🌐 Real-World EXAMPLE 4   Speeds of Two Vehicles

FREIGHT TRAINS Two trains are 550 miles apart heading toward each other on parallel tracks. Train A is traveling east at 35 miles per hour, while Train B travels west at 45 miles per hour. When will the trains pass each other?

Step 1   Draw a diagram.

←— 550 mi —→

35 mph   45 mph
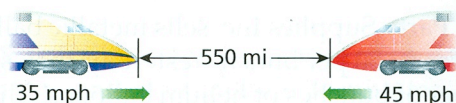
Step 2   Let t = the number of hours until the trains pass each other. Make a table.

	r	t	d = rt
Train A	35	t	35t
Train B	45	t	45t

Step 3   Write and solve an equation.

Distance traveled by Train A	plus	distance traveled by Train B	equals	550 miles.
35t	+	45t	=	550

$$35t + 45t = 550 \quad \text{Original equation}$$
$$80t = 550 \quad \text{Simplify.}$$
$$\frac{80t}{80} = \frac{550}{80} \quad \text{Divide each side by 80.}$$
$$t = 6.875 \quad \text{Simplify.}$$

The trains will pass each other in about 6.875 hours.

✔️ Check Your Progress

4. CYCLING Two cyclists begin traveling in opposite directions on a circular bike trail that is 5 miles long. One cyclist travels 12 miles per hour, and the other travels 18 miles per hour. How long will it be before they meet?

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Check Your Understanding

Example 1
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1 FOOD Tasha ordered soup and salad for lunch. If Tasha ordered 10 ounces of soup for lunch and the total cost was $3.30, how many ounces of salad did Tasha order?

15¢/ounce   20¢/ounce

Example 2
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2. CHEMISTRY Margo has 40 milliliters of 25% solution. How many milliliters of 60% solution should she add to obtain the required 30% solution?

Example 3
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3. TRAVEL A boat travels 16 miles due north in 2 hours and 24 miles due west in 2 hours. What is the average speed of the boat?

4. EXERCISE Felisa jogged 3 miles in 25 minutes and then jogged 3 more miles in 30 minutes. What was her average speed in miles per minute?

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5. CYCLING A cyclist begins traveling 18 miles per hour. At the same time and at the same starting point, an inline skater follows the cyclist's path and begins traveling 6 miles per hour. After how much time will they be 24 miles apart?

Practice and Problem Solving

= **Step-by-Step Solutions** begin on page R12.
Extra Practice begins on page 815.

Example 1
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6. CANDY A candy store wants to create a mix using two hard candies. One is priced at $5.45 per pound, and the other is priced at $7.33 per pound. How many pounds of the $7.33 candy should be mixed with 11 pounds of the $5.45 candy to sell the mixture for $6.14 per pound?

7. BUSINESS Party Supplies Inc. sells metallic balloons for $2 each and helium balloons for $3.50 per bunch. Yesterday, they sold 36 more metallic balloons than the number of bunches of helium balloons. The total sales for both types of balloons were $281. Let b represent the number of metallic balloons sold.

a. Copy and complete the table representing the problem.

	Number	Price	Total Price
Metallic Balloons	b		
Bunches of Helium Balloons	$b - 36$		

b. Write an equation to represent the problem.

c. How many metallic balloons were sold?

d. How many bunches of helium balloons were sold?

8. FINANCIAL LITERACY Lakeisha spent $4.57 on color and black-and-white copies for her project. She made 7 more black-and-white copies than color copies. How many color copies did she make?

Type of Copy	Cost per Page
color	$0.44
black-and-white	$0.07

Example 2
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9. FISH Rosamaria is setting up a 20-gallon saltwater fish tank that needs to have a salt content of 3.5%. If Rosamaria has water that has 2.5% salt and water that has 3.7% salt, how many gallons of the water with 3.7% salt content should Rosamaria use?

10. CHEMISTRY Hector is performing a chemistry experiment that requires 160 milliliters of 40% sulfuric acid solution. He has a 25% sulfuric acid solution and a 50% sulfuric acid solution. How many millimeters of each solution should he mix to obtain the needed solution?

Example 3
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11. TRAVEL A boat travels 36 miles in 1.5 hours and then 14 miles in 0.75 hour. What is the average speed of the boat?

12. RUNNING A runner ran 1.5 miles in 28 minutes and then 1.2 more miles in 10 minutes. What was the average speed in miles per minute?

13. AIRLINERS Two airliners are 1600 miles apart and heading toward each other at different altitudes. The first plane is traveling north at 620 miles per hour, while the second is traveling south at 780 miles per hour. When will the planes pass each other?

Example 4
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14. SAILING A ship is sailing due east at 20 miles per hour when it passes the lighthouse. At the same time a ship is sailing due west at 15 miles per hour when it passes a point. The lighthouse and the point are 175 miles apart. When will these ships pass each other?

15. CHEMISTRY A lab technician has 40 gallons of a 15% iodine solution. How many gallons of a 40% iodine solution must he add to make a 20% iodine solution?

16. GRADES At Westbridge High School, a student's grade point average (GPA) is based on the student's grade and the class credit rating. Brittany's grades for this quarter are shown. Find Brittany's GPA if a grade of A equals 4 and a B equals 3.

Class	Credit Rating	Grade
Algebra 1	1	A
Science	1	A
English	1	B
Spanish	1	A
Music	$\frac{1}{2}$	B

17. SPORTS In a triathlon, Steve swam 0.5 mile in 15 minutes, biked 20 miles in 90 minutes, and ran 4 miles in 30 minutes. What was Steve's average speed for the triathlon in miles per hour?

18. MUSIC Amalia has 10 songs on her MP3 player. If 3 songs are 5 minutes long, 3 are 4 minutes long, 2 are 2 minutes long, and 2 are 3.5 minutes long, what is the average length of the songs?

19. DISTANCE Garcia is driving to Florida for vacation. The trip is a total of 625 miles.

a. How far can he drive in 6 hours at 65 miles per hour?

b. If Garcia maintains a speed of 65 miles per hour, how long will it take him to drive to Florida?

20. TRAVEL Two buses leave Smithville at the same time, one traveling north and the other traveling south. The northbound bus travels at 50 miles per hour, and the southbound bus travels at 65 miles per hour. Let t represent the amount of time since their departure.

a. Copy and complete the table representing the situation.

	r	t	$d = rt$
Northbound bus	?	?	?
Southbound bus	?	?	?

b. Write an equation to find when the buses will be 345 miles apart.

c. Solve the equation. Explain how you found your answer.

21. TRAVEL A subway travels 60 miles per hour from Glendale to Midtown. Another subway, traveling at 45 miles per hour, takes 11 minutes longer for the same trip. How far apart are Glendale and Midtown?

H.O.T. Problems   Use **H**igher-**O**rder **T**hinking Skills

22. OPEN ENDED Write a problem that depicts motion in opposite directions.

23. REASONING Describe the conditions so that adding a 50% solution to a 100% solution would produce a 75% solution.

24. CHALLENGE Find five consecutive odd integers from least to greatest in which the sum of the first and the fifth is one less than three times the fourth.

25. CHALLENGE Describe a situation involving mixtures that could be represented by $1.00x + 0.15(36) = 0.50(x + 36)$.

26. WRITING IN MATH Describe how a gallon of 25% solution is added to an unknown amount of 10% solution to get a 15% solution.