



DISTANCE = RATE TIMES TIME

One of the most daunting tasks in mathematics is to translate a “word problem” into a mathematical equation. Honestly, there is no one way that works for everyone. Teachers, students, textbooks outline step after step that hopefully will help with the process. Usually, you just have to discover an approach that is best for YOU. However, it does seem that “*LOTS of PRACTICE*” helps one to improve ones’ skills in this area of mathematics.

Here is another “list” and “some practice” aimed at translating “word problems into mathematical equations”.

READ THE PROBLEM SLOWLY AND SEVERAL TIMES. OUTLINE THE PROBLEM.

You aren’t suppose to read a word problem like a novel because you might miss some important clues. So begin by reading *carefully* and *slowly*. A problem might be so packed with information that it will require several readings. Make an “outline” of the information as you read.

Example from Allen R. Angel. Elementary Algebra for College Students. Pearson Education, Inc. (2004).

“In the Mississippi River near New Orleans, the Creole Queen paddleboat travels 4 miles upstream (against the current) in the same amount of time it travels 6 miles downstream (with the current). If the current of the river is 2 miles per hour, determine the speed of the Creole Queen in still water.”

If you read it slowly, you might notice the following:

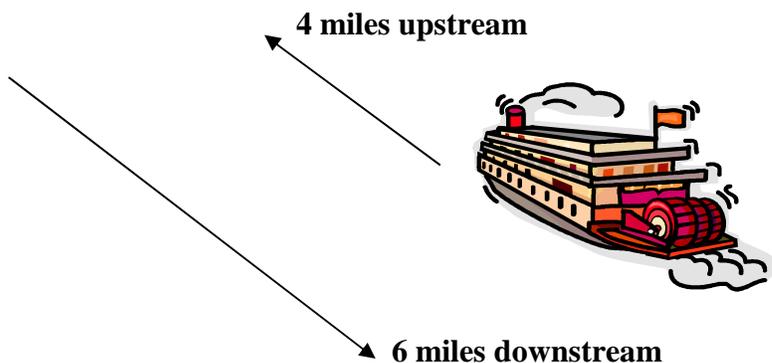
“In the Mississippi River near New Orleans, the Creole Queen paddleboat travels 4 miles upstream (against the current) in the same amount of time it travels 6 miles downstream (with the current). If the current of the river is 2 miles per hour, determine the speed of the Creole Queen in still water.”

So your outline might begin:

Paddleboat upstream and Paddleboat downstream.

**TRANSLATE ENGLISH INTO MATH SYMBOLS.
 USE OUTLINE ABOVE TO HELP.
 DRAW A SKETCH TO ALSO HELP.
 ORGANIZE INFORMATION.**

From the example, we know the paddleboat is going 4 miles upstream and 6 miles downstream. A sketch might help.



Time is “the same”

So from this information, we write: **(Time upstream) = (Time downstream).**

Now let’s start to get organized.

Usually problems that deal with distance, rate, and time are organized in a 3 row by 4 column chart like the one below.

$$\text{Distance} = (\text{Rate})(\text{Time})$$

	R	T	D

We get the information for the chart from the outline made earlier.

When two of the **R-T-D** cells are filled, use **D = (R)(T)** to find the remaining entry for the chart.

Here's the earlier outline:

Paddleboat upstream	and	Paddleboat downstream.
a). 4 miles upstream.		a). 6 miles downstream
b). River current 2 mph.		b). River current 2 mph.
Time upstream same as time downstream.		

Fill the chart (note how the colors match from outline to chart)

$$\text{Distance} = (\text{Rate})(\text{Time})$$

	R	T	D
Paddleboat upstream			
Paddleboat downstream			

If there wasn't a current, then the paddleboat would be chugging through the water at a certain speed unaffected by the speed of the river. We don't know the speed of the paddleboat, so define "x" as the paddleboat's speed in still water.

When going against an opposing force, such as a River Current, subtract the river rate from the boat speed, e.g. Boat Speed – River Current. When going with the current add the two rates: Boat Speed + River Current.

