

# William Daniels AMS 326 exam three writeup

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All of my source files can be found in this github repository:

<https://github.com/William-J-Daniels/DanielsAms326.git>

A detailed README on how the repository is used is there.

## Problem One

### Description

This problem is to optimize the starting angle of a ship crossing a river to minimize the distance it travels.

### Algorithms

#### Euler method

I used the euler method to integrate the ODE. The Euler method uses the slope at the current position to update the state according to  $y^{(k+1)} = y^{(k)} + \Delta x$ .

My Euler class is implemented in `OrdinaryDifferentialEquations/include/euler.h` and `OrdinaryDifferentialEquations/euler.cpp`.

#### Brute force optimization

I decided to use brute force to find the optimal path. That is, I computed the path at each of many angles in a search space and selected the optimal path from among them.

This is implemented in the driver code for the problem, `ExamThree/examples/problem`.

### Results

I found that the optimal angle was 0 radians, producing a distance traveled of 16.381 miles. The following plots show the distance traveled as a function of the starting angle and the path of least distance.

