Instruction

Example 3

Suppose two brothers who live 55 miles apart decide to have lunch together. To prevent either brother from driving the entire distance, they agree to leave their homes at the same time, drive toward each other, and meet somewhere along the route. The older brother drives cautiously at an average speed of 60 miles per hour. The younger brother drives faster, at an average speed of 70 mph. How long will it take the brothers to meet each other?

1. Read the statement carefully.

2. Reread the scenario and make a table of the known quantities.

   Problems involving "how fast," "how far," or "how long" require the distance equation, $d = rt$, where d is distance, r is rate of speed, and t is time.

   Complete a table of the known quantities.

	Rate (r)	**Distance (d)**
Older brother	60 mph	55 miles
Younger brother	70 mph	55 miles

3. Read the statement again and look for the unknown or the variable.

   The scenario asks for how long, so the variable is time, t.

Instruction

4. Create expressions and inequalities from the known quantities and variable(s).

   Step 2 showed that the distance equation is $d = rt$ or $rt = d$. Together the brothers will travel a distance, d, of 55 miles.

   (older brother's rate)(t) + (younger brother's rate)(t) = 55

   The rate r of the older brother = 60 mph and the rate of the younger brother = 70 mph.

   $60t + 70t = 55$

   Expand the table from step 2 to see this another way.

	Rate (r)	**Time (t)**	**Distance (d)**
Older brother	60 mph	t	$d = 60t$
Younger brother	70 mph	t	$d = 70t$

   Together, they traveled 55 miles, so add the distance equations based on each brother's rate.

   $60t + 70t = 55$

5. Solve the problem for the time it will take for the brothers to meet each other.

   $60t + 70t = 55$ Equation

   $130t = 55$ Combine like terms $60t$ and $70t$.

   $\frac{130t}{130} = \frac{55}{130}$ Divide both sides by 130.

   $t \approx 0.42$ hours

   It will take the brothers 0.42 hours to meet each other.

   Note: The answer was rounded to the nearest hundredth of an hour because any rounding beyond the hundredths place would not make sense. Most people wouldn't be able to or need to process that much precision. When talking about meeting someone, it is highly unlikely that anyone would report a time that is broken down into decimals, which is why the next step will convert the units.

Instruction

6. Convert to the appropriate units if necessary.

   Automobile speeds in the United States are typically given in miles per hour (mph). Therefore, this unit of measurement is appropriate.

   However, typically portions of an hour are reported in minutes unless the time given is $\frac{1}{2}$ of an hour.

   Convert 0.42 hours to minutes using 60 minutes = 1 hour.

   $60 \text{ min} = 1 \text{ hr}$

   $$0.42 \text{ hr} \bullet \frac{60 \text{ min}}{1 \text{ hr}}$$

   $$0.42 \cancel{\text{hr}} \bullet \frac{60 \text{ min}}{1 \cancel{\text{hr}}} = 25.2 \text{ minutes}$$

   Here again, rarely would a person report that they are meeting someone in 25.2 minutes. In this case, there is a choice of rounding to either 25 or 26 minutes. Either answer makes sense.

   The two brothers will meet each other in 25 or 26 minutes.

Example 4

Think about the following scenarios. In what units should they be reported? Explain the reasoning.

a. Water filling up a swimming pool

   A swimming pool, depending on the size, has between several gallons and hundreds of thousands of gallons of water.

   Think about water flowing out of a faucet and picture filling up a milk jug. How long does it take? Less than a minute? The point is that gallons of water can be filled in minutes.

   Report the filling of a swimming pool in terms of gallons per minute.