

## Lesson 22: Getting the Job Done—Speed, Work, and Measurement Units

### Classwork

If an object is moving at a constant rate of speed for a certain amount of time, it is possible to find how far the object went by multiplying the rate and the time. In mathematical language, we say, distance = rate · time.

### Example 1

**Walker:** Substitute the walker's distance and time into the equation and solve for the rate of speed.

example: distance 50 feet      Time: 8 seconds

distance = rate · time

$$d = r \cdot t$$

or

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

$$\frac{50 \text{ feet}}{8 \text{ seconds}} = 6.25 \text{ ft/second}$$

*Hint: Consider the units that you want to end up with. If you want to end up with the rate (feet/second), then divide the distance (feet) by time (seconds).*

**Runner:** Substitute the runner's time and distance into the equation to find the rate of speed.

distance = rate · time

$$d = r \cdot t$$

## Example 2

**Part 1:** Chris Johnson ran the 40-yard dash in 4.24 seconds. What is the rate of speed? Round any answer to the nearest hundredth.

$$d = 40 \text{ yard} \quad t = 4.24$$

distance = rate  $\cdot$  time

$$d = r \cdot t$$

$$r = \frac{40 \text{ yards}}{4.24 \text{ seconds}} \approx 9.43 \text{ yards/second}$$

**Part 2:** In Lesson 21, we converted units of measure using unit rates. If the runner were able to run at a constant rate, how many yards would he run in an hour? This problem can be solved by breaking it down into two steps. Work with a partner, and make a record of your calculations.

- a. How many yards would he run in one minute?

$$\frac{9.43 \text{ yards}}{1 \text{ second}} \cdot \frac{60 \text{ seconds}}{1 \text{ min}} = 565.80 \text{ yards in one minute.}$$

- b. How many yards would he run in one hour?

$$\frac{565.80 \text{ yards}}{1 \text{ minute}} \cdot \frac{60 \text{ min}}{1 \text{ hour}} = 33,948 \text{ yards in an hour.}$$

We completed that problem in two separate steps, but it is possible to complete this same problem in one step. We can multiply the yards per second by the seconds per minute, then by the minutes per hour.

$$\frac{9.43 \text{ yards}}{1 \text{ second}} \cdot 60 \frac{\text{seconds}}{\text{minute}} \cdot 60 \frac{\text{minutes}}{\text{hour}} = 33,948 \text{ yards in one hour}$$

Cross out any units that are in both the numerator and denominator in the expression because these cancel each other out.

**Part 3:** How many miles did the runner travel in that hour? Round your response to the nearest tenth.

$$\frac{33,948 \text{ yards}}{1 \text{ hour}} \cdot \frac{1 \text{ mile}}{1760 \text{ yards}} = 19.3 \text{ miles/hour.}$$

1 mile = 1,760 yards

Cross out any units that are in both the numerator and denominator in the expression because they cancel out.

## Exercises: Road Trip

## Exercise 1

I drove my car on cruise control at 65 miles per hour for 3 hours without stopping. How far did I go?

$$d = r \cdot t$$

$$d = \underline{65} \frac{\text{miles}}{\text{hour}} \cdot \underline{3} \text{ hours}$$

Cross out any units that are in both the numerator and denominator in the expression because they cancel out.

$$d = \underline{195} \text{ miles}$$

## Exercise 2

On the road trip, the speed limit changed to 50 miles per hour in a construction zone. Traffic moved along at a constant rate (50 mph), and it took me 15 minutes (0.25 hours) to get through the zone. What was the distance of the construction zone? (Round your response to the nearest hundredth of a mile.)

$$d = r \cdot t$$

$$d = \underline{50} \frac{\text{miles}}{\text{hour}} \cdot \underline{0.25} \text{ hours}$$

12.50 miles.