Solution to Number 7:

Divide the job up into horizontal slices, each slice will be a circular cylinder. Each cylinder has volume $\pi r^2 h$. Let x be the distance from the bottom of the tank to the cylindrical slice. Then, by similar triangles, each slice has radius equal to $\frac{1}{3}x$, and volume equal to $\pi\frac{1}{9}x^2dx$. The force is obtained by multiplying the volume by the density by the acceleration due to gravity, giving $9800\pi\frac{1}{9}x^2dx$. The amount of work done in moving this slice is equal to the force times the distance that it is moved, or $9800\pi\frac{1}{9}x^2(30-x)dx$. The x values will range from 0 to 25, giving the solution

$$W = \int_0^{25} 9800\pi\frac{1}{9}x^2(30-x)dx$$

If the figure were a pyramid with a square base, the slices would be square prisms, each with side length $\frac{1}{3}x$. Hence,

$$W = \int_0^{25} 9800\frac{1}{9}x^2(30-x)dx$$