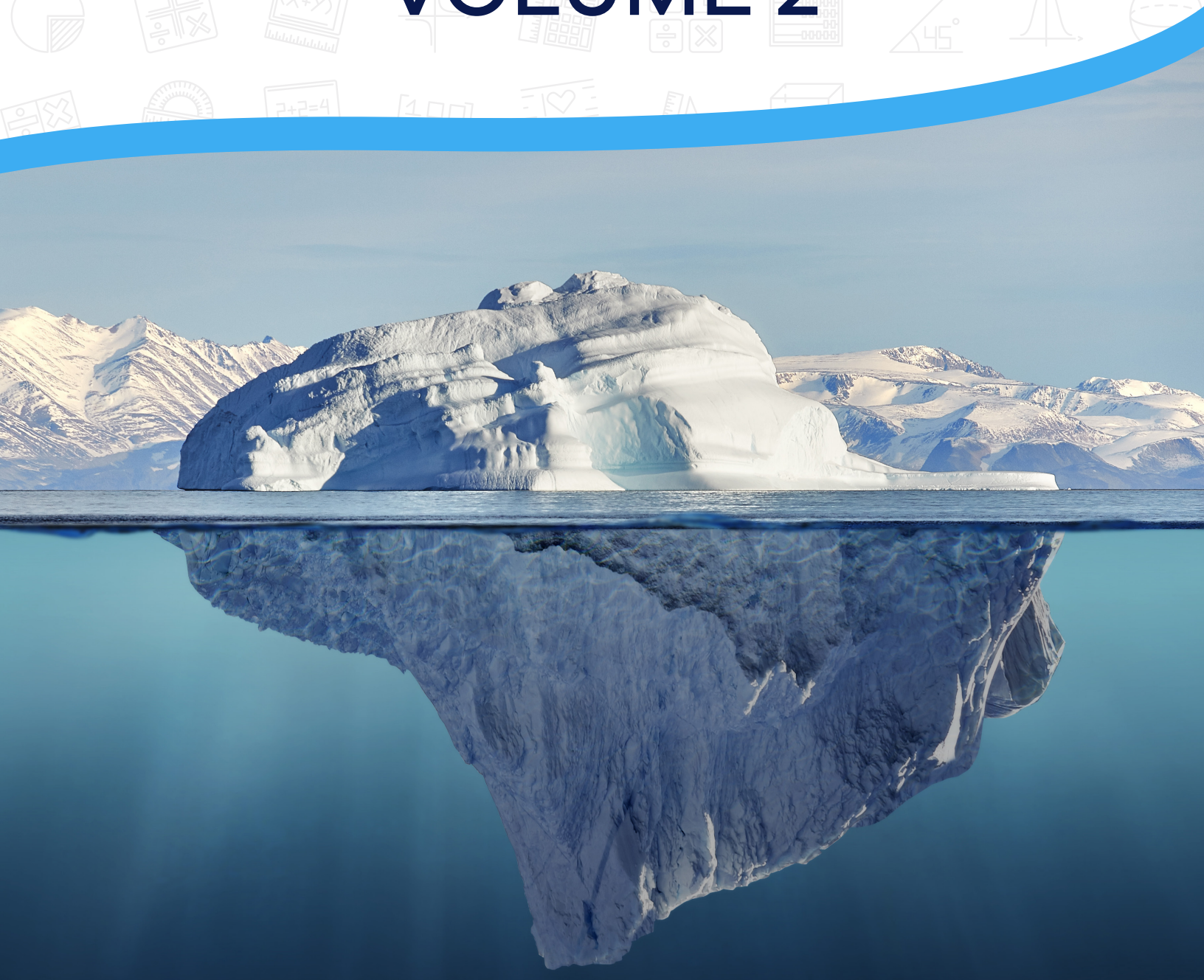
Learn BRIGHT

VOLUME 2



GRADE 5-6

Classroom Procedure:

