Name Key Period ____ Date ____

Area and Volume Word Problems

Each of the problems below involves calculation for area, volume, or both. Drawing a picture often helps to make sense of the problem, just like we did with Pythagorean Theorem problems. Use the MCAS Reference Sheet, and round all final answers to the tenths place. Use the π button instead of 3.14.

All work must be shown.

1. A new turf field is going to be installed at Gillette Stadium, but the dimensions of the field are unknown. If the field is a rectangle with a perimeter of 340 yards with two sides equal to 50m yards, what is the area of the field?

$P = L + L + W + W$

$P = 2L + 2W$

$340 = 2L + 2(50)$

$340 = 2L + 100$

$-100 \quad -100$

$\frac{240}{2} = \frac{2L}{2}$

$120 = L$

$A = L \cdot W$

$= 120 \cdot 50$

$= 6000 m^2$

2. A Campbell's Soup can is 6 inches tall and has a radius of 2.5 inches. How much paper is needed to make the label? How much room is there inside the can to hold the soup?

Label

$C = 2\pi r$

$C = 2\pi(2.5)$

$C = 15.7 in$

$A = L \cdot W$

$= 15.7 \cdot 6$

$= 94.2 in^2$

Area of the label = $94.2 in^2$

Volume:

$V = Bh$

$= \pi r^2 \cdot h$

$= \pi (2.5)^2 (6)$

$= 117.8 in$

The volume of the can is $117.8 in^3$

3. Tamika has a hard rubber ball whose circumference measures 13 inches. She wants to box it for a gift but can only find cube-shaped boxes of sides 3 inches, 4 inches, 5 inches, or 6 inches. What it the *smallest* box that the ball will fit into with the top on?

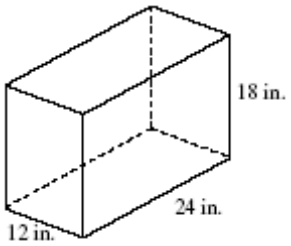
$C = \pi d$

$\frac{13}{\pi} = \frac{\pi d}{\pi}$

$4.1 = d$

The ball is 4.1" tall so she will need a 5" cube-shaped box.

4. The figure below shows an aquarium that is shaped like a rectangular prism.



a. What is the volume, in cubic inches, of the aquarium?

$V = Bh$

$= (12)(24)(18)$

$= 5184 \text{ in}^3$

b. One gallon is equal to 231 cubic inches. How many gallons of water will the aquarium hold?

$\frac{\text{Total Vol.}}{\text{Vol of 1 gal}} = \frac{5184 \text{ in}^3}{231 \text{ in}^3/\text{gallon}} = 22.4 \text{ gallons}$

c. If 10 gallons of water were poured into the empty aquarium, what would be the depth, in inches, of the water? Show your work or explain how you got your answer.

10 gallons: $10 \text{ gal} \left(\frac{231 \text{ in}^3}{\text{gal}}\right) = 2310 \text{ in}^3$

$V = Bh$

$2310 = (24)(12)h$

$\frac{2310}{288} = \frac{288h}{288}$

$8.02 = h$

The water will be 8" high in the tank.

5. Calculate the shaded areas in the two figures below. Make sure your work clearly shows your thinking.

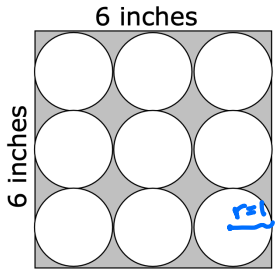


Figure A

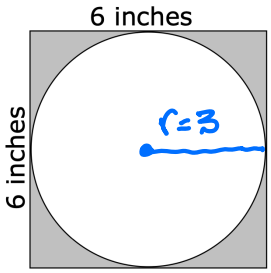


Figure B

Which figure has the greatest amount of shaded area?

Figure A

Area of square $= 6 \cdot 6 = 36\ in^2$

Area of 1 circle $= \pi r^2$
$= \pi(1)^2$
$= \pi\ in^2$

shaded area $= Area_{Box} - 9A_{circle}$
$= 36 - 9\pi$
$= 7.73\ in^2$

Figure B

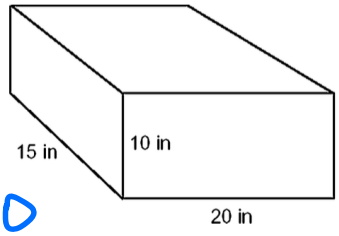
Area of square $= 6 \cdot 6 = 36\ in^2$

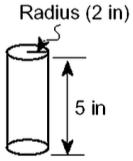
Area of large circle $= \pi r^2$
$= \pi(3^2)$
$= 9\pi\ in^2$

shaded area $= Area_{Box} - Area_{circle}$
$= 36 - 9\pi$
$= 7.73\ in^2$

The shaded areas are the SAME!

6. A rectangular container with the dimensions 10 inches by 15 inches by 20 inches needs to be filled with water. The water is poured into the container using a cylindrical can with a radius of 2 inches and a height of 5 inches. What is the maximum number of full cans of water that can be put into the container without the container overflowing?





Volume of container $= L \cdot w \cdot h$
$= 15 \cdot 20 \cdot 10$
$= 3000\ in^3$

Volume of the can $= Bh$
$= \pi r^2 h$
$= \pi(2^2)5$
$= 62.83\ in^3$

How many cans can fill the container?

$\frac{V_{container}}{V_{can}} = \frac{3000}{62.83}$

$= 47.75$

It will take 47 full cans

7. Suppose a sugar cone is 10 centimeters tall and has a diameter of 4 centimeters. A spherical scoop of ice cream with a diameter of 4 centimeters rests on the top of the cone. If all the ice cream melts into the cone, will the cone overflow? Explain.

Volume of the cone

$V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi (2)^2 \cdot 10$

$= 41.89 \text{ cm}^3$

Volume of Ice Cream

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi (2)^3$

$= 33.51 \text{ cm}^3$

The volume of the cone is greater than the volume of the ice cream.

The melted ice cream will NOT overflow.

8. The Mars Cereal Company has two different cereal boxes for Mars Cereal. The large box is 8 inches wide, 11 inches high, and 3 inches deep. The small box is 6 inches wide, 10 inches high, and 2.5 inches deep.

a. How much more cardboard is needed to make the large box than the small box?

$SA_{large} = 2(8 \cdot 11) + 2(8 \cdot 3) + 2(3 \cdot 11)$

$= 290 \text{ in}^2$

$SA_{small} = 2(6 \cdot 10) + 2(6 \cdot 2.5) + (10 \cdot 2.5)$

$= 200 \text{ in}^2$

Large Box Area - Small Box Area

$290 - 200 = 90 \text{ in}^2$

The large box needs 90 in^2 more cardboard.

b. How much more cereal does the large box hold than the small box?

$V_{large\ box} = L \cdot W \cdot h$

$= 8 \cdot 11 \cdot 3$

$= 264 \text{ in}^3$

$V_{small\ box} = L \cdot W \cdot h$

$= 6 \cdot 10 \cdot 2.5$

$= 150 \text{ in}^3$

Difference in Volume:

$264 - 150 = 114 \text{ in}^3$

The large box holds 114 in^3 more cereal than the small box.