equivalent to the one you wrote above? Explain why or why not.



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1. The following steps show how the equation for the average rate can be transformed so that it is written in terms of only the rates for each leg of the trip. Write an algebraic justification for each step. Think about the number operations and properties that you know.





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1. Using the equation for average rate above, determine the cheetah’s average rate for the entire trip.