

### Objective 58

Solve a motion problem that can be represented by a system of linear equations

#### **PROBLEM**

Kerry is training for a bike race that will take place next month. On Saturday she rode her bike 120 miles in a practice race. Kerry rode part of the race at an average speed of 30 miles per hour, and she averaged 15 miles per hour for the remaining part of the race. If it took Kerry 5 hours to finish the practice race, how much time did she spend riding at a rate of 30 miles per hour?

#### **STEP 1**

Determine the unknowns in the problem.

The problem states that Kerry rode part of the race at an average speed of 30 miles per hour.  
The number of hours she spent traveling at 30 miles per hour is unknown.  
The distance she traveled at this speed is unknown.

The problem states that Kerry averaged 15 miles per hour for the remaining part of the race.  
The number of hours she spent traveling at 15 miles per hour is unknown.  
The distance she traveled at this speed is unknown.

#### **STEP 2**

Write an expression for the distance Kerry rode while traveling at a speed of 30 miles per hour. Recall the distance formula, distance = rate  $\times$  time.

Let  $x$  equal the time, in hours, she spent traveling at 30 miles per hour.

$$\begin{aligned}\text{distance} &= \text{rate} \times \text{time} \\ &= 30x\end{aligned}$$

#### **STEP 3**

Write an expression for the distance Kerry rode while traveling at a speed of 15 miles per hour.

Let  $y$  equal the time, in hours, she spent traveling at 15 miles per hour.

$$\begin{aligned}\text{distance} &= \text{rate} \times \text{time} \\ &= 15y\end{aligned}$$

#### **STEP 4**

Write an equation relating the distance traveled at each speed to the total distance traveled, 120 miles.

$$\begin{array}{rccccr} \text{distance rode at 30 mph} & + & \text{distance rode at 15 mph} & = & 120 \text{ miles} \\ 30x & + & 15y & = & 120 \end{array}$$

#### **STEP 5**

Write an equation relating the time Kerry spent riding at each speed to the total time it took her to finish the practice race, 5 hours.

$$\begin{array}{rccccr} \text{time riding at 30 mph} & + & \text{time riding at 15 mph} & = & 5 \text{ hr} \\ x & + & y & = & 5 \end{array}$$

**STEP 6**

Solve the equation from Step 5 for  $y$ .

$$x + y = 5$$

$$y = 5 - x$$

**STEP 7**

Substitute  $(5 - x)$  for  $y$  in the equation from Step 4.

$$30x + 15y = 120$$

$$30x + 15(5 - x) = 120$$

**STEP 8**

Solve for  $x$  to find the number of hours Kerry spent riding at a rate of 30 miles per hour.

$$30x + 15(5 - x) = 120$$

$$30x + 75 - 15x = 120$$

$$15x + 75 = 120$$

$$15x + 75 - 75 = 120 - 75$$

$$15x = 45$$

$$x = 3$$

Kerry spent 3 hours riding at a rate of 30 miles per hour.

**ANSWER**

3 hr

**Practice:** *Hint: remember the equation  $d=rt$*

Marcos is training for a bike race that will take place next month. On Saturday he rode his bike 99 miles in a practice race. Marcos rode part of the race at an average speed of 27 miles per hour, and he averaged 18 miles per hour for the remaining part of the race. If it took Marcos 5 hours to finish the practice race, how much time did he spend riding at a rate of 27 miles per hour?

On Wednesday, the Malloy family left home to drive to a resort in Oregon for vacation. They drove at an average rate of 55 miles per hour. On Monday, they drove back the same route, traveling at an average rate of only 33 miles per hour because of road construction. If the Malloy family spent a total of 8 hours driving to and from the resort in Oregon, how many miles did they travel from their house to the resort?

One evening Brody and Raja both drive to a concert in a city that lies between their hometowns. Together they drive a total of 384 miles to the concert. Brody drives an average of 10 miles per hour faster than Raja. If Brody and Raja both arrive at the concert after 3 hours, what is the average speed of Brody's car?

