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MATH 1210
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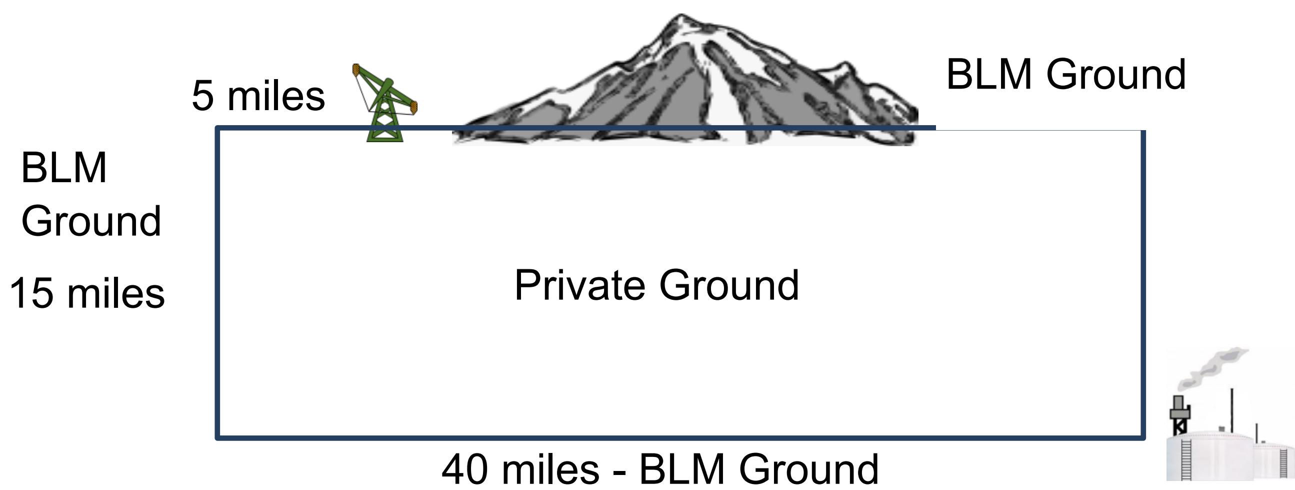
Salt Lake CC
Math 1210
Pipeline Project
Summer 2014



The U.S. Interior Secretary recently approved drilling of natural gas wells near Vernal, Utah. For this project, I was told to build a pipeline to get the natural gas to their refinery and find the cost from a few directions. Later, I will need to find this minimum cost of the pipeline.

BLM ground=$500,000 per mile

Drilling through mountain = $2,000,000

Study before drilling the mountain = $320,000

Delaying Project for 4 months = $120,000 per month

Pipeline on private ground = $350,000 per mile

S=South, W=West, M=Mountain, E=East

Part a)

i) C(W/S/E)=500,000 (5 + 15 + 40) = 30,000,000

ii) C(M/S)=2,000,000 + 320,000 +120,000(4) + 500,000(15+35) = 27,800,000

Part b)

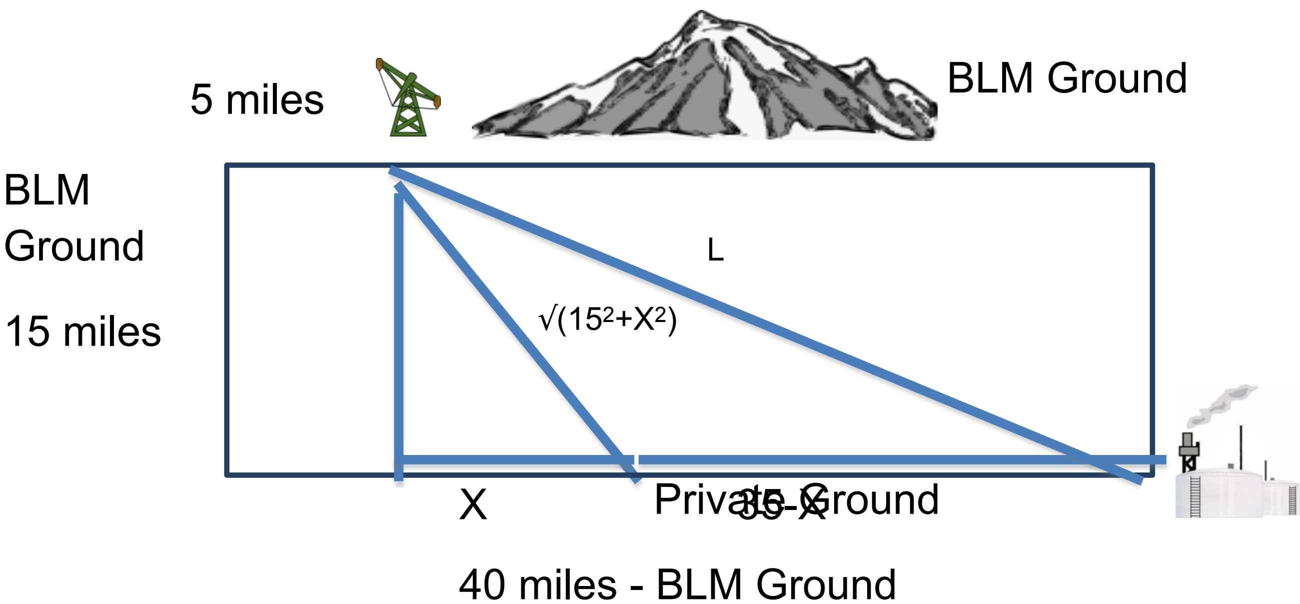
From Well to Refinery across Private Ground, we set that to be L

