

Just Jogging Learning Task (Rational Expressions)

For distances of 12 miles or less, a certain jogger can maintain an average speed of 6 miles per hour while running on level ground.

1. If this jogger runs around a level track at an average speed of 6 mph, how long in hours will the jogger take to run each of the following distances? [Express your answers as fractions of an hour in simplest form, the decimal equivalent of that fraction, and the equivalent number of minutes.] (a) 3 miles (b) 9 miles (c) 1 mile (d) $\frac{1}{2}$ mile (e) $\frac{1}{10}$ mile
2. Analyze your work in Question 1. Each answer can be found by using the number of miles, a single operation, and the number 6. What operation should be used? Write an algebraic expression for the time it takes in hours for this jogger to run x miles on level ground at an average speed of 6 miles per hour.
3. Each day this jogger warms up with stretching exercises for 15 minutes, jogs for a while, and then cools down for 15 minutes. How long would this exercise routine take, in hours, if the jogger ran for 5 miles? [Express your answer as a fraction in simplest form.]
4. Let T represent the total time in hours it takes for this workout routine when the jogger runs for x miles. Write a formula for calculating T given x , where, as in Question 2, x is number of miles the jogger runs. Express the formula for T as a single algebraic fraction.
5. If the jogger skipped the warm-up and cool-down period and used this additional time to jog, how many more miles would be covered? Does this answer have any connection to the answer to question 4 above?

Suppose this same jogger decides to go to a local park and use one of the paths there for the workout routine one day each week. This path is a gently sloping one that winds its way to the top of a hill.

6. If the jogger can run at an average speed of 5.5 miles per hour up the slope and 6.5 miles per hour going down the slope, how long, in hours, will it take for the jogger to cover 2 miles by going uphill for 1 mile and then returning 1 mile back down the hill? Give an exact answer expressed as a fraction in simplest terms and then give a decimal approximation correct to three decimal places.
7. If the jogger can run at an average speed of 5.3 miles per hour up the slope and 6.7 miles per hour going down the slope, how long, in hours, will it take for the jogger to cover 2 miles by going uphill for 1 mile and then returning 1 mile back down the hill? Give an exact answer expressed as a fraction in simplest terms and then give a decimal approximation correct to three decimal places.

8. Write an algebraic expression for the total time, in hours, that it takes the jogger to cover 2 miles by going uphill for 1 mile and then returning 1 mile back down the hill if the jogger runs uphill at an average speed that is c miles per hour slower than the level-ground speed of 6 miles per hour and runs downhill at an average speed that is c miles per hour faster than the level-ground speed of 6 miles per hour. Simplify your answer to a single algebraic fraction. Verify that your expression gives the correct answers for Questions 6 and 7.
9. The average speed in miles per hour is defined to be the distance in miles divided by the time in hours spent covering the distance.
- What is the jogger's average speed for a two mile trip on level ground?
 - What is the jogger's average speed for the two mile trip in question 6?
 - What is the jogger's average speed for the two mile trip in question 7?
 - Write an expression for the jogger's average speed over the two-mile trip (one mile up and one mile down) when the average speed uphill is c miles per hour slower than the level-ground speed of 6 miles per hour and the average speed downhill at an average speed that is c miles per hour faster than the level-ground speed of 6 miles per hour. Express your answer as a simplified algebraic fraction.
 - Use the expression in part (d) to recalculate your answers for parts (b) and (c)? What value of c should you use in each part?
10. For what value of c would the jogger's average speed for the two-mile trip (one mile up and one mile down) be 4.5 miles per hour? For this value of c , what would be the jogger's average rate uphill and downhill?