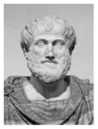
SM3-A Lesson 13-13 The "Box Problem"

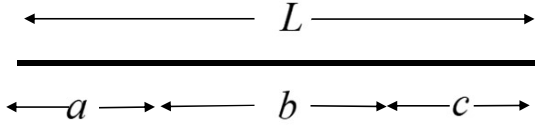
"The whole is greater than the sum of its parts."
Aristotle



This is a good definition for ***synergism***.

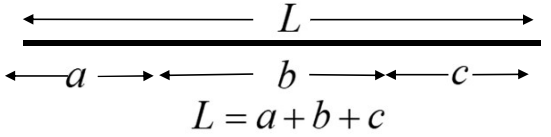
It doesn't make sense for math.

The length of a line segment is the sum of the its parts.

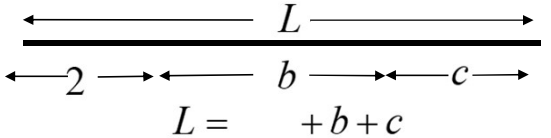


$$L = a + b + c$$

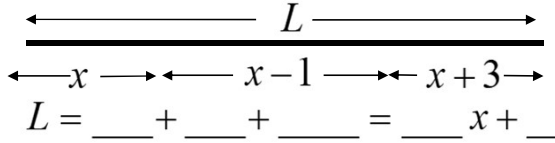
Rewrite the relation between the total length of the segment and its parts.



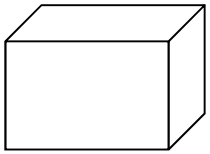
$$L = a + b + c$$



$$L = \_\_\_ + b + c$$



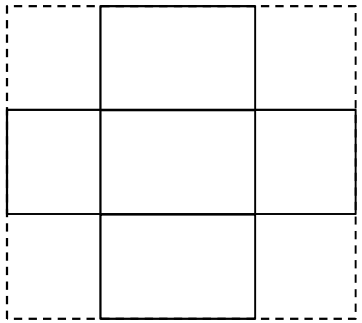
$$L = \_\_\_ + \_\_\_ + \_\_\_\_ = \_\_\_\,x + \_\_\_$$



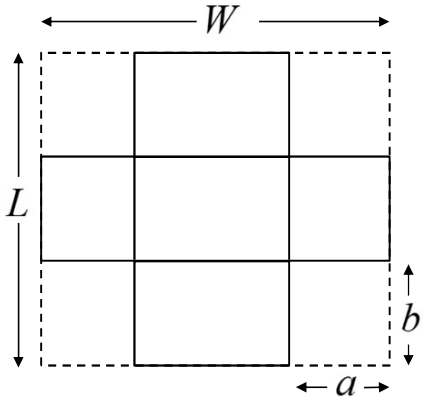
Start with an open-topped box.

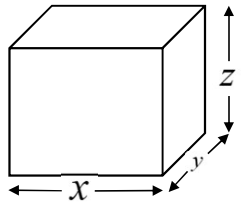
Build the "net" for the box.

Describe how you can use a single flat piece of cardboard to build the box.



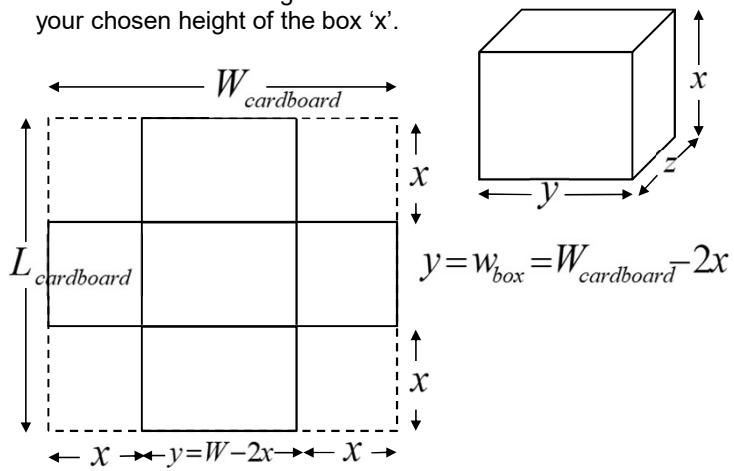
Dimensions "a" and "b" on the net correspond to which dimensions on the box?