$15^2 + 35^2 = L^2$ L= square root of $(15^{2+}35^2)$ which is about 38.079 miles

i) C(L) = 350,000(L) + 500,000(L) = 32,367,035.7

ii) C(S/E)=350,000(15) + 500,000(15+35) = 30,250,000

Part c)



$C(x) = 850{,}000(\sqrt{(15^2+X^2)} + 500{,}000(35-X) \Rightarrow C'(X)=0 \Rightarrow 0=850{,}000(1/2)(15^2+X)^{-1/2}+500{,}000(-1) = 850{,}000x / \sqrt{(15^2+X^2)} - 500{,}000 \Rightarrow 500{,}000 = 850{,}000X/\sqrt{(15^2+X^2)}\ (85/50)\ ^2X^2=15^2+X^2 \Rightarrow (85/50)\ ^2X^2-X^2=15^2 \Rightarrow X(85/50)\ ^2X^2[(85/50)^2-1]=15^2 \Rightarrow X^2=15^2/[(85/50)^2-1] \Rightarrow X=\sqrt{\text{Answer}} \Rightarrow X$ I about 10.91

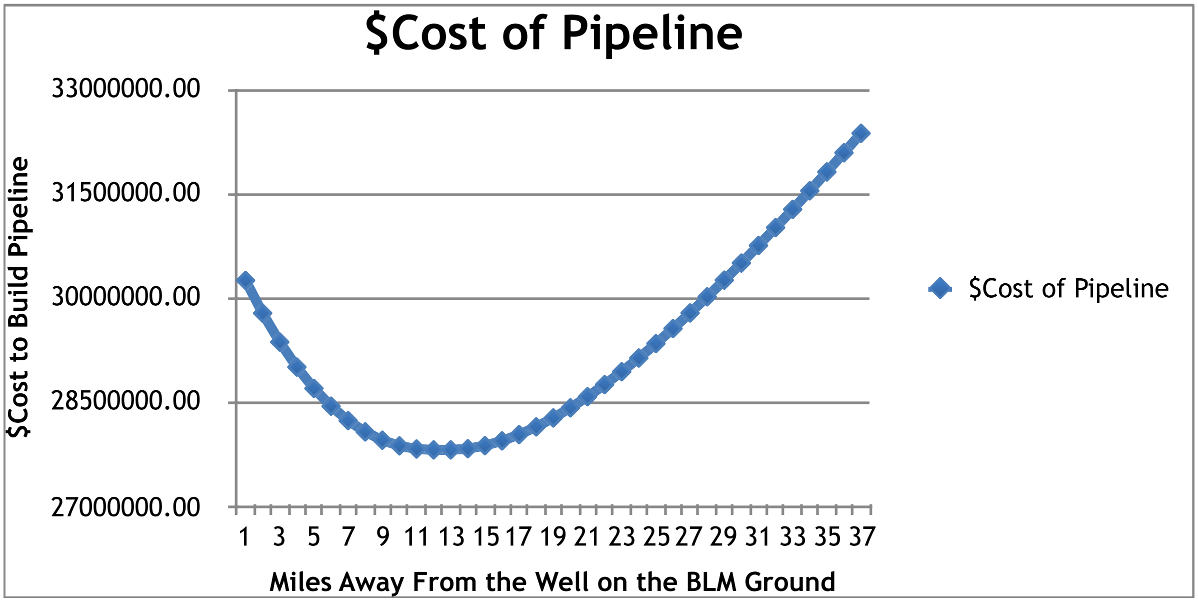
C(0)=30,250,000

C(35)=32,367,035.7

Now putting 10.91 into X, C(10.91)=27,810,795.33

X is in the interval [0,35}

Part d)



The minimum point is at about x=10.91 miles, which is between the [9,11]. The cost to build pipeline at x=10.91 miles is about $27,810,795.33.

In part a and part b, I used algebra, but the first question in part b required the use of Pythagorean Theorem to solve the problem. Part c required mostly all the things I learned in Chapter 4, but this part was optimization problem. First, I used Pythagorean Theorem to get 5^2 plus the base^2, which I called X, so that it could equal the $\sqrt{(15^2+X^2)}$. I knew since if you go straight down from the well to the BLM Ground, you are still 35 miles west from the refinery, so I used 35-X as the base. So I used the formula: $C(X)=850,000(\sqrt{(15^2+X^2)})+500,000(35-X)$ to solve part C. To find the minimum, I put C'(X)=0 After I found the derivative, was able to find X and used that to get the minimum point, and thus, the minimum cost of the pipeline. Finding this was important because you had to graph the function C(X) from part c to get the graph of part d. If you put X to equal an interval between [0, 10.91), you would find C(X) decreasing. If you put X to equal an interval between (10.91, 35], you would find C(X) increasing. So that helped in finding the graph for part d.