

*MATH 224 Spring 2026*  
**Minimizing Travel Costs Project**  
**Due: Friday, May 8**

The ClawedAI Corporation is building four large computer clusters with power plants to supply them with electricity. The four sites will be in Middlebury Vermont, Dallas Texas, Tampa Florida, and Detroit Michigan. The number of computers at each site may differ with Tampa housing the most and Detroit the fewest.

The corporation determines that it will need to have a small full time staff of five expert repair technicians to service these computers. It is estimated that the entire staff will have to travel as a group to Middlebury three times a month, to Dallas two times a month to Tampa four times a month and to Detroit once a month. The group will have its own corporate jet (a SyberJet SJ30i) which is capable of landing at small or large airports in each of the four cities. When the group is not traveling, it will work out of an office somewhere in the United States. The technicians have been so well trained that they can fix any problem within a day. The group will fly from its home location to the troubled site, fix the problem, and then fly back to its home.

You are asked to advise the group where in the continental United States it should locate this office if it wants to minimize its travel costs. It costs \$6.74 per mile to operate the SyberJet SJ30i.

For the purposes of this problem, you may model the United States as a flat 2-dimensional plane. You may use latitude and longitude coordinates to build an  $(x,y)$  coordinate system. One degree of latitude is about 70 miles while one degree of longitude over the U.S. is about 50 miles.

Assume that the plane will fly straight line paths between the home base and the locations of the computer clusters. Create a function that will output the total monthly cost of all the flights for each possible home office location. The home office can be anywhere in the U.S. It does not have to be at one of the four cities.

Management has asked you as an expert in vector calculus to determine the location or locations that minimize that total monthly cost. What is the nearest town to the ideal location? Demonstrate through the use of Hessian matrices or other arguments that you have located a minimum and not a relative maximum or saddle point. Compare the minimum cost to the cost if the home base is situated at each of the four cities.

Feel free to make use of MATLAB in developing a solution to this project.

You should submit a full description of your work. Envision your submission as a careful report to management of on how you developed and analyzed your function, what assumptions you made, and what your final recommendation is. Note that if you recommend a location which turns out to be a relative **maximum** instead of a minimum, you are likely to get fired!