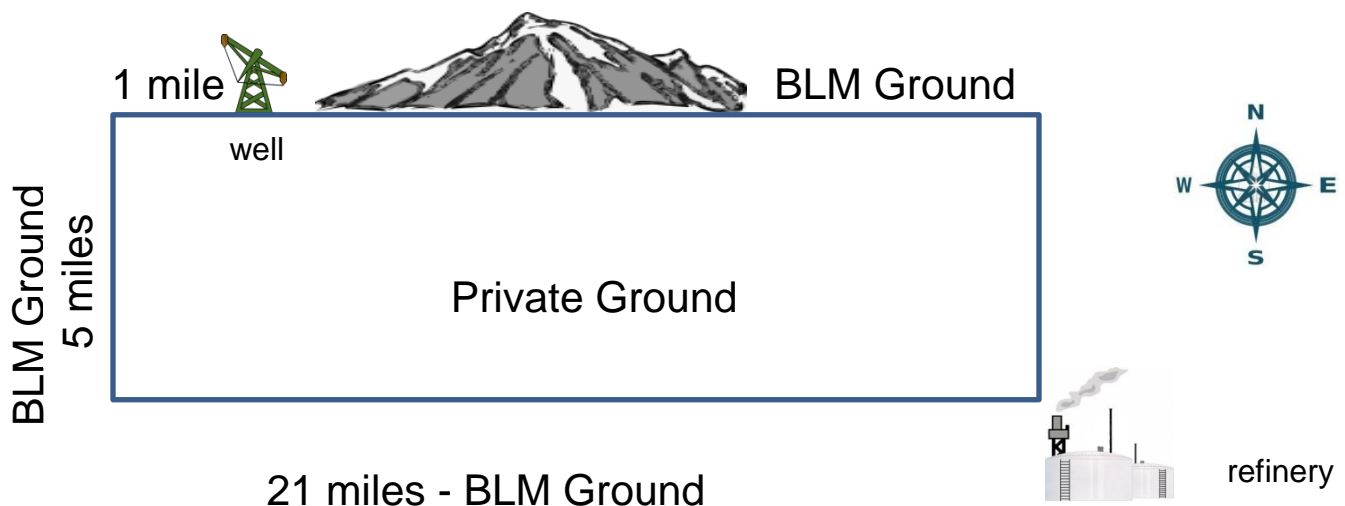


Math 1210 Pipeline Project

The U.S. Interior Secretary recently approved drilling of natural gas wells near Vernal, Utah. Your company has begun drilling and established a high-producing well on BLM ground. They now need to build a pipeline to get the natural gas to their refinery. While running the line directly to the refinery will be the least amount of pipe and shortest distance, it would require running the line across private ground and paying a right-of-way fee. There is a mountain directly east of the well that must be drilled through in order to run the pipeline due east. Your company can build the pipeline around the private ground by going 1 mile directly west and then 5 miles south and finally 21 miles east to the refinery (see figure below). Cost for materials, labor and fees to run the pipeline across BLM ground is \$300,000 per mile. For any pipeline run across private ground, your company incurs an additional \$200,000 per mile cost for right-of-way fees. Cost of drilling through the existing mountain would be \$500,000 on top of the normal costs of the material, labor and fees for the pipeline itself. Also the BLM will require an environmental impact study before allowing you to drill through the mountain. Cost for the study is estimated to be \$100,000 and will delay the project by 3 months costing the company another \$50,000 per month. Your company has asked you to do the following:

- Determine the cost of **running the pipeline strictly on BLM ground** with two different scenarios:
 - heading east through the mountain and then south to the refinery
 - running west, south and then east to the refinery.
- Determine the cost of **running the pipeline the shortest distance** (straight line joining well to refinery across the private ground).
- Determine the cost function for this pipeline for the configuration involving running from the well across the private ground at some angle and intersecting the BLM ground to the south and then running east to the refinery. Use this function to determine the optimal place to run the pipeline to minimize cost. Clearly show all work including sketching the placement of the optimal pipeline. Make it very clear how you use your knowledge of calculus to determine the optimal placement of the pipeline. Draw a graph of this cost function and label the point of minimum cost.



Write up a report of your findings to submit to your company's CEO. This report should include solutions to parts a-c showing all math steps and clearly labeled. Summarize the costs to be incurred by each scenario. Include any appropriate figures to make each scenario clear.

Write a paragraph reflecting on the things you have learned in your calculus class and how they may apply to the real world. Do you see calculus as a useful tool? What kinds of things have you learned that can be useful in your areas of interest? Please be specific and give some examples to back up your statements.