

Warm-up:

Solve:

$$\frac{10}{10-x} = \frac{22}{10+x}$$

A distance problem involves distance, rate, and time.

A river barge travels 140 miles from a loading dock to a warehouse to deliver supplies. Then the barge returns to the loading dock. The barge travels with the current to the warehouse and against the current from the warehouse. The barge's total travel time is 20 hours, and it travels in still water at an average speed of 15 miles per hour.

- 1. Use the given information to complete the table. Let x represent the average speed of the current.**

	Distance Traveled	Time Traveled	Average Speed
	Miles	Hours	$\frac{\text{Miles}}{\text{Hours}}$
With the Current	140	$\frac{140}{15 + x}$	$15 + x$
Against the Current	140	$\frac{140}{15 - x}$	$15 - x$
Round Trip	280	20	$\frac{280}{20}$

2. You are given that the barge’s total travel time is 20 hours. Write an algebraic expression, in terms of the number of hours the barge travels with the current and the number of hours it travels against the current, that is equivalent to 20 hours.

$$\frac{140}{15 + x} + \frac{140}{15 - x}$$

3. Write and solve an equation to calculate the average speed of the current.

$$\frac{140}{15+x} + \frac{140}{15-x} = 20$$

4. Calculate each value.

- a. What is the barge's average speed during its trip to the warehouse?**

- b. What is the barge's average speed during its trip back to the loading dock?**

- c. How long does it take the barge to get from the loading dock to the warehouse?**

- d. How long does it take the barge to return to the loading dock from the warehouse?
- e. Use your answers to parts (a) and (b) to calculate the average speed of the barge in still water. Verify that your answer matches the given information.
- f. Use your answers to parts (c) and (d) to calculate the barge's total travel time. Verify that your answer matches the given information.

A cost problem involves the cost of ownership of an item over time.

Melinda has decided that it is time to replace her old refrigerator. She purchases a new Energy Star certified refrigerator. Energy Star certified refrigerators use less electricity than those that are not certified. In the long run, the Energy Star refrigerator should cost Melinda less to operate.

Melinda purchases a new Energy Star refrigerator for \$2000. The refrigerator costs \$46 per year to operate. Assume that the refrigerator is reliable and its only costs of ownership are the purchase price and the cost of operation.

1. Determine Melinda's average annual cost of owning the new refrigerator for the given number of years.

a. 1 year \$2046

b. 5 years \$446

c. 10 years \$246

2. Write an expression to represent Melinda's average annual cost of owning the new refrigerator for x years.

$$\frac{2000 + 46x}{x}$$

Melinda is curious to know how much money the Energy Star certified refrigerator will save her, compared to one that is not certified. A comparable non-certified model costs \$1900 to purchase and \$60 per year to operate. Assume that this non-certified refrigerator's only costs of ownership are the purchase price and the operation cost.

4. Determine the average annual cost of owning this refrigerator in the given number of years.

a. 1 year \$1960

b. 5 years $\$2200 / 5 = \440

c. 10 years \$250

5. Write an expression to represent the average annual cost of owning the non-certified refrigerator for x years.

$$\frac{1900 + 60x}{x}$$

6. In how many years will the average annual cost of owning the Energy Star certified refrigerator be less than the average annual cost of owning the non-certified refrigerator? Show all of your work.