

# Math 2300-013: Quiz 4

Name: Solution

Score: \_\_\_\_\_

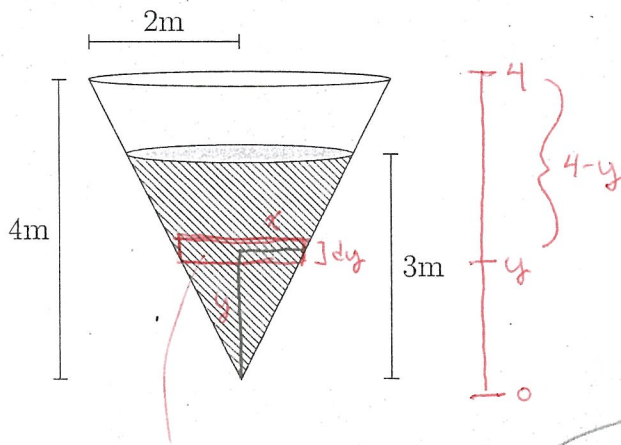
1. (1 point) Write down a formula for work in terms of force and distance.

$$W = F \cdot d$$

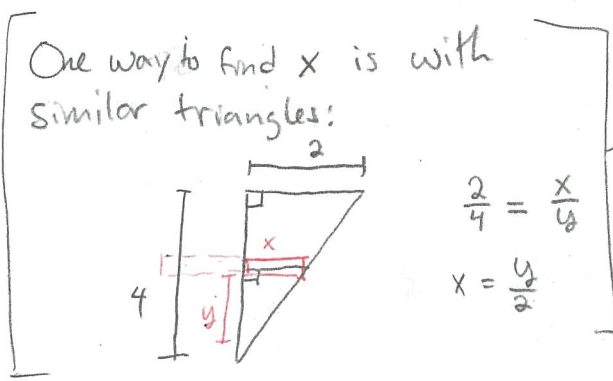
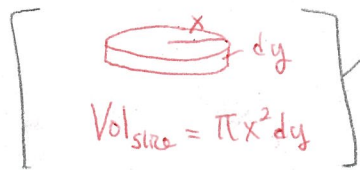
2. (2 points) In a sentence or two, describe your plan for solving the problem below.

The gist: Chop water into slices, find work done to lift each slice.

3. (7 points) Water is pumped from the top of a conical tank of height 4 meters and base radius 2 meters depicted below. How much work is required to empty the tank of water if the initial height of the water is 3 meters? You may assume that the mass of water on Earth is 1000 kilograms per cubic meter and that  $g = 9.8 \frac{m}{sec^2}$  is the acceleration due to gravity on Earth. (Set up, but do not evaluate the integral.)



$$\begin{aligned}
 W_{\text{slice}} &= F \cdot d \\
 &= m_{\text{slice}} \cdot g \cdot d \\
 &= \text{Vol}_{\text{slice}} \cdot 1000 \frac{kg}{m^3} \cdot 9.8 \frac{m}{sec^2} \cdot (4-y) \\
 &= \pi x^2 dy \cdot 9800 \cdot (4-y) \\
 &= \pi \left(\frac{y}{2}\right)^2 dy \cdot 9800 \cdot (4-y) \\
 &= 9800 \pi (4-y) \left(\frac{y}{2}\right)^2 dy
 \end{aligned}$$



$$W_{\text{Total}} = \int_0^3 9800 \pi (4-y) \left(\frac{y}{2}\right)^2 dy$$