So we'd write Speed **upstream** (against the current) as $x - 2$.
And the Speed **downstream** (with the current) as $x + 2$

$$\text{Distance} = (\text{Rate})(\text{Time})$$

	R	T	D
Paddleboat upstream	$x - 2$		
Paddleboat downstream	$x + 2$		

We also know the **upstream distance** is 4 miles and the **downstream distance** is 6 miles.

$$\text{Distance} = (\text{Rate})(\text{Time})$$

	R	T	D
Paddleboat upstream	$x - 2$		4 miles
Paddleboat downstream	$x + 2$		6 miles

For both the upstream and downstream, two cells in the chart are filled.

Use Distance = (Rate) (Time) and the information from the cells to find the remaining cell.

<p>Paddleboat upstream</p> <p>Distance = (Rate) (Time)</p> <p>4 miles = (x - 2)(Time)</p> <p>$\frac{4}{(x-2)} = \frac{(x-2)(\text{Time})}{(x-2)}$</p> <p>$\frac{4}{(x-2)} = (\text{Time})$</p>	<p>Paddleboat downstream</p> <p>Distance = (Rate) (Time)</p> <p>6 miles = (x + 2)(Time)</p> <p>$\frac{6}{(x+2)} = \frac{(x+2)(\text{Time})}{(x+2)}$</p> <p>$\frac{4}{(x+2)} = (\text{Time})$</p>
--	--

Fill the time cells with the information.

Distance = (Rate)(Time)

	R	T	D
Paddleboat upstream	x - 2	$\frac{4}{(x-2)}$	4 miles
Paddleboat downstream	x + 2	$\frac{6}{(x+2)}$	6 miles

DEFINE AN EQUATION

Look for words and phrases that imply equality.

For example, “is” means “equal”. The phrase “the same as” also means “equal”.

The word “total” means to add two quantities and make the sum “equal” to something.

From the sketch, we wrote: **Time upstream same as time downstream.**

Using information from the chart under “T” for time,
translate : **Time upstream same as time downstream.**

As:

$$\frac{4}{x-2} = \frac{6}{x+2}$$

SOLVE THE EQUATION

$$\frac{4}{x-2} = \frac{6}{x+2}$$

$$LCD = (x-2)(x+2)$$

$$\cancel{(x-2)}(x+2) \frac{4}{\cancel{x-2}} = \cancel{(x-2)}(x+2) \frac{6}{\cancel{x+2}}$$

$$4(x+2) = 6(x-2)$$

$$4x+8 = 6x-12$$

$$4x - 4x + 8 = 6x - 4x - 12$$

$$8 = 2x - 12$$

$$8 + 12 = 2x - 12 + 12$$

$$20 = 2x$$

$$\frac{20}{2} = \frac{2x}{2}$$

$$10 = x$$

From the chart, x is the “Paddleboat’s Speed” in miles per hour.

CHECK THE ANSWER. IS IT REASONABLE?

DID YOU ANSWER THE QUESTION?

The question asked “determine the speed of the Creole Queen in still water.”

YES! We have answered the question.

**WORD PROBLEMS
SUMMARY**

1. When it comes to translating word problems into math equations, you just have to discover an approach that is best for YOU.
2. *“LOTS of PRACTICE”* helps
3. **SOME SUGGESTED STEPS ARE:**
 - a). **READ THE PROBLEM SLOWLY AND SEVERAL TIMES.
OUTLINE THE PROBLEM.**
 - b). **TRANSLATE ENGLISH INTO MATH SYMBOLS.
USE OUTLINE ABOVE TO HELP.**
 - c). **DRAW A SKETCH TO ALSO HELP.
ORGANIZE INFORMATION.**
 - d). **DEFINE AN EQUATION and THE UNKNOWN.**
 - e). **SOLVE THE EQUATION.**
 - f). **CHECK THE ANSWER. IS IT REASONABLE?
DID YOU ANSWER THE QUESTION?**
4. For distance equals rate times time organize information in a chart before trying to set up an equation.

$$\text{Distance} = (\text{Rate})(\text{Time})$$

	R	T	D

5. If there are two rates in a distance equals rate times time problem, when a vehicle is going against an opposing force such as wind or a river current, subtract the rate of the opposing force from the rate of the vehicle, e.g. Boat Speed – River Current, Plane Speed – Wind Speed.
When going with it, add the two rates e.g. Boat Speed + River Current, Plane Speed + Wind Speed.

