

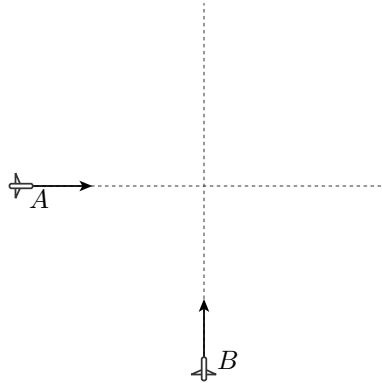
**AE 252: Introduction to Aerospace Dynamics**  
*Spring 2007*

Homework #3

Due Thursday, February 8, at 5PM in the “AE252” box in the mailroom.  
Please start every problem on a new sheet of paper, and put your name on the *back* of each page.

1. Text problem 13.169
2. Text problem 14.1
3. Text problem 14.3
4. Do the “airplane roundabout maneuver” problem on the following page...
5. Pose a problem of your own. (A homework or exam problem, a design problem, a “real-world” problem, ...) Then, suggest a solution.

### Problem 4. Airplane “Roundabout” Maneuver



Two aircraft are flying at constant speed  $v_0 = 300\text{km/h}$  as shown above. They are both flying toward the same point, and both start the same distance away from that point. If they continue on their present course, they will crash. So instead, they choose to execute a “roundabout” maneuver as shown below. Each plane travels a distance  $h = 100\text{km}$ , then moves along three consecutive circular paths with radius  $r_0 = 50\text{km}$ , and finally travels another  $h = 100\text{km}$ . Each plane maintains constant speed throughout the maneuver.

First, (a) compute the total time  $t_{\text{total}}$  it takes to complete the maneuver. Then, use MATLAB to (b) plot the position of both planes in Cartesian coordinates from time  $t = 0$  to  $t = t_{\text{total}}$ ; (c) plot the position  $\vec{r}_{A/B}$  of plane A relative to plane B from time  $t = 0$  to  $t = t_{\text{total}}$ ; and (d) plot the relative distance between plane A and plane B as a function of time, and determine when and where this distance is minimized.

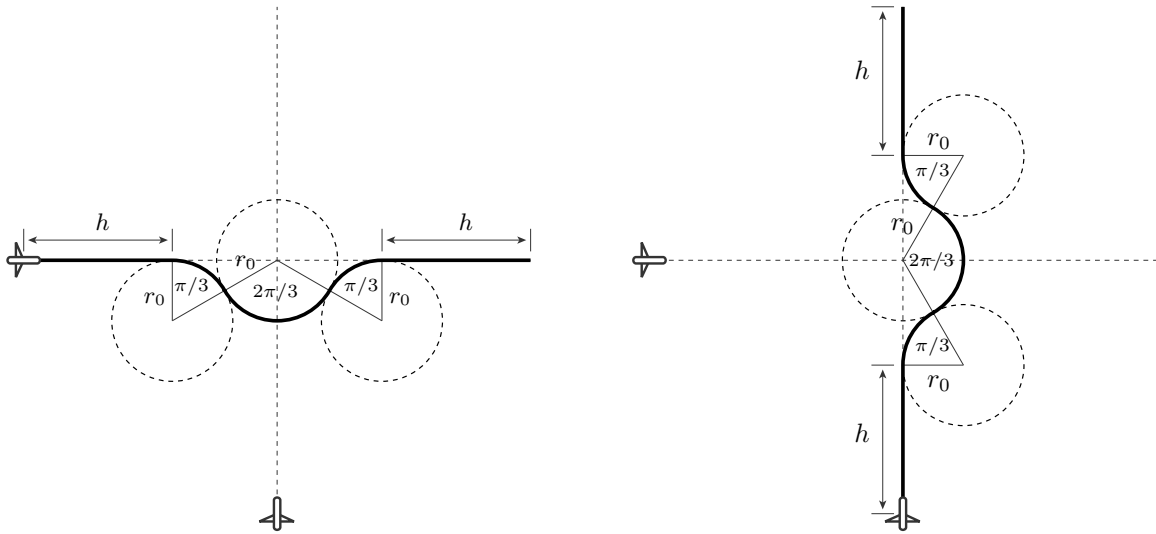


Figure 1: A roundabout maneuver for each plane. (The second is identical, but rotated ninety degrees.) They are drawn separately for clarity—of course, both planes execute their maneuvers *at the same time*.