If you look at Figure 13-3, you will see that the total distance is the **sum** of the individual distances each car went, since each is going in the opposite direction: $2x + 2(x + 10) = 160$.

IMPLEMENTATION: Solve the equation for x:

$$\begin{aligned} 2x + 2(x + 10) &= 160 \\ 2x + 2x + 20 &= 160 \\ 4x + 20 &= 160 \\ 4x + 20 - 20 &= 160 - 20 \\ 4x &= 140 \\ \frac{4^1 x}{4^1} &= \frac{140}{4} \\ x &= 35 \text{ miles per hour} \\ x + 10 &= 35 + 10 = 45 \text{ miles per hour} \end{aligned}$$

Hence the slower automobile was traveling at 35 miles per hour and the faster automobile was traveling at 45 miles per hour.

EVALUATION: We can find the distance each automobile traveled and then see if the sum is 160 miles.

Automobile 1: $D = RT$

$D = 35 \times 2 = 70$ miles

Automobile 2: $D = RT$

$D = 45 \times 2 = 90$ miles

Hence, $70 + 90 = 160$ miles.

Try These

1. Two people leave from two towns that are 195 miles apart at the same time and travel along the same road toward each other. The first

person drives 5 miles slower than the second person. If they meet in 3 hours, at what rate of speed did each travel?

2. Two planes leave the same airport and travel in opposite directions. Their speeds are 150 miles per hour and 100 miles per hour, respectively. In how many hours will they be 500 miles apart?
3. Two people travel in opposite directions after leaving at the same time from the same place. If one person walks twice as fast as the other, and in two hours they are 10.5 miles apart, find the walking speeds of each.
4. In order to return her friend's bicycle, a girl rides it to her friend's house at a speed of 9 miles per hour. She then walks back home at a speed of 3 miles per hour. If the total time of the round trip was 1.5 hours, how far was her friend's house?
5. A person riding a motorcycle leaves an hour after a person riding a bicycle. Both travel the same road. If the person riding the bicycle is traveling at 10 miles per hour and the person riding the motorcycle is traveling at 30 miles per hour, how long will it take the motorcycle to overtake the bicycle?

SOLUTIONS:

1. Let x = the speed (rate) of the first person and $x+5$ = the rate of the second person.

	Rate	× Time	= Distance
First person	x	3	$3x$
Second person	$x+5$	3	$3(x+5)$

The total distance they travel is 195 miles.

$$\begin{aligned} 3x + 3(x+5) &= 195 \\ 3x + 3x + 15 &= 195 \\ 6x + 15 &= 195 \\ 6x + 15 - 15 &= 195 - 15 \\ 6x &= 180 \\ \frac{\cancel{6}^{1}x}{\cancel{6}^{1}} &= \frac{180}{60} \end{aligned}$$

$x = 30$ miles per hour

$x + 5 = 30 + 5 = 35$ miles per hour

2. Let t = the time of the planes.

	Rate	× Time	= Distance
Plane one	150	t	$150t$
Plane two	100	t	$100t$

The total distance is 500 miles since they are going in opposite directions.

$$150t + 100t = 500$$
$$250t = 500$$
$$\frac{250^1 t}{250^1} = \frac{500}{250}$$
$$t = 2 \text{ hours}$$

3. Let x = the speed (rate) of the first person and $2x$ = the rate of the second person.

	Rate	× Time	= Distance
First person	x	2	$2x$
Second person	$2x$	2	$2(2x)$

The total distance is 10.5 miles since they are going in opposite directions.

$$2x + 2(2x) = 10.5$$
$$2x + 4x = 10.5$$
$$6x = 10.5$$
$$\frac{6^1 x}{6} = \frac{10.5}{6}$$
$$x = 1.75 \text{ miles per hour}$$
$$2x = 2 \cdot 1.75 = 3.5 \text{ miles per hour}$$

4. Let t = the time it takes to ride to the friend's house and $1.5 - t$ = the time it takes to walk back.

	Rate	× Time	= Distance
To friend's house	9	t	$9t$
Return home	3	$(1.5 - t)$	$3(1.5 - t)$

The distances are equal since she is making a round trip.

$$\begin{aligned} 9t &= 3(1.5 - t) \\ 9t &= 4.5 - 3t \\ 9t + 3t &= 4.5 - 3t + 3t \\ 12t &= 4.5 \\ \frac{\cancel{12}^{1}t}{\cancel{12}^{1}} &= \frac{4.5}{12} \\ t &= 0.375 \text{ hour} \\ D &= RT \\ D &= 9 \cdot 0.375 = 3.375 \text{ miles} \end{aligned}$$

5. Let t = the time the person on the motorcycle takes to overtake the person on the bicycle and $t + 1$ = the time the person on the bicycle rides.

	Rate	× Time	= Distance
Bicycle	10	$t + 1$	$10(t + 1)$
Motorcycle	30	t	$30t$

The distances are equal.

$$\begin{aligned} 30t &= 10(t + 1) \\ 30t &= 10t + 10 \\ 30t - 10t &= 10t - 10t + 10 \\ 20t &= 10 \\ \frac{\cancel{20}^{1}t}{\cancel{20}^{1}} &= \frac{10}{20} \\ t &= 0.5 \text{ hour} \end{aligned}$$