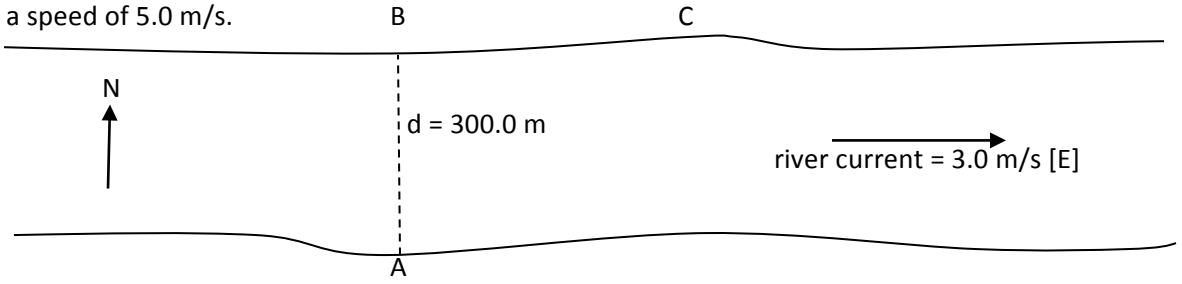
PART 1: Physics – Vector Kinematics in 2-D – <u>GRAPHICAL METHODS</u> – Rivers and Airplanes

Rivers/sailboats/airplanes – The same basic strategies are used for all (2-D vector addition) Use GRAPHICAL METHODS (scale diagrams, ruler, and protractor) to solve problems 4 to 7.

Examples of River Problems:

Parameters: A 300.0 m wide river flows with a current of 3.0 m/s [E]. In still water the boat can travel at a speed of 5.0 m/s.



1) Concept: Relative velocity:
   a. What is the velocity of the water relative to the shore ($\mathbf{v_{ws}}$)? _____
   b. What is the velocity of the shore relative to the water ($\mathbf{v_{sw}}$)? _____
   c. What is the velocity of the water relative to the water ($\mathbf{v_{ww}}$)? _____

2) The boat heads directly upstream:
   a. What is the boats' **heading**? _____
   b. What is the velocity of the boat relative to the water ($\mathbf{v_{bw}}$)? _____
   c. What is the velocity of the boat relative to the shore (land) ($\mathbf{v_{bs}}$)? _____

3) The boat heads directly downstream:
   a. What is the boats' heading? _____
   b. What is the velocity of the boat relative to the water? _____
   c. What is the velocity of the boat relative to the shore (land)? _____

COMPLETE PROBLEMS 4 to 7 ON A SEPARATE PIECE OF PAPER USING <u>SCALE DIAGRAMS</u>:

4) The boat starts at the south shore (at point A) and heads directly North to get to the opposite shore: What is the resultant velocity of the boat? (magnitude and direction)

5) The boat starts at the south shore (at point A). The captain wants to travel directly across the river to opposite shore, covering the shortest possible distance (travelling directly from point A to B):
   a. In what direction should the captain head the boat? (heading)
   b. What is the resultant velocity of the boat? (magnitude and direction)

6) The captain heads 10.0 degrees East of North: What is the resultant velocity of the boat? (magnitude and direction)

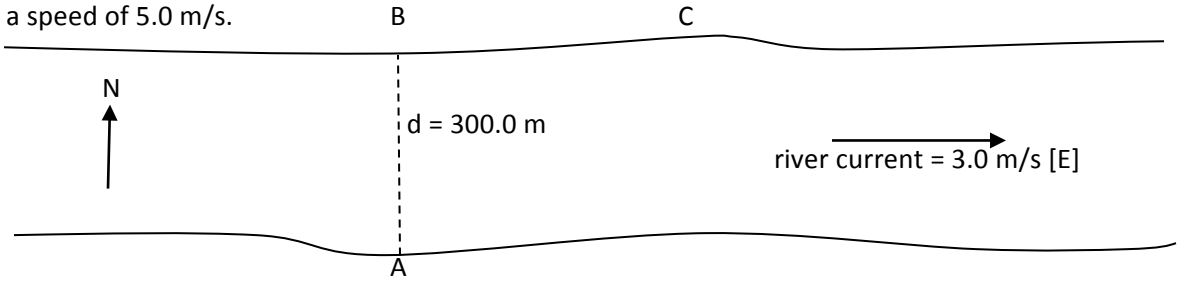
7) In what direction should the captain head the boat in order to reach the opposite shore in the shortest possible time?

PART2: Physics – Vector Kinematics in 2-D – <u>ANALYTICAL METHODS</u> – Rivers and Airplanes

Rivers/sailboats/airplanes – The same basic strategies are used for all (2-D vector addition) <u>*Sketch*</u> each situation to estimate results graphically. Then, solve <u>mathematically</u> using techniques such as trigonometry and Pythagorean theorem.

Examples of River Problems:

Parameters: A 300.0 m wide river flows with a current of 3.0 m/s [E]. In still water the boat can travel at a speed of 5.0 m/s.



1) The boat starts at the south shore (at point A) and heads directly North to get to the opposite shore:
    a. What is the resultant velocity of the boat? (magnitude and direction)

    b. How much time does it take to get to the opposite shore?

    c. How far downstream does the boat land? (distance from point B to point C)

2) The boat starts at the south shore (at point A). The captain wants to travel directly across the river to opposite shore, covering the shortest possible distance (travelling directly from point A to B):
    a. In what direction should the captain head the boat? (heading)

    b. What is the resultant velocity of the boat? (magnitude and direction)

    c. How much time does it take to get to the opposite shore?

3) The captain heads 10.0 degrees East of North:
    a. What is the resultant velocity of the boat? (magnitude and direction)

    b. How much time does it take to get to the opposite shore?

    c. How far downstream does the boat land? (distance from point B to point C)

4) In what direction should the captain head the boat in order to reach the opposite shore in the shortest possible time?