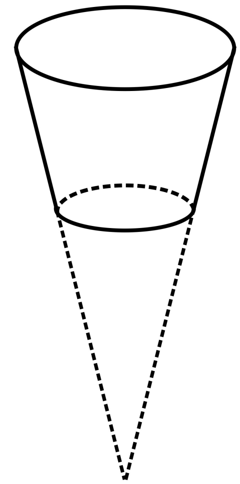
Name: ___________________________________ Date: _________________

THE VOLUME OF A TRUNCATED CONE (CUP)
COMMON CORE GEOMETRY

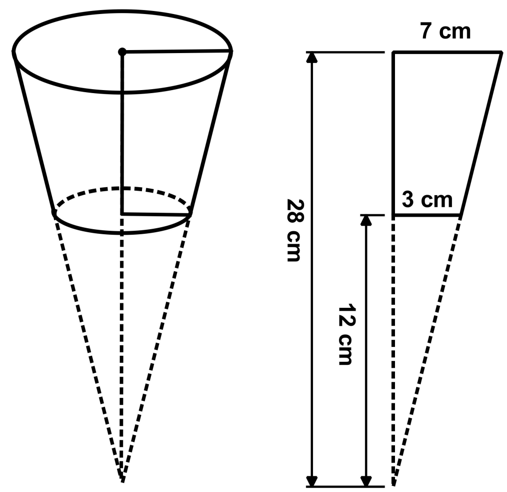
In our last lesson on volume, we will explore a case study that you see often in the real world, the volume of a truncated cone, which is the shape of many cups. A truncated cone is created by essentially slicing off a portion of the cone that includes its vertex.



***Exercise* #1:** What strategy might make sense to find the volume of the cup (truncated cone)?

***Exercise* #2:** What information would you need to carry out your strategy in #1?

***Exercise* #3:** Say we have the following cup which is 16 centimeters tall, has a large radius of 7 centimeters and a smaller radius of 3 centimeters.



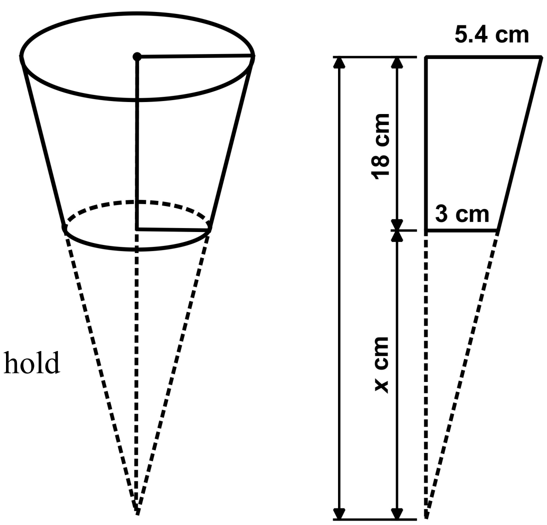
(a) Find the volume of the cup to the nearest cubic centimeter. Show the work that leads to yours answer.

(b) Find the ratio of the two cone heights in simplest form. Why is this ratio the same as that of the two radii?

(c) Of the measurements given in this problem, which one would we realistically **not know**?

In the last problem, we were given the height of the overall cone. Interestingly, even though this is necessary to calculate the volume of the truncated cone, we don't need to be given this height if we know the height of the cup and the two radii.

***Exercise* #4:** In the following cup problem, a cup with a height of 18 centimeters has a large radius of 5.4 centimeters and a small radius of 3 centimeters.

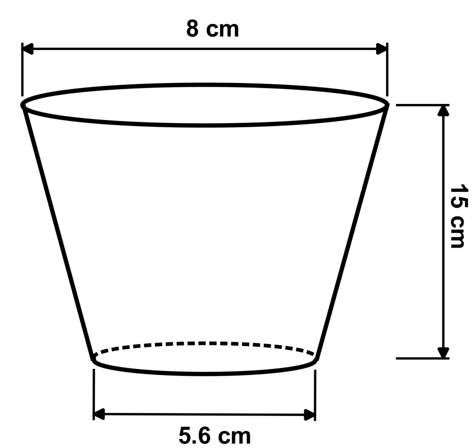


(a) Set up and solve an equation that could be used to find the value of x, the height of the smaller cone.

(b) One liter is equivalent to 1,000 cubic centimeters. Can this cup hold more than one liter? Justify your answer.

Similarity is the key to solving all cup problems. Try one now with just the basic dimensions of the cup given.

