YOU TRY IT! #2

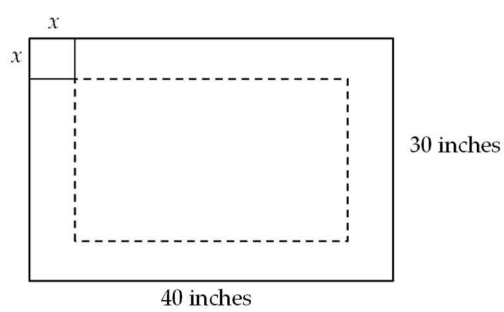
A pet store sells fish tanks in the shape of a hexagonal prism with square lateral faces. They advertise various size tanks, but the manufacturer will customize any size ordered. The function $V(s) = \frac{3}{2}\sqrt{3}(s^3)$ can be used to calculate the volume in cubic inches based on the side length of a face of the prism, measured in inches. Recall that 1 gallon is equivalent to 231 cubic inches. What side length would be needed for a 30-gallon fish tank? Write a function and related equation then use a table of values to determine your solution.

PRACTICE/HOMEWORK

Use the scenario below to complete questions 1 – 9.

GEOMETRY

A company manufactures open storage boxes that are each made from a single piece of sheet metal that measures 40 inches by 30 inches. To manufacture the box, a machine cuts a square with a side length of x inches from each corner of the metal and then folds the four sides up (along the dotted lines in the drawing) to create an open box that is in the shape of a rectangular prism.



1. Write an expression, in terms of x, to represent the length, width, and height of the open box.

2. Write a function, $V(x)$ that could be used to represent the volume of the open box. Use the expressions you wrote in problem 1 to write the function in factored form.

3. In this scenario, the maximum value of x has to be less than 15 inches. Explain why.

4. The function for determining the volume of an open box is $V(x) = 4x^3 - 140x^2 + 1200x$. Use graphing technology to complete the table shown.

SIDE LENGTH OF SQUARE, x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VOLUME OF OPEN BOX, $V(x)$															

5. The company wants to manufacture an open box with a volume of 2,000 cubic inches. What should be the dimensions of the square removed from each corner of the sheet metal?

6. The company wants to manufacture an open box with a volume of 3,000 cubic inches. What should be the dimensions of the square removed from each corner of the sheet metal?

7. The company wants to manufacture an open box with a volume of 2,500 cubic inches. Write an equation that could be used to determine x, the side length of the removed square.

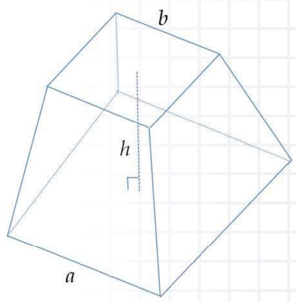
8. Use a graph to approximate the 3 solutions to the equation.

9. Which solution(s) from the previous question do NOT apply to the open box scenario and why?

Use the scenario below to complete questions 10 – 15.

ART AND ARCHITECTURE

The volume formula of a frustum of a square pyramid was introduced by the ancient Egyptian mathematics in what is called the Moscow Mathematical Papyrus, written ca. 1850 BC. The volume formula is shown.



$$V = \frac{1}{3}h(a^2 + ab + b^2)$$

In the formula, a and b are the base and top side lengths of the truncated pyramid and h is the height. The frustum of a square pyramid is shown.

For this particular frustum, the function $V(x) = 0.5x^3 - 3x^2 + 6x$ can be used to calculate the volume when $a = x$, $b = x - 6$, and $h = \frac{1}{2}x$.

10. Use graphing technology to complete the table shown.

x	1	2	3	4	5	6	7	8	9	10
$V(x)$										

11. What is the length of the larger base, a, if the volume is 4 cubic units?

12. What is the length of the larger base, a, if the volume is 175.5 cubic units?

13. Write an equation that could be used to determine the value of the length of the larger base, x, if the volume is 100 cubic units.

14. Use graphing technology to graph $V(x)$ and the line $y = 100$ to determine the point on the graph of $V(x)$ with a function value of 100.

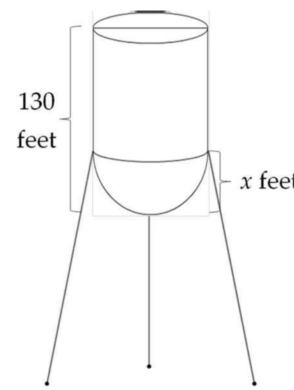
15. Use the value of x to determine the dimensions of a frustum with a volume of 100 cubic units.

- Length of larger base (a):
- Length of smaller base (b):
- Height:

Use the scenario below to complete problems 16 – 22.

GEOMETRY

A town has a water tower that is composed of a cylinder and a hemisphere. The dimensions, in terms of the radius x, are shown.



16. Using the diagram, express each dimension in terms of x.

- Radius of base of cylinder:
- Height of cylinder:
- Radius of hemisphere:

The function $130\pi x^2 - \frac{1}{3}\pi x^3$ can be used to calculate the volume of the water tower. Use graphing technology to complete the table below.

x	5	10	15	20	25	30	35	40	45	50
$V(x)$										

17. What is the radius of the cylinder if the volume of the water tower is approximately 455,400 cubic feet?

18. If a water tower has to have a minimum diameter of 20 feet and a maximum diameter of 40 feet, what is the minimum and maximum volume of water the tower could hold?

19. Use graphing technology to graph $V(x)$ and the line $y = 1{,}000{,}000$ to determine the three points of intersection or solutions to the equation $1{,}000{,}000 = 130\pi x^2 - \frac{1}{3}\pi x^3$.

20. Use the approximate value of x in all three points to determine the possible dimensions of the water tower.

Point A	**Point B**	**Point C**
radius:	radius:	radius:
height:	height:	height:

21. Which x-value makes sense in the situation and why?