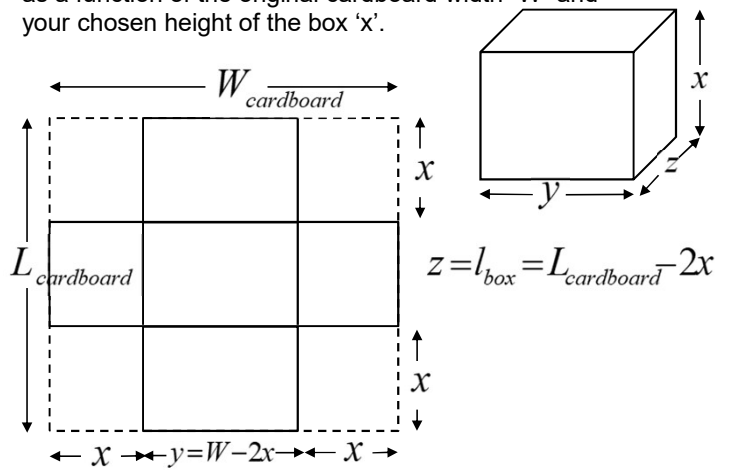


$$a = b = z$$

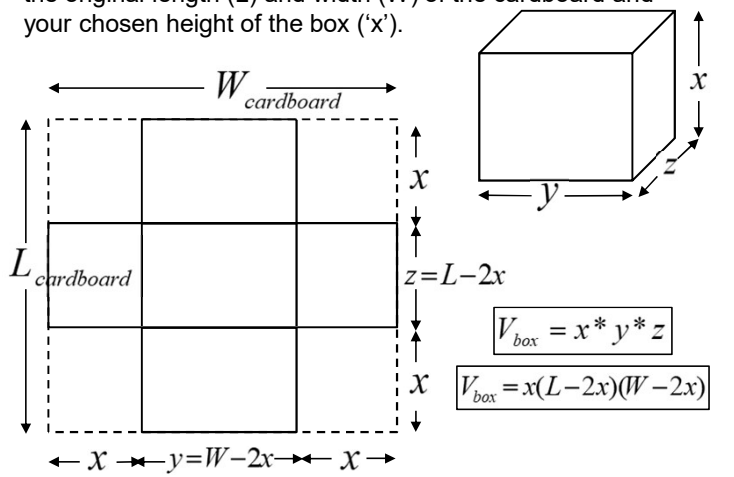
Write an expression for length ‘y’ (the width of the box) as a function of the original cardboard width “W” and your chosen height of the box ‘x’.



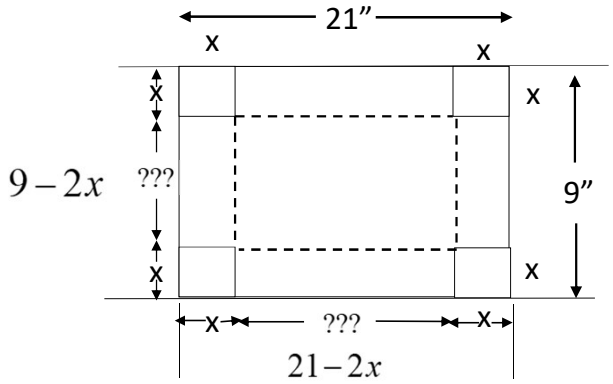
Write an expression for length ‘z’ (the length of the box) as a function of the original cardboard width “W” and your chosen height of the box ‘x’.



Write an expression for the volume of the box as a function of the original length (L) and width (W) of the cardboard and your chosen height of the box (‘x’).



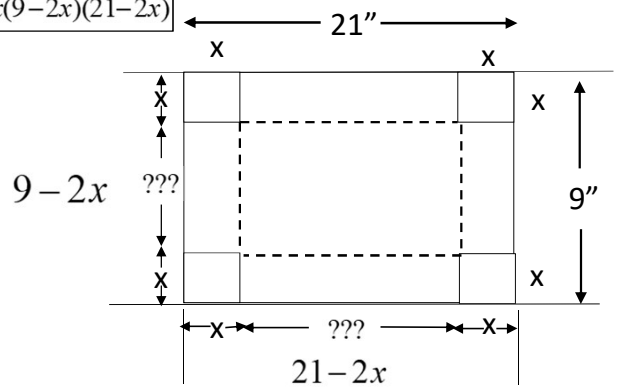
Corners are cut out of a 9” x 21” piece of cardboard. Then the sides are folded up along the dotted lines.



Write a formula for the volume of the box as a function of its height "x" only.

$V_{box} = x(L-2x)(W-2x)$

$V_{box} = x(9-2x)(21-2x)$



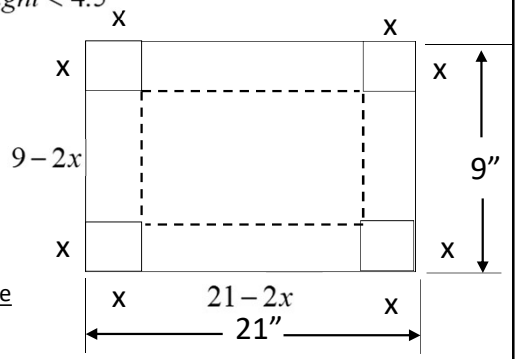
What is the implied domain for the height of the box (that starts out as a piece of cardboard measuring 9" x 21')?

Hint: what is the minimum distance you can fold the sides of the cardboard up? $height > 0"$

Hint: What is the max distance? $height < 4.5"$

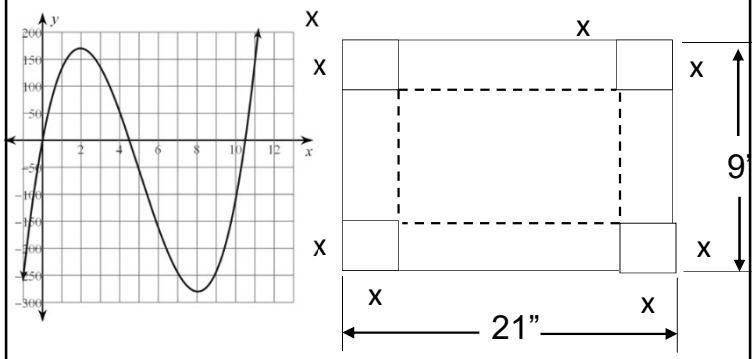
implied domain:
0" < x < 4.5"
or
x = (0", 4.5")

Why is the maximum height determined by the shortest side of the cardboard?



Graph your equation for the volume of the box.

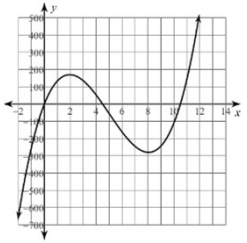
$V = x(9-2x)(21-2x)$ $V = L*w*h$



Maximizing Volume of a Box

$V(h) = h(9-2h)(21-2h)$

$y = x(9-2x)(21-2x)$



Why does the "implied domain" make sense now that you can see the graph of volume as a function of height?

What is the maximum volume of the box?

What height corresponds to the maximum volume of the box?