

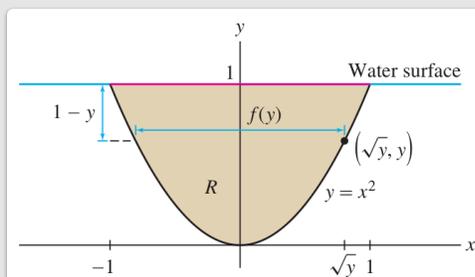
W05 Regular

Due date: Sunday 2/15, 11:59pm

01

✍ Fluid force on a parabolic plate

A parabolic plate is submerged vertically in water as in the figure:



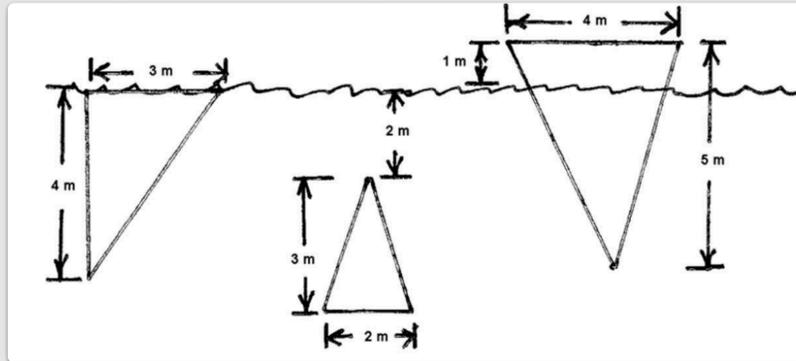
The shape of the plate is bounded below by $y = x^2$ and above by the line $y = 1$. (Note that y *increases going up* in this coordinate system.)

Compute the total fluid force on this plate.

(Hint: your integrand should contain $(1 - y)$ as a factor.)

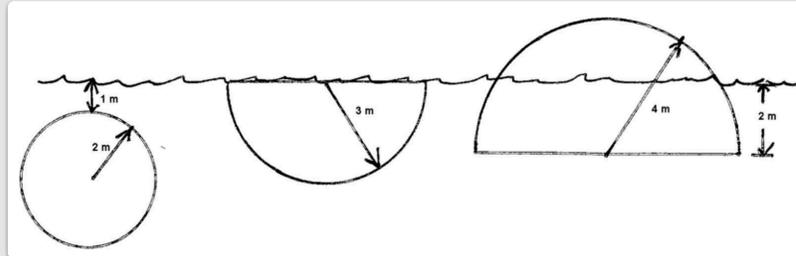
✍ Fluid force on triangular plates

For diagrams 1, 2, 3 (L to R) below, set up an integral to compute the hydrostatic force on the plate.



✍ Fluid force on circular plates

For diagrams 1, 2, 3 (L to R) below, set up an integral to compute the hydrostatic force on the plate.



✍ Work to raise a leaky bucket

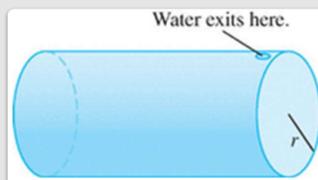
A bucket of water is raised by a chain to the top of a 50-foot building. The water is leaking out, and the chain is getting lighter.

The bucket weighs 4 lbs, the initial water weighs 30 lbs, and the chain weighs 0.25 lb/ft, and the water is leaking at a rate of 0.3 lbs/sec as the bucket is lifted at a constant rate of 3 ft/sec.

What is the total work required to raise the bucket of water?

✍ Work to pump water from cylindrical tank

A cylindrical tank is full of water and the water is pumped out the top. (See figure.) The length of the tank is 7m and the radius is 5m.



- (a) Set up an integral for the total work performed assuming the tank is initially completely full.
- (b) Set up an integral for the total work performed assuming the tank is initially full to 3m and the water is pumped out of a spigot extending 1m above the top of the tank.

✍ Work to build a pyramid

The Great Pyramid of Giza is 140m tall and has a square base with 230m on each side. It is built of stone with mass density 2000kg/m^3 .

Set up an integral that expresses the work (against gravity) required to build the pyramid.