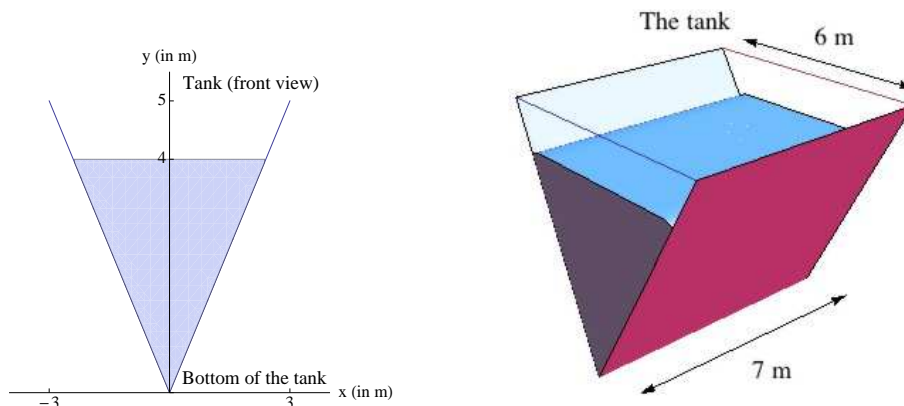


6. [11 points] The Math Department has recently acquired a triangular storage tank 6 m wide, 5 m tall and 7 m long, which it will use to store coffee for its graduate students. The tank currently contains a special coffee blend, with a mass density 1033 kg per m³, up to a depth of 4 m.



- a. [8 points] Write an expression that approximates the work done in lifting a horizontal slice of the liquid in the tank that is y meters above the bottom of the tank, with thickness Δy , to the top of the tank. Use $g = 9.8$ m per s² for the acceleration due to gravity.

Solution:

$$\Delta W = W_{\text{slice}} = \frac{6}{5}y \cdot 7 \cdot 9.8 \cdot 1033 \cdot (5 - y)\Delta y \text{ Joules.}$$

- b. [3 points] While grading this exam, the grad students will need coffee. Find a definite integral that computes the work required to pump all the coffee to the top of the tank. Give the units of this integral. You do not need to evaluate it.

Solution:

$$W = \int_0^4 \frac{6}{5}y \cdot 7 \cdot 9.8 \cdot 1033 \cdot (5 - y)dy \text{ Joules.}$$