***Exercise* #5:** Determine the volume of the cup below to the nearest cubic centimeter. Show all your work.



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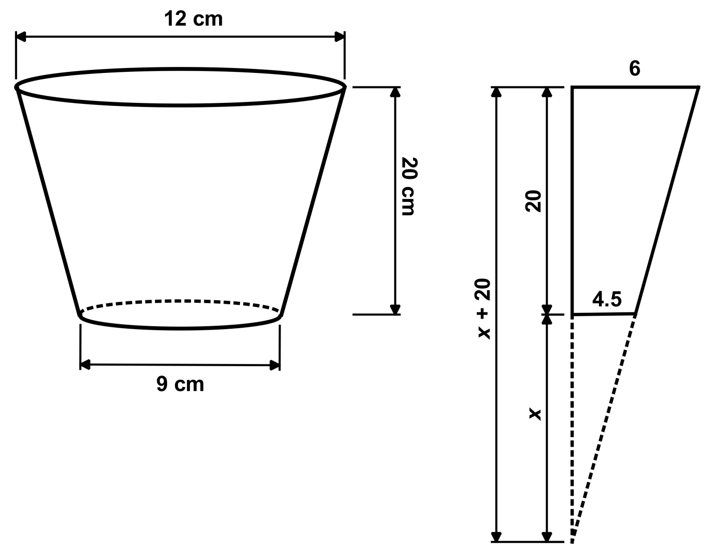
THE VOLUME OF A TRUNCATED CONE
COMMON CORE GEOMETRY HOMEWORK

PROBLEM SOLVING

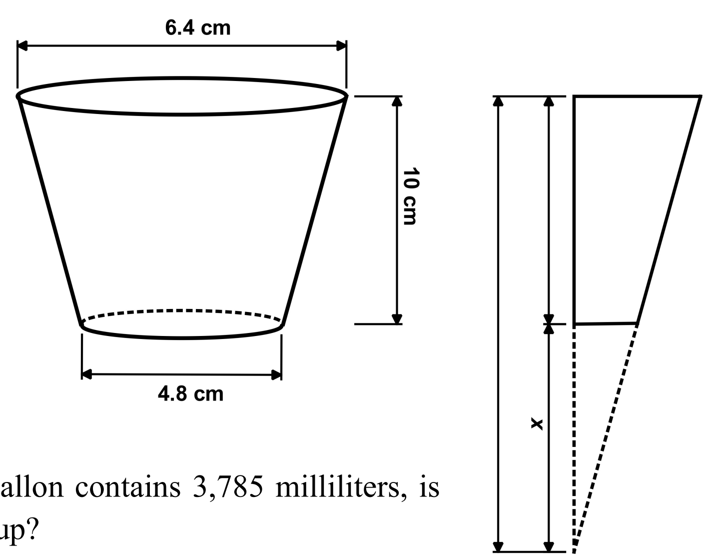
1. For the cup with the dimensions shown do the following:



   (a) Set up and solve an equation to find the value of x shown in the diagram.

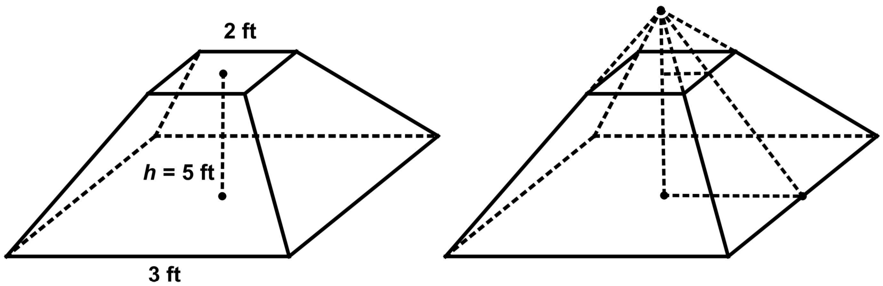
   (b) Determine the volume of the cup to the nearest cubic centimeter.

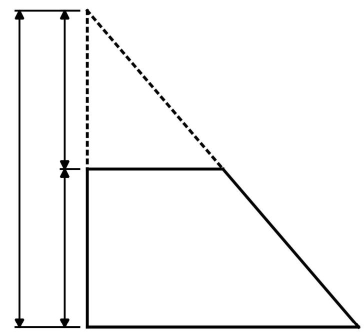
2. A small plastic vessel has the shape of a truncated cone as shown. A cubic centimeter is the same as a milliliter. What is the volume of this cup to the nearest milliliter? Show the work you use to find the answer.



3. There are 16 liquid measuring cups in a gallon. If a gallon contains 3,785 milliliters, is the vessel above more or less than a liquid measuring cup?

4. Truncated pyramids would have volumes found in a manner identical to the truncated cone. And, like the cone, the key will be similar right triangles. A monument has the shape of the truncated pyramid shown below that has a square base and square top with dimensions shown. Its height is 5 feet. The extended version is shown beside it along with a diagram for use with the similar triangles.





(a) Determine the volume of the monument to the nearest tenth of a cubic foot.

(b) If the monument is made from marble that weighs 170 pounds per cubic foot, how many tons is this monument, to the nearest tenth of a ton? If you don't remember how many pounds are in a ton, do an internet search.

5. Find a cup at home that is in the shape of a truncated cone. It should be easy. Measure its height and its two base diameters (that will be easier than the radii). Do all measurements to the nearest tenth of a centimeter. Then, calculate its volume in cubic centimeters. Since a cubic centimeter is equal to a milliliter, you have also found its volume in milliliters. If you have a measuring cup (like the one pictured below) that measures in milliliters, check your answer by filling up the appropriate amount water.