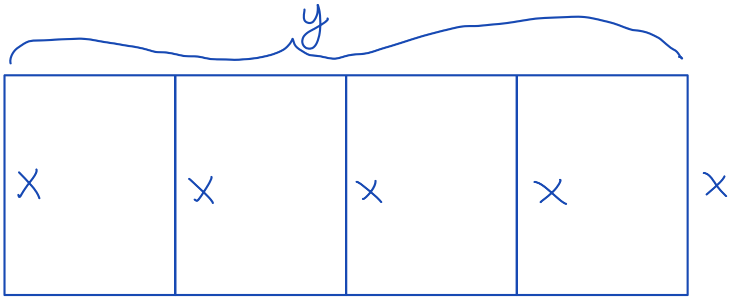
Optimization Name____________________________

1) Olivia and MGO decide to become farmers and need to buy all of their farming supplies on a budget. They only have 750 feet of fencing with which to work and want to enclose a rectangular area dividing it into a row of four equal subdivisions. Find the maximum total area possible with this much fencing.

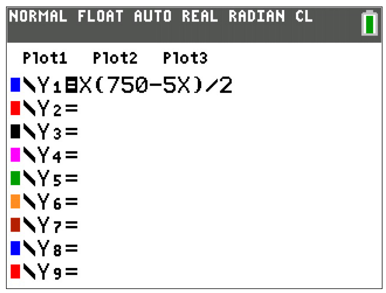


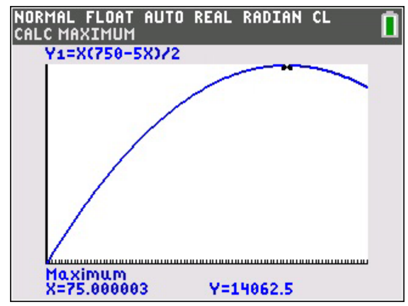
F = fencing = 750 ft

$750 = 5x + 2y$

$A_{max} = xy \leftarrow$ we need to substitute for y

because there are 5 lengths that measure x, our domain will be $0 < x < \frac{750}{5}$





$750 = 5x + 2y$

$750 - 5x = 2y$

$y = \frac{750 - 5x}{2} \Rightarrow A = x\left(\frac{750 - 5x}{2}\right)$ now go to the calculator

So the maximum area that can be enclosed is 14,062.5 ft^2

2) Winston and Kanye think that Olivia and MGO are doing it all wrong and need to decide on an area first then find the minimum amount of fencing needed to enclose that area. They decide to enclose 15,000 square feet with the same 4 subdivisions. Find the minimum amount of fencing that they will need.

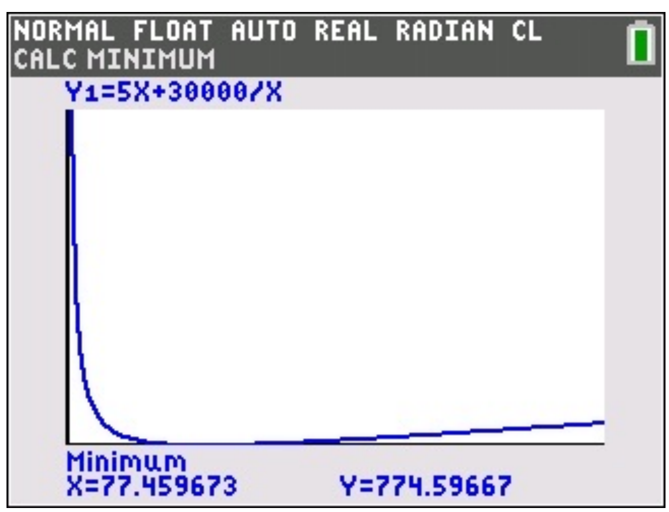
$A = 15000 = xy \Rightarrow y = \frac{15000}{x}$

