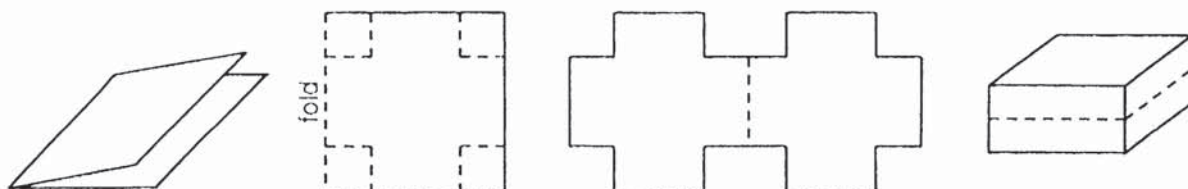


MAKING A SUITCASE

Think-Outside-The-Box Luggage Company wants to make suitcases. They plan to use 20 by 10 pieces of cardboard to design a suitcase that holds the maximum volume. As their mathematician, you are to find what dimensions will create such a box.



- Create some possible suitcases by folding the 20 by 10 models in half as shown above. Then cut four equal-sized squares from the corners and fold the paper to form a box with a top. Determine the volume of the box.
- Record your data in the table below. Be sure to include some fractional heights.

Square (s)	Length (l)	Width (w)	Height (h)	Volume (V)
1 by 1	8	8	2	128
1.5 by 1.5	7	7	3	147
2 by 2	6	6	4	144
2.5 by 2.5	5	5	5	125
3 by 3	4	4	6	96
3.5 by 3.5	3	3	7	63
4 by 4	2	2	8	32
4.5 by 4.5	1	1	9	9
5 by 5	0	0	10	0

- On a sheet of graph paper, plot V vs. h .

4. What are the x-intercepts of $V(h)$? Considering the problem, explain why those are the x-intercepts.

0 and 10

5. Using your graph, estimate the greatest possible volume for the suitcase. What dimensions (length, width, and height) will create this volume?

147.875 6.5 by 6.5 by 3.5

6. Referring to the patterns in your data chart, propose a function relating the width and the height. (i.e. $w(h) = ?$)

$$w(h) = 10 - h$$

7. Referring to the patterns in your data chart, propose a function relating the length and the height. (i.e. $l(h) = ?$)

$$l(h) = 10 - h$$

8. Referring to the patterns in your data chart, propose an equation representing $V(h)$.

$$V = w l h$$

$$V = (10 - h)(10 - h)h$$

$$V = (100 - 20h + h^2)h$$

$$V = h^3 - 20h^2 + 100h$$

9. Plot the data on your calculator using the lists, and then graph your $V(h)$ equation from #8. Make sure to choose an appropriate **WINDOW**. How well does your equation match the data?

