

## 12.17 The Oil Tank

STEWART'S CALCULUS: 6 ed. §§6.2, 6.4 and 9.3, 6ET ed. §§6.2, 6.4 and 8.3

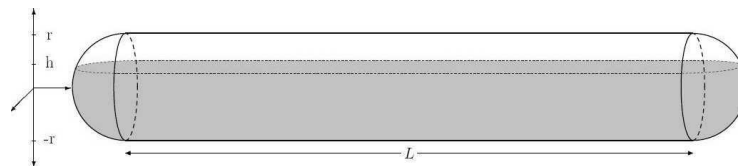
BACKGROUND: Review the following applications of integration:

How to compute a volume by slicing.

How to find the work done to pump a liquid out of a tank.

How to find the center of mass of a solid.

ASSIGNMENT: The oil tank<sup>3</sup> below is cylindrical with hemispherical “caps”. The length of the cylinder part is  $L = 40 \text{ ft}$  and the radius of the cylinder (and of each hemispherical cap) is  $r = 5 \text{ ft}$ .



The tank contains  $V = 22,300 \text{ gal}$  of Texas crude oil whose density is  $\rho = 54.5 \text{ lb/ft}^3$ . Find:

1. The height  $h$  of the oil above the center of the tank.
2. The weight (or force induced by gravity) of the oil.
3. The amount of work required to pump the oil out of the top of the tank.
4. The distance below the center of the tank where the center of gravity of the oil occurs.

You may assume that the acceleration of gravity is  $g = 32