Name ________________________

Class ________________________

Problem 1 – Observe Motion & Graphically Solve

From the town of Alton to Barnhart, the Mississippi River has an average surface speed of about 2 mph. Suppose it takes a boat 3 hours to travel downstream, but 5 hours to travel upstream the same distance between the two towns. Work through the questions to find the rate of the boat in still water and how far apart the towns are.

Press Play on page 1.3 to view the motion of boats traveling downstream and upstream on the Mississippi River.

1. How long does it take the boat to travel *downstream* from towns A to B?

2. How long does it take the boat to travel *upstream* from towns B to A?

3. Let *r* be the rate of the boat in still water. How could the rate upstream and the rate downstream be expressed?

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

   distance = rate × time

   down *d* =_____ × _____

   up *d* =_____ × _____

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

6. On page 1.9, graph the two equations. Solve the system of equations graphically. Press **MENU > Analyze Graph > Intersection.** Then, to the left of the intersection and then to the right of the intersection. The coordinates of the intersection point will appear.

   Does this agree with your solution from Question 5? Record the rate of the boat in still water and the distance between the towns. Include units.

Problem 2 – Distance-Time Graph, Explore Slopes

Read the problem on page 2.1. On page 2.3, click the arrows to graphically explore values for the rate *s* of the steam engine locomotive and *v* of Velma walking that satisfy the given information. Notice the two different slopes.

7. What does the slope of the distance-time graph represent? ______________________

8. Draw a diagram for the situation similar to the boat animation.

9. Apply $d = r \cdot t$ to this situation. What is *r*?

   (Hint: *r* depends on *s,* the speed of the steam engine, and *v,* the velocity of Velma.)

   distance = rate $\times$ time

   forward ___ =_______ $\times$ ____

   back ___ =_______ $\times$ ____

10. Algebraically solve the equation.

Problem 3 – Planes

An airplane flew 3 hours with a tail wind of 20km/h. The return flight with the same wind took 3.5 hours. In this problem, you will find the speed of the airplane in still air.

11. How long does the trip take with the tail wind?

12. How long does the trip take with the head wind?

Continue to page 3.3, and provide the missing information.

13. Apply $d = r \cdot t$ to this situation.

	distance = rate $\times$ time
with	___ =_______ $\times$ ____
against	___ =_______ $\times$ ____

14. Use this information to find the speed of the airplane in still air. Support your work algebraically here.

15. On page 3.4, graph the two equations. Solve the system of equations graphically. Compare the graphical result with your algebraic answer.

Problem 4 – Cars

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? The problem is stated on page 4.1.

16. Fill in the chart.

	distance	=	rate	×	time
slow car	___	=	_______	×	____
fast car	___	=	_______	×	____

17. Use this information to find the speed of the airplane in still air. Support your work algebraically here.

18. Then, compare the graphical result with your algebraic answer.