

Last Name, First Name

Discussion Section

Student ID

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### Worksheet 7 • Linear Motion and Optimization

For the following problems, you will assume the following: Initially at time zero, Boat 1 is at  $(2, 3)$  and Boat 2 is at  $(9, 4)$ . Boat 1 is traveling four miles per hour North (the positive  $y$  direction) and ten miles per hour East. Boat 2 is traveling two miles per hour North and one mile per hour East.

1. What are the vector equations for the positions of Boat 1 and Boat 2 as functions of time? How fast is each boat moving?
2. Independent of time, describe the paths of motion of Boat 1 and Boat 2. Do the lines that the two boats travel along intersect?
3. Will the boats crash into each other?
4. Can you change the speed of Boat 2 to ensure that the boats collide but maintain the same path of motion? If so how fast should Boat 2 go and what will be its new velocity vector? Hint: It may be helpful to consider the distance between the boats and scale the velocity vector of Boat 2 by a constant.
5. In the original setup, what is the distance between the boats as a function of time?
6. In the original setup, what is the closest the boats get to each other and at what time does this occur?