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## Miniproject 9: Related Rates

**Overview:** This miniproject focuses on another important class of applied calculus problems, namely *related rates* problems. These problems augment and extend the kinds of problems you have worked with in WeBWorK and class discussions.

**Prerequisites:** Section 3.5 of *Active Calculus*.

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For this miniproject, select EXACTLY TWO of the following and give complete and correct solutions that abide by the specifications for student work.

**Problem 1.** A sailboat is sitting at rest near its dock. A rope attached to the bow of the boat is drawn in over a pulley that stands on a post on the end of the dock that is 5 feet higher than the bow. If the rope is being pulled in at a rate of 2 feet per second, how fast is the boat approaching the dock when the length of rope from bow to pulley is 13 feet?

**Problem 2.** A baseball diamond is a square with sides 90 feet long. Suppose a baseball player is advancing from second to third base at the rate of 24 feet per second, and an umpire is standing on home plate. Let  $\theta$  be the angle between the third baseline and the line of sight from the umpire to the runner. How fast is  $\theta$  changing when the runner is 30 feet from third base?

**Problem 3.** We want to construct a box whose base length is 3 times the base width. The material used to build the top and bottom cost  $\$10/\text{ft}^2$  and the material used to build the sides cost  $\$6/\text{ft}^2$ . If the box must have a volume of  $50 \text{ ft}^3$ , determine the dimensions that will minimize the cost to build the box.

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**Submission instructions:** The writeup that you prepare is to be saved as a PDF file and submitted using Canvas. (You may use any program you want to write the writeup but the submission *must* be a PDF, or your work will be marked as Unsatisfactory and returned without comment. You may want to include screenshots to show the Desmos output for any steps. Just remember to be neat with your work.)