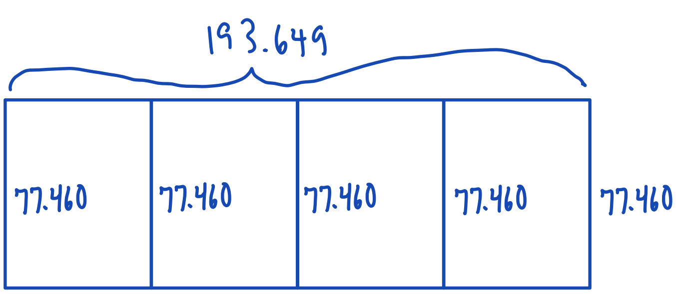
$F = 5x + 2y = 5x + 2\left(\frac{15000}{x}\right)$

$= 5x + \frac{30000}{x}$

Here the domain can't include zero because x is in the denominator

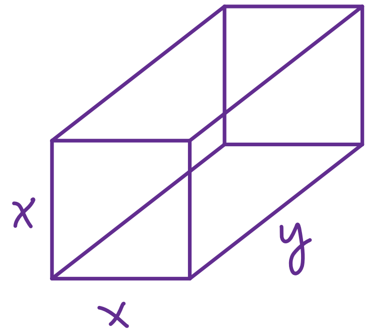
Now to the calculator

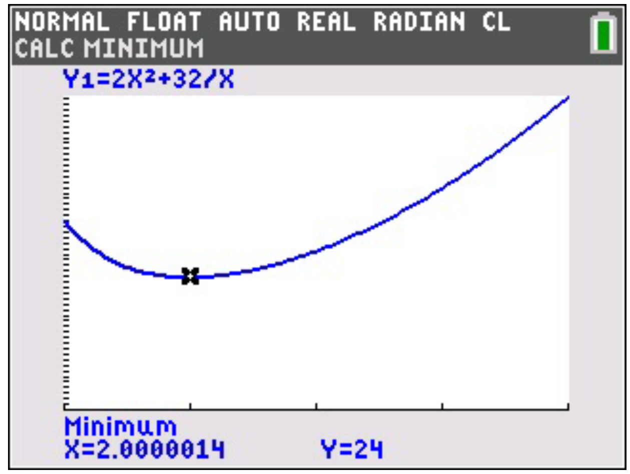




So the minimum amount of fencing needed is 774.597 ft

3) Edvin, Declan, and Jake M. need to find a way to use the least amount of cardboard to make a closed box with square ends and a volume of 8 m^3. How much cardboard will they need?





$V = x^2 y = 8 \text{ m}^3 \Rightarrow y = \frac{8}{x^2}$

$A = 2x^2 + 4xy \Rightarrow 2x^2 + 4x\left(\frac{8}{x^2}\right) = \underbrace{2x^2 + \frac{32}{x}}_{\text{now to the calculator}}$

minimum

two square sides x by x

four x by y sides

So the minimum amount of cardboard needed is 24 m^2

4) Chloe and Nora think that Jake M is leading his group down the wrong path and need to use 25 m^2 of cardboard and maximize the volume. Will they produce a box with greater volume?

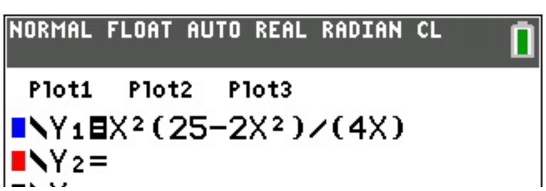
$25 = 2x^2 + 4xy$

$25 - 2x^2 = 4xy$

$\frac{25 - 2x^2}{4x} = y$

$V = x^2 y = x^2\left(\frac{25 - 2x^2}{4x}\right)$

$\underbrace{Y_1 = x^2(25 - 2x^2)/(4x)}_{\text{Make sure that you enter it into your calculator like this}}$



So the maximum volume of this box would be 8.505 m^3