1. Display a real (or images of) a cone, cylinder, and sphere. Ask students what they have in common or their differences.
2. Allow for responses and discussion. Ask students what makes them different than cubes, rectangular prisms, and pyramids.
3. Allow for responses and discussion. Lead to them being curved figures, circular, etc. Introduce all have space inside and have volume.
4. Distribute *Volume 2* content pages. Read and review the information with the students. Stress the different ways the formulas may be written. Use the additional resources to enhance understanding. Save final question for lesson closing.
5. Distribute Activity page. Read and review the instructions. Remind students to use a variety of numbers. Limit the measurements to less than 100 for all figures. Allow for the use of calculators. Distribute scratch paper.
6. Once students are completed, allow them to exchange the work with others. You may do this more than one time by having students do the work on separate paper.
7. Allow students to check each other's completed work.
8. Distribute Practice page. Check and review the students' responses.
9. Distribute the Homework page. The next day, check and review the students' responses.
10. In closing, ask students: Would you rather eat ice cream in a cone, play with a ball (sphere) or drink some soda or juice from a glass (cylinder) and why?
11. Allow for responses and discussion.

Approximate Grade Level: 5 – 6

Objectives: The students will be able to identify and use the formulas for the volume of cylinders, cones, and spheres.

State Educational Standards*
LB.Math.Content.5.MD. C.3
LB.Math.Content.5.MD. C.4
LB.Math.Content.5.MD. C.5
LB.Math.Content.6.EE. A.2.C
LB.Math.Content.6.G.A.2

Class Sessions (45 minutes):
At least 2 class sessions

Teaching Materials/Worksheets:
Volume 2 content pages (2), Activity page, Practice page, Homework page

Student Supplies:
calculators, scratch paper, handouts

Prepare Ahead of Time:
Student supplies needed for activity.
Copy handouts.

Options for Lesson: Repeat the activity several times to give students additional practice. Depending on level of students, you may choose to give students problems with missing measurements to find with known volumes. Students measure cylinders, cones, spheres located in the classroom or elsewhere in the school, perhaps using gym equipment.

*Lessons are aligned to meet the education objectives and goals of most states. For more information on your state objectives, contact your local Board of Education or Department of Education in your state.

Teacher Notes

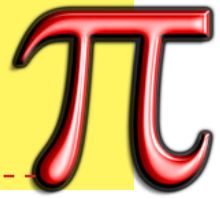
The lesson presents the formulas for the volume of a cylinder, cone, and sphere. Understanding Pi and the area of a circle is necessary for students prior to beginning this lesson. The more practice students have using the formulas the better they will grasp it. The lesson could also be used in conjunction with finding formulas of cubes, rectangular solids, and pyramids. It is also an effective lesson to introduce students to the use of equations to solve problems.

Volume II

What does an ice cream cone, a basketball, and a pipe have in common? The answer: Each of the items can hold something and the amount they can hold is called volume. **Volume** is the amount of space in a three-dimensional (3D) object. All 3D objects have volume and take up space. A two-dimensional object has just two measurements, length and width. Most 3D objects include a third dimension: height. Examples of 3-dimensional objects which include curved lines are the cone, cylinder, and sphere.

A pipe is an example of a **cylinder**, which has parallel sides and a circular cross section. An empty ice cream cone is an example of a **cone** and has a circular base that spirals to a point. Finally, a basketball is an example of a **sphere**, which is a round solid figure (or filled with air), with each point on its surface the same distance to its center. All three figures are curved and their designs are used often in everyday life.

The amount of space inside each figure, its volume, can be found using a formula. By using the different formulas, the amount of water, air, or liquid that each can hold can easily be determined. Finding the volume is not difficult, but you must take your time and identify the measurements of each figure carefully. The symbol for Pi: **π = 3.14.**

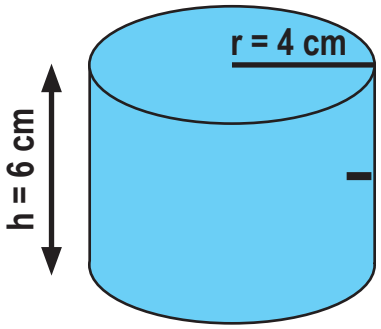


This symbol is used in all three formulas. You must also identify the radius (r) and the height (h) in two of the figures. They are numbers you have previously learned about when finding the area of a circle and in other formulas. Pi is a special number, but used like all other numbers when multiplying.

