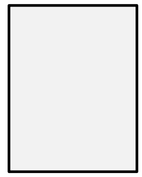
The Biggest Box from a Sheet



Imagine you have a thin metal sheet with the same dimensions as a sheet of paper: **8.5** inches by **11** inches.
How could you make a lidless box-shaped container using just this one sheet?

What dimensions, in inches, would the box need to be in order for it to have the greatest possible volume?

1. Sketch a drawing of the sheet and label the measures of the length and the width. Draw the square corners that will need to be cut from each corner. Let ***x*** represent the side of the square, in inches, and label the square. Next, sketch the box with the sides folded up and label the dimensions of the length, the width, and the height.

2. Write the equation that models the volume of the box as a function of ***x***. (***x*** is now height) Expand the expression. Also, write the interval of the domain values for this problem. (What's the least and the greatest that ***x*** can be?)

V(x) =

3. Find the first derivative and the second derivative for the volume function ***V(x)***.
What can the first derivative help you find? What can the second derivative help you find?

V'(x) =

V''(x) =

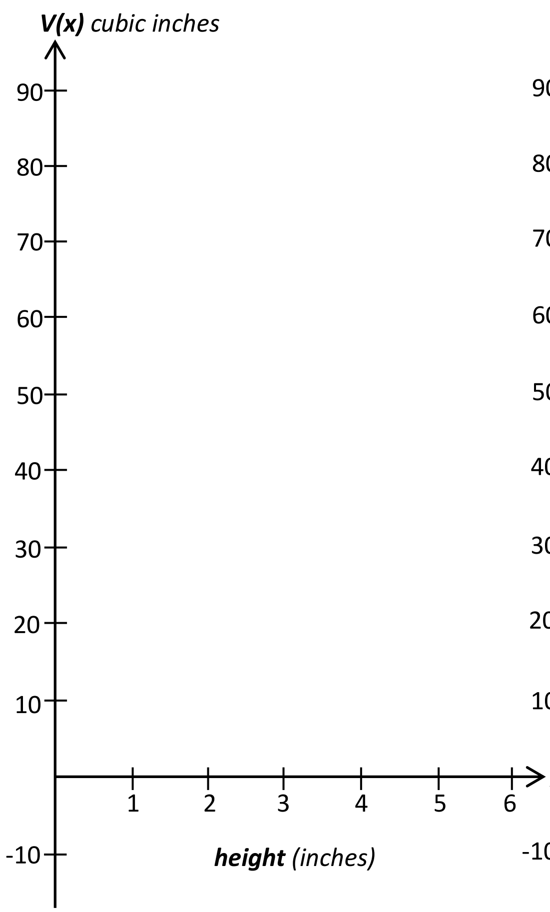
4. Find the ***x***-value that would ***maximize*** the volume & find the volume at this **x**. State the dimensions for this box.

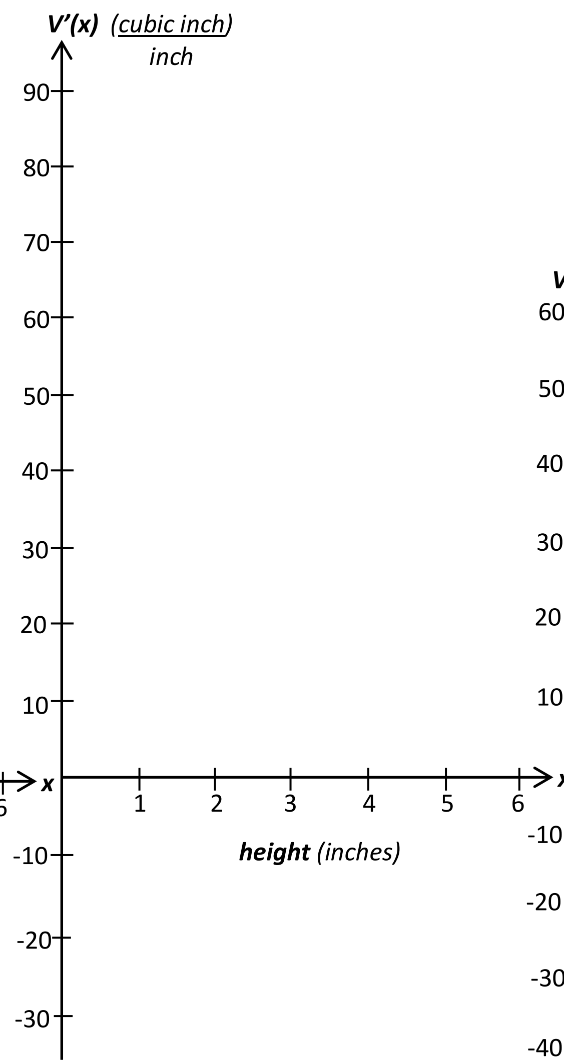
5. Complete the tables (use the TABLE feature of the graphing calculator) and graph ***V(x)***, ***V' (x)***, and ***V''(x)***.

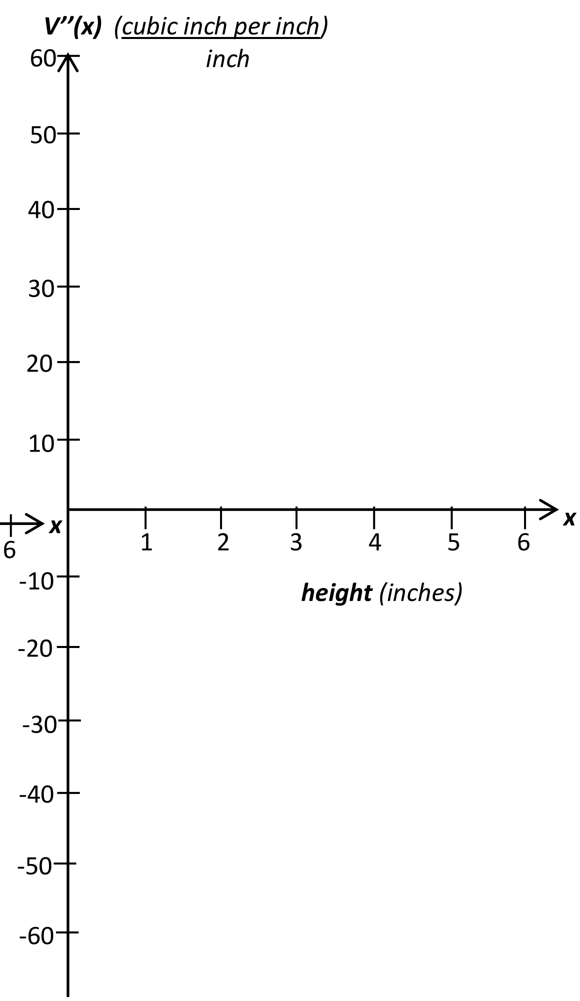
x	***V(x)***
0	
.5	
1	
1.5	
2	
2.5	
3	
3.5	
4	
4.5	
5	
5.5	
6	

x	***V'(x)***
0	
.5	
1	
1.5	
2	
2.5	
3	
3.5	
4	
4.5	
5	
5.5	
6	

x	***V''(x)***
0	
.5	
1	
1.5	
2	
2.5	
3	
3.5	
4	
4.5	
5	
5.5	
6	







6. Mark and label the **LMax** point on the ***V(x)*** graph.
Mark the x-values of **critical numbers** on the ***V'(x)*** graph.
Mark the x-value of **point of inflection** on the ***V''(x)*** graph.

→ *Consider where all these numbers are located in the tables above.*