**Problem 1 – Boat Motion & Graphically Solve**

From the town of Alton to the town of Barnhart, the Mississippi River has an average surface speed of about 2 mph. Suppose it takes a boat 3 hours to travel downstream between the two towns, but 5 hours to travel upstream the same distance.

1. Let *r* be the rate of the boat in still water. How could the rate with the current and the rate against the current be expressed?

2. Use the above information to fill in the blank spaces.

   distance = rate × time

   **with current:** *d* = ____ × ____

   **against current:** *d* = ____ × ____

   *Note: The solution occurs when the distance* d *in both equations is the same.*

3. Set the equations equal to each other and solve for *r* algebraically. Show your work here.

   Solve the system of equations graphically. Press [y=] and enter both equations.
   **Note:** *x* should replace *r*.

   The solution is the intersection point. Adjust the window so that you can see the intersection of the two lines.

   Find this intersection point by pressing [2nd] [calc] and selecting **intersect**. Select the first line, the second line, and make a guess. The coordinates of the intersection point will appear.

4. How does this point compare with your solution from Question 3?

   Record the rate of the boat in still water and the distance between the towns. Include units.

### Problem 2 – Distance-Time Graph, Explore Slopes

Velma is riding on a steam engine locomotive. As she walks forward, she travels 1.1 miles in 2 minutes. As she walks back to her seat she travels 0.9 miles in 2 minutes. How fast is the train moving and how fast is Velma walking inside the train?

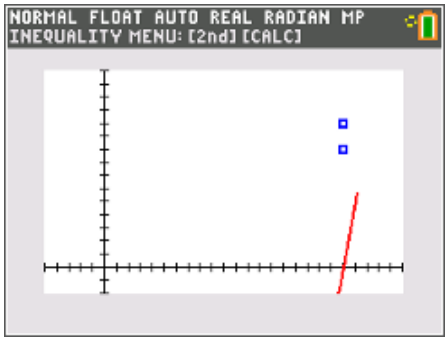
To explore this situation graphically, we need to set up the graph.

**Create a scatter plot of the data points.**

Press [stat] [enter] and enter the two pieces of the data (2, 1.1) and (2, 0.9) into lists L1 and L2.

Press [2nd] [stat plot] [enter], choose scatter plot, **L1** for Xlist and **L2** for Ylist.

Press [window]. Set *x* to [–0.5, 2.5] and *y* to [–0.2, 1.5].

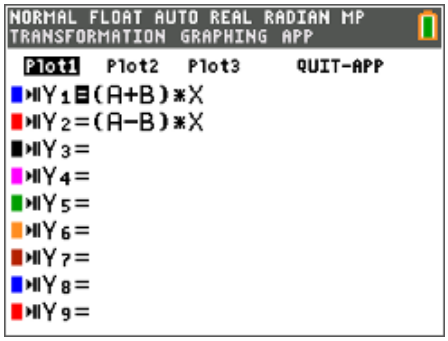



**Graph the two $d = r \cdot t$ equations**

Press [apps] and select **Transform**. Enter the equations on the [y=] screen as shown at the right.

Then press [window] and press [▲] to go to SETTINGS.
Set **A=0.1**, **B=0.1** and **Step=0.01**

In these equations, **A** represents the rate of the train and **B** represents the rate of Velma walking.




Press [graph]. Use the arrow keys to change the values of A and B so the line goes through the point. The Y1 line should go through the top point and the Y2 line should go through the bottom point.

5. What does the slope of the line in the distance-time graph represent?

6. Apply $d = r \cdot t$ to this situation. What does $r$ equal?

   (Hint: $r$ depends on $A$, the speed of the steam engine, and $B$, the velocity of Velma.)

   distance = rate × time

   **forward:** _____ = _____ × _____

   **back:** _____ = _____ × _____

7. Algebraically solve the equation.

**Problem 3 – Extension/Homework**

8. An airplane flew 3 hours with a tail wind of 20km/h. The return flight with the same wind took 3.5 hours. Find the speed of the airplane in still air. Fill in the chart and solve.

   **distance = rate × time**

   **west:** _____ = ($r$ +_____) × _____

   **east:** _____ = ($r$ – _____) × _____

9. Two cars leave town going in opposite directions. One travels 50 mph and the other travels 30 mph. In how many hours will they be 160 miles apart?

   **distance = rate × time**

   **slow car:** _____ = _____ × _____

   **fast car:** _____ = _____ × _____

   *Hint: Distances will add up to 160.*