FINDING VOLUME OF A CYLINDER

Drinking cups, pipes, and trash cans are examples of **cylinders**. Use this formula to find the volume of a cylinder:

π x r2 x h or 3.14 x r2 x h *or* **(πr2h)**



CYLINDER formula in action:

π x r^2 x h =

3.14 x 4^2 x 6 =

3.14 x 16 x 6 =

301.44 cm^3

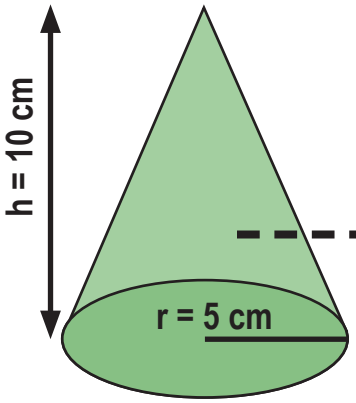
NOTE: Final answers are shown in cubic units. cm^3 = cubic centimeters

FINDING VOLUME OF A CONE

Most people have seen an ice cream cone. Another example is a traffic cone. A cone is one-third the size of a cylinder. Use this formula to find the volume of a cone:

1/3 x π x r2 x h or 1/3 x 3.14 x r2 x h

or **(1/3 πr2h)**



CONE formula in action:

1/3 x π x r2 x h =

1/3 x 3.14 x 52 x 10 =

1/3 x 3.14 x 25 x 10 =

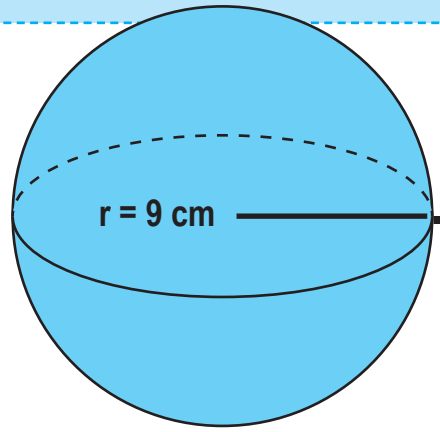
261.7 in^3

NOTE: Final answers are shown in cubic units. cm^3 = cubic centimeters

FINDING VOLUME OF A SPHERE

Spheres are everywhere. They include basketballs, baseballs, soccer balls, planets, marbles and more. Use this formula to find the volume of a sphere:

4/3 x π x r3 or 4/3 x 3.14 x r3 *or* **(4/3 πr3)**



SPHERE formula in action:

4/3 x π x r3 =

4/3 x 3.14 x 93 =

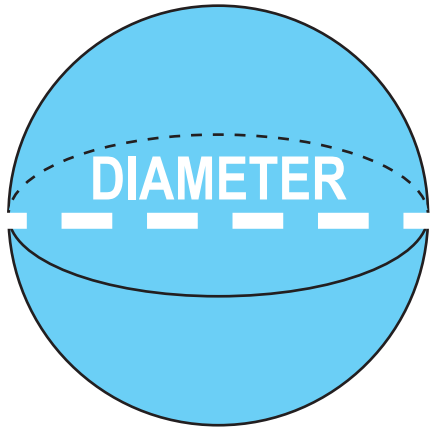
4/3 x 3.14 x 729 =

3,052 cm^3

NOTE:

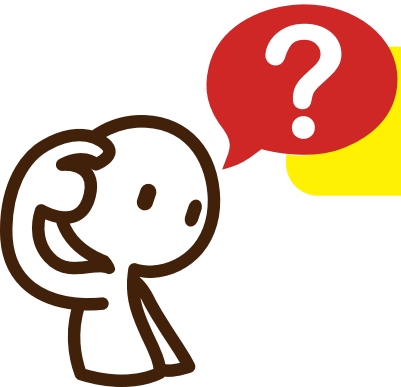
When finding the volume of a sphere, the radius must be cubed and there is no height.