0. On your calculator, **TRACE** to find the maximum volume. What dimensions will create this volume?

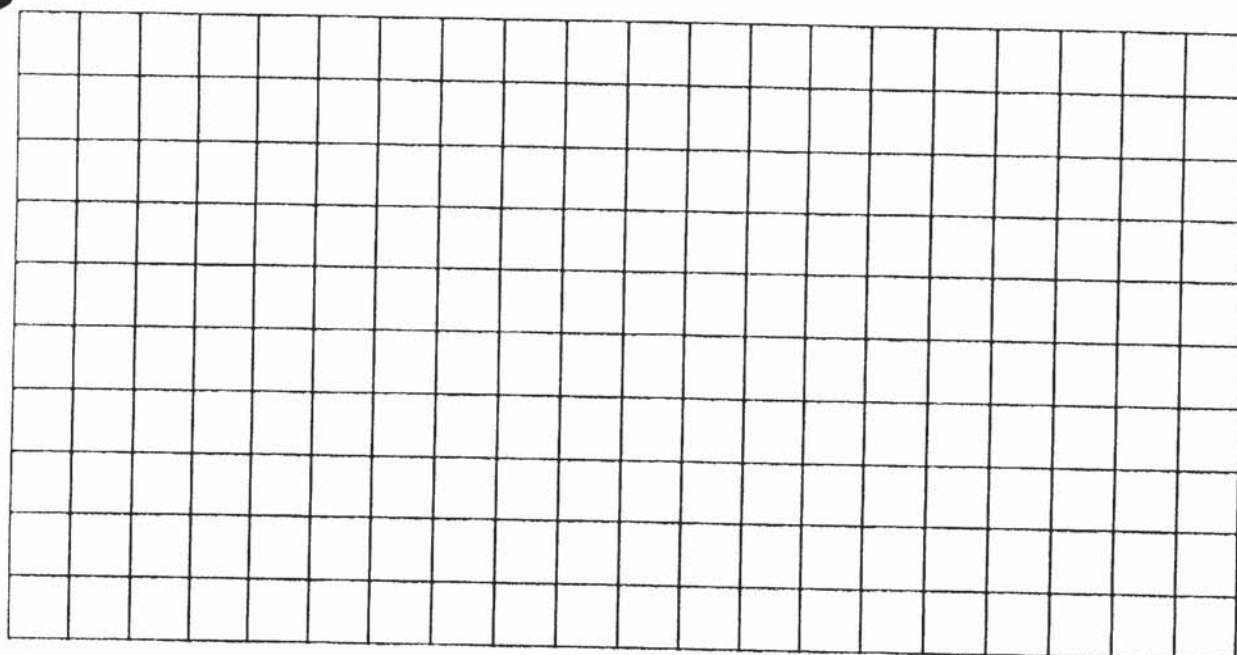
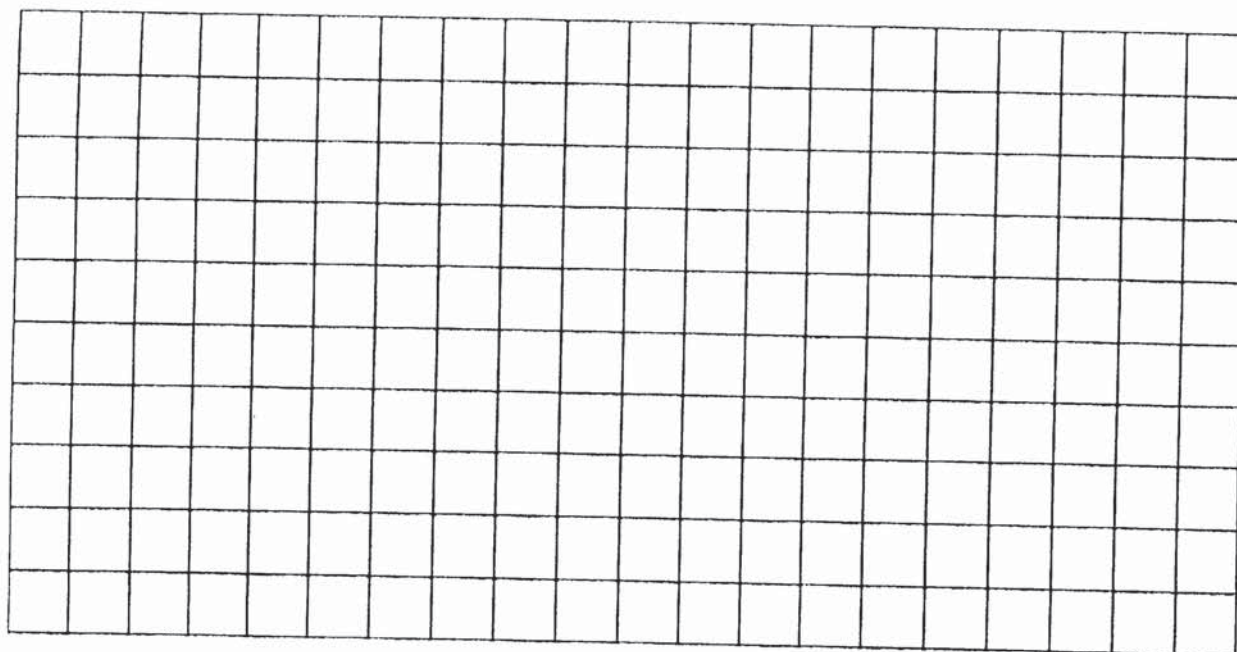
$\begin{matrix} w & \times & l & \times & \text{height} \\ 6.66 & 6.66 & 3.33 & & 148.15 \end{matrix}$

1. Choose a larger **WINDOW** and describe the general characteristics of the $V(h)$ graph. Are there any other x-intercepts? How many turns does the graph have?

↓
0 and 10

3 turns

SUITCASE TEMPLATES



GRAPH PAPER

