Applications of Rational Expressions:

Distance Problems

Recall:

$$\boldsymbol{Rate \times Time = Distance}$$
$$\boldsymbol{RT = D}$$

This formula allows us to find the **Distance** given the **Rate** and the **Time**.

What if we are given the **Rate** and **Distance** and need to find the **Time**.

We need to use $\boldsymbol{RT = D}$ and solve for $\boldsymbol{T}$.

$$\frac{RT}{\boldsymbol{R}} = \frac{D}{\boldsymbol{R}}$$

$$\boxed{\boldsymbol{T = \frac{D}{R}}}$$

Example 1:

Charlie's boat can travel **15** miles upstream in the same amount of time it takes to travel **45** miles downstream. How fast is Charlie's boat in still water if the rate of the current is **4** miles per hour?

We can make a table to help organize the information.

	Rate	Time	Task
Upstream			
Downstream			

	Rate	Time	Task
Upstream	$x-4$	$\frac{15}{x-4}$	**15**
Downstream	$x+4$	$\frac{45}{x+4}$	**45**

We let x represent the rate of Charlie's boat.

> **NOTE**: It takes the same amount of time to go upstream as to go downstream, so we set the "times" equal to each other and solve.

$$\frac{15}{x-4}=\frac{45}{x+4}$$

LCD= $(x-4)(x+4)$

$$(x-4)(x+4)\left(\frac{15}{x-4}\right)=(x-4)(x+4)\left(\frac{45}{x+4}\right)$$

$$15(x+4)=45(x-4)$$

To simplify, we can divide both sides by **15**.

$$\frac{15(x+4)}{15}=\frac{45(x-4)}{15}$$

$$(x+4)=3(x-4)$$

$$x+4=3x-12$$

$$-x \qquad -x$$

$$4=2x-12$$

$$+12 \qquad +12$$

$$\frac{16}{2}=\frac{2x}{2}$$

$$\boxed{x=8}$$

Therefore Charlie's boat can travel **8 mph** in still water.

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Practice Problems

Charlie can row 2 miles upstream in the same amount of time it takes him to row 6 miles downstream. How fast can Charlie row in still water if the rate of the current is 3 mph?