A couple of things to remember: Sometimes you will see the diameter of a sphere, cone, or cylinder. **If you recall, the radius is half the diameter.** Be sure you make the adjustments before you use a formula. Finally, since you are multiplying by a fraction in each formula, sometimes you may need to round off your answers to the nearest tenth or hundredth place.



In summary, the formula for each figure is as follows:

Cylinder:	$3.14 \times r^2 \times h$
Cone:	$1/3 \times 3.14 \times r^2 \times h$
Sphere:	$4/3 \times 3.14 \times r^3$



Would you rather eat ice cream in a cone, play with a ball (sphere), or drink some soda or juice from a glass (cylinder)?

Activity Name _____ Date _____

Draw four of each figure showing its measurements. Solve each to complete the answer key. Once completed, you will exchange them with another student to solve.

CYLINDERS	CONES	SPHERES
1	5	9
2	6	10
3	7	11
4	8	12

Remove the answer key and retain until your exchange partner completes the work.

ANSWER KEY

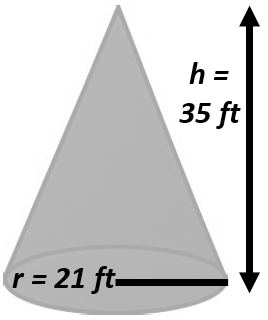
1 _____	5 _____	9 _____
2 _____	6 _____	10 _____
3 _____	7 _____	11 _____
4 _____	8 _____	12 _____

Practice

Name _____ Date _____

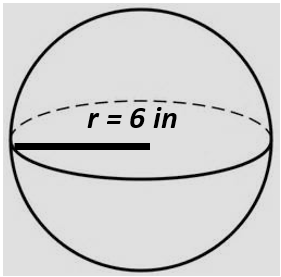
Find the volume for each figure.

1.



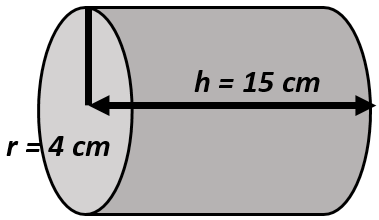
Volume = _____

2.



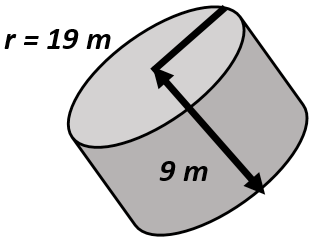
Volume = _____

3.



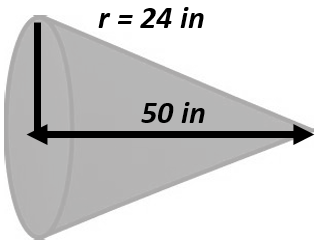
Volume = _____

4.



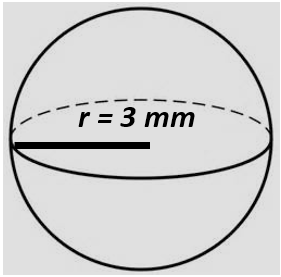
Volume = _____

5.



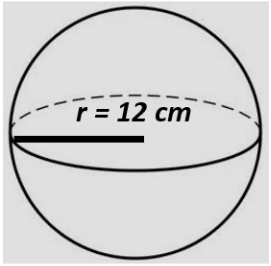
Volume = _____

6.



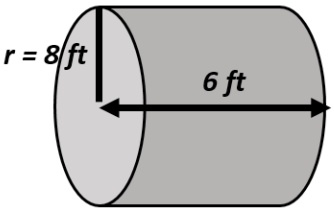
Volume = _____

7.



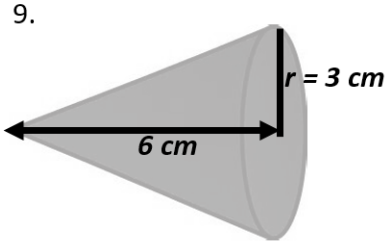
Volume = _____

8.



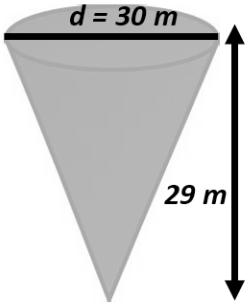
Volume = _____

9.



