Conical storage tanks come in many different sizes, from grain storage silos like the one top-left, to chemical storage and separating funnels like the one shown top-right. The nice thing about cones is that they have a wide base area that is easy to poor things into, and a valve at the conical tip lets you remove carefully-measured amounts of whatever is being stored. Recall that the volume of a cone is given by \( V = \frac{1}{3} \pi R^2 h \) where \( R \) is the base radius and \( H \) is the vertical height (not the slant height along the side of the cone!).

**Problem 1** – Suppose that the function that relates the radius of the cone to the vertical height of the cone is given by \( R(h) = 0.5h \), where \( h \) and \( R \) are in meters. The maximum height of the storage vessel is 3.0 meters. What is the radius of the upside-down conical tank at its maximum height?

**Problem 2** – To the nearest tenth of a cubic meter, what is the maximum volume of this conical tank?

**Problem 3** – At what height, \( H \), should the astronaut place a mark on the outside of the tank to indicate a level of \( \frac{1}{2} \) the volume of the conical tank?

Space Math  
http://spacemath.gsfc.nasa.gov
Problem 1 – Suppose that the function that relates the radius of the cone to the vertical height of the cone is given by $R(h) = 0.5h$, where $h$ and $R$ are in meters. The maximum height of the storage vessel is 3.0 meters. What is the radius of the upside-down conical tank at its maximum height?

Answer: $R(2.5) = 0.5 \times 3.0 = 1.5$ meters.

Problem 2 – To the nearest tenth of a cubic meter, what is the maximum volume of this conical tank?

Answer: $H = 3.0$ meters, $R = 1.5$ meters

so $V = \frac{1}{3} \pi (1.5)^2 (3.0)

= 7.1$ meters$^3$.

Problem 3 – At what height should the astronaut place a mark on the outside of the tank to indicate a level of ½ the volume of the conical tank?

Answer: We want $V = \frac{1}{2} \times 7.1$ m$^3 = 3.55$ m$^3$

But $R = 0.5H$

So $V = \frac{1}{3} \pi (0.5H)^2 H = 0.333(3.141)(0.25) H^3$ and so $V = 0.26H^3$

Then $3.55$ m$^3 = 0.26 H^3$ and so solving for $H$ we get $H = 2.4$ meters.