Math 103 Precalculus (Vinroot)
September 23, 2015

Homework #1 Part B

1. A box has dimensions ℓ, w, and h.
(a): Find the lengths of each of the face diagonals of the box.
(b): If the space diagonal of the box is length d, explain why $\ell^2 + w^2 + h^2 = d^2$.

2. An ice cream cone has height 6 in and radius 2 in. It is completely filled with ice cream, with a hemisphere of ice cream on top with the same radius as the cone. What is the total volume of the ice cream (both in the cone and on top)? Leave your answer in the form $a\pi$ in^3, for some rational number a.

3. A person who is 5 ft tall is standing 8 ft away from a 15 ft tall lamppost. How long is the shadow of the person cast by the light of the lamppost?

4. A small pool is the shape of a hemisphere with radius 3 m.
(a): If the pool has a cover for the top, what is the total surface area for the pool and cover?
(b): If the water is filled to a depth of 1 m, what is the radius of the surface of the water? (This is a Pythagorean Theorem problem).

5. A large water cup is in the shape of a cone, with base radius 3 in and height 6 in. Water is filled (with point-side down) to a height of 2 in. What is the volume of the water in the cup? (Use similar triangles to find the radius of the cone formed by the water.)

6. A sphere of radius r is inscribed in a cylinder, where the sphere touches the top, bottom, and side of the cylinder.
(a): What is the height and surface area of the cylinder?
(b): What is the ratio of the surface area of the cylinder to the surface area of the sphere?

7. An aquarium is 4 ft by 2 ft by 2 ft. Water is filled in the aquarium to a height of 1 ft. A solid lead pyramid with height 1 ft and square base which is 1 ft by 1 ft is put into the aquarium. By what height, in inches, does the water level rise?