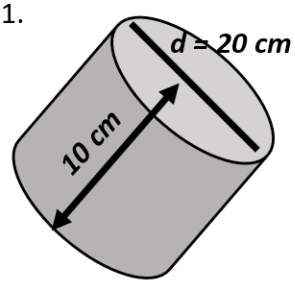
Volume = _____

10.



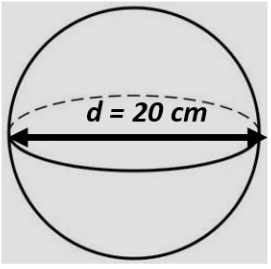
Volume = _____

11.



Volume = _____

12.



Volume = _____

Homework

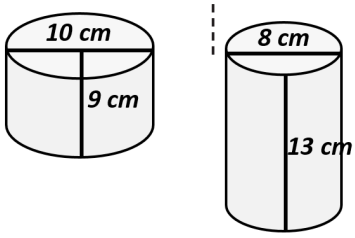
Name _____ Date _____

Solve each problem

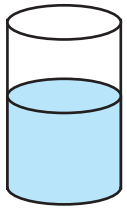
1. Emma purchased an ice cream cone similar to the one in the image. The cone had a height of 5 inches. The cone and the scoop of ice cream had a radius of 3 inches. Approximately, how many cubic inches of ice cream was there in all? (The cone was filled from top to bottom.)

2. A golf ball has a diameter of 4 centimeters and a tennis ball has a diameter of 7 centimeters. How many more cubic centimeters are there in the tennis ball than the golf ball?

3. Below are two containers. Which container would be able to hold 700 cm^3 of juice?

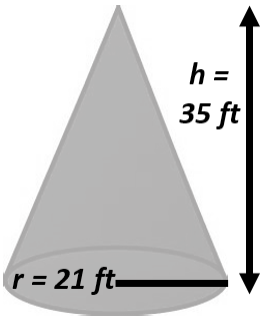


4. About how many cubic centimeters of water is in the cup that is 8 cm tall with a radius of 4 cm?

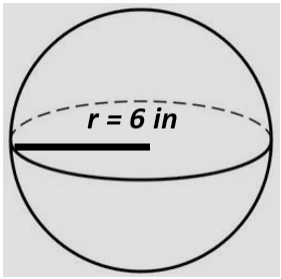


5. A vendor sells snow cones by the cubic millimeter. He charges 50¢ for each 25 cubic millimeters. How much would a snow cone cost that is 140 millimeters deep and has a radius of 80 millimeters?

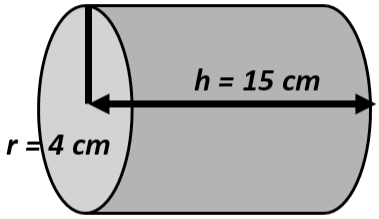
Practice Name Answer Key Date _____

1. 

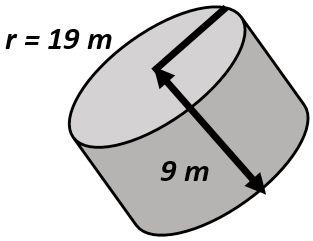
Volume = 16155.3 ft^3

2. 

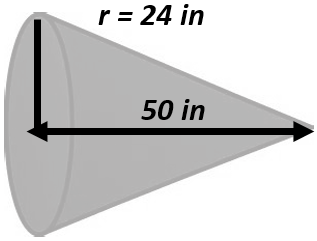
Volume = 904.32 in^3

3. 

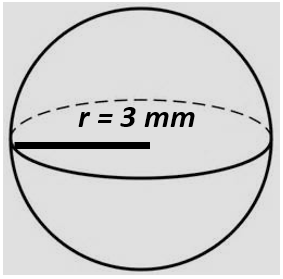
Volume = 19782 cm^3

4. 

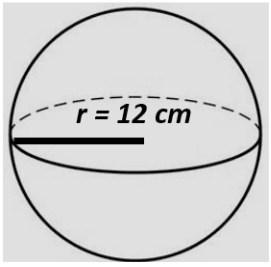
Volume = 4832.46 m^3

5. 

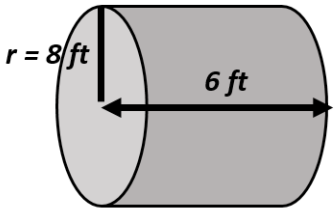
Volume = 30144 in^3

6. 

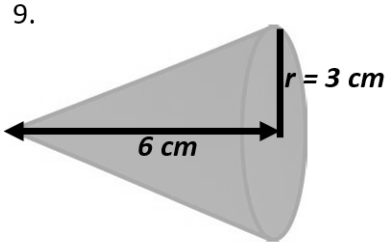
Volume = 113.04 mm^3

7. 

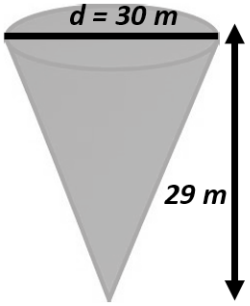
Volume = 7234.56 cm^3

8. 

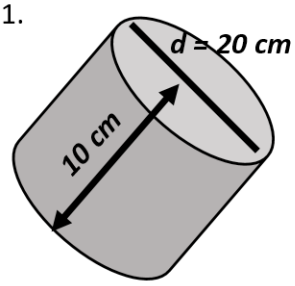
Volume = 1205.76 ft^3

9. 

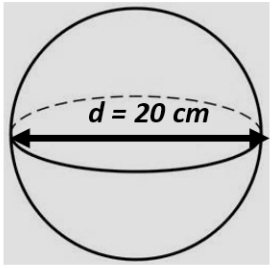
Volume = 56.52 cm^3

10. 

Volume = 35861.9 ft^3

11. 

Volume = 3140 cm^3

12. 

Volume = 4186.67 cm^3

Homework

Name Answer Key Date _____

Solve each problem

1. Emma purchased an ice cream cone similar to the one in the image. The cone had a height of 5 inches. The cone and the scoop of ice cream had a radius of 3 inches. Approximately, how many cubic inches of ice cream was there in all? (The cone was filled from top to bottom.) CONE: 1/3 x 3.14 x 3^2 = 1/3 x 3.14 x 9 = 9.42 in^3 SPHERE: 4/3 x 3.14 x 3^3 = 4/3 x 3.14 x 27 = 113.04^3 Add the two answers: 9.42 + 113.104 = 122.46 cubic inches of ice cream in all

2. A golf ball has a diameter of 4 centimeters and a tennis ball has a diameter of 7 centimeters. How many more cubic centimeters are there in the tennis ball than the golf ball?Golf Ball: 4/3 x 3.14 x 4^3 = 4/3 x 3.14 x 64 = 267.9 cm^3Tennis Ball: 4/3 x 3.14 x 7^3 = 4/3 x 3.14 x 343 = 1436.0 cm^3Tennis Ball – Golf Ball = 1436.0 – 267.9 = 1168.1 more cubic centimeters than golf ball

3. Below are two containers. Which container would be able to hold 700 cm^3 of juice?Short container: 3.14 x 5^2 x 9 = 706.5 cm^3Tall container: 3.14 x 4^2 x 13 = 653.12 cm^3The short container can hold the juice.

4. About how many cubic centimeters of water is in the cup that is 8 cm tall with a radius of 4 cm? 3.14 x 4^2 x 8 = 3.14 x 16 x 8 = 401.92 cm^3 It is about half full so divide by 2.401.92 ÷ 2 = 200.96 cm^2 is about the amount of water in the cup.

5. A vendor sells snow cones by the cubic millimeter. He charges 2¢ for each 10,000 cubic millimeters. How much would a snow cone cost that is 140 millimeters deep and has a radius of 80 millimeters? Cone: 1/3 x 3.14 x 80^2 x 140 = 1/3 x 6400 x 140 = 937,813.3 cm^3 Divide the total cubic centimeters by 10,000:937,813.3 ÷ 10,000 = 93.78 Multiply by 2¢ or 0.02.93.78 x 0.02 = 1.88 The vendor charges about $1.88 per snow cone.