3.4 Part 2 Finding Maximums & Minimums of Polynomial Functions

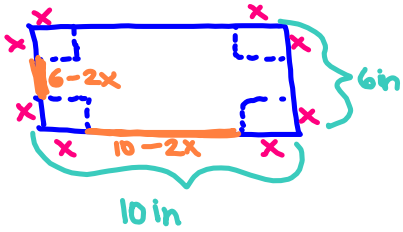
Example 1

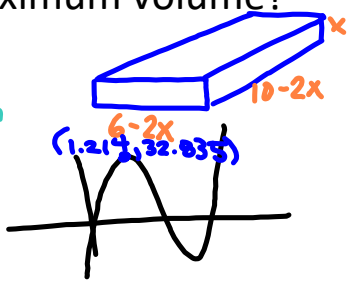
Squares with sides of length x are cut from the corners of a rectangular piece of sheet metal with dimensions of 6 in. and 10 in. The metal is then folded to make an open-top box.

a) Develop a function for the volume of the box.

b) Determine the dimension of the piece that should be cut out to maximize the volume.

c) What is the maximum volume?





a) $V = lwh$

$V = (10-2x)(6-2x)x$

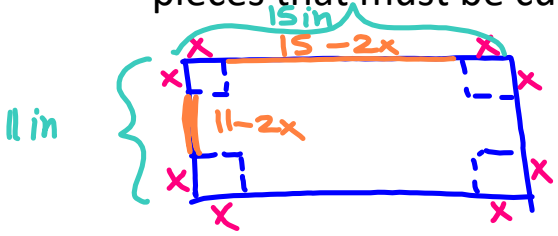
b) $x \approx 1.214$ in

c) max vol $\approx 32.835\ in^3$

Example 2

You are working for the Charleston Packaging Company, and you are currently on a team that is working together to create a cake pan for Pyrex with no lid that holds the most amount of cake batter as possible. Pyrex's machine that produces the cake pan has not been programmed yet for the size of steel they have in stock.

a) You and your team just received the dimensions to the piece of steel you will be using the create the cake pan with no lid. Pyrex currently has steel pieces that are 15 inches long and 11 inches wide. Create a diagram of the steel piece showing the dimensions and the pieces that must be cut out to form the steel into a pan.

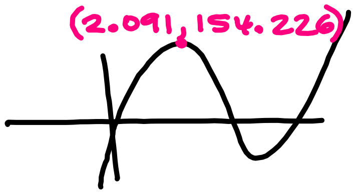


Example 2 Continued

b) Develop a function for the volume of the box based on the diagram you just created.

$V = lwh$

$V = (15-2x)(11-2x)x$



c) Use the graph of your polynomial to determine the dimensions of the piece that should be cut out to maximize the volume of your box. What is the maximum volume?

piece ≈ 2.091 in

max vol ≈ 154.226 in^3

Example 3

A box with an open top is to be constructed from a rectangular piece of cardboard with dimensions 12 in. by 20 in. by cutting out equal squares of side x at each corner and then folding up the sides.

a) Find the function that models the volume of the box.

$V = (20-2x)(12-2x)x$

b) Find the largest volume that such a box can have.

262.682 in^3

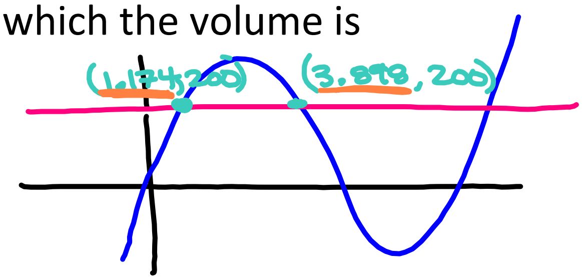
Example 3 Continued

c) Find the values for x for which the volume is greater than 200 in^3.

$V > 200 \text{ in}^3$

$(20-2x)(12-2x)x > 200$

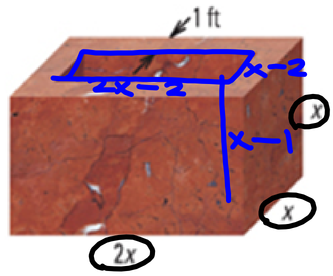
graph ✓ graph ✓



$1.174 < x < 3.898$

Example 4

You are designing a marble basin that will hold a fountain for a city park. The basin's sides and bottom should be 1 foot thick. Its outer length should be twice its outer width and outer height.



$V = (2x-2)(x-2)(x-1)$

What should the outer dimensions of the basin be if it is to hold 36 cubic feet of water?

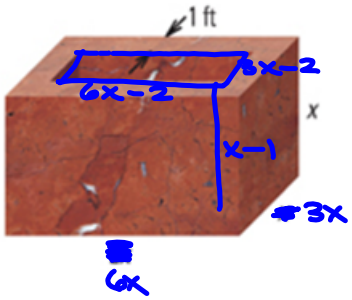
4ft x 4ft x 8ft

$36 = (2x-2)(x-2)(x-1)$ $x=4$

graph graph

Example 5

What should the outer basin's dimensions be if it is to hold 40 cubic feet of water and have outer length 6x, width 3x, and height x?



$40 = (6x-2)(3x-2)(x-1)$

$x = 2$

2ft × 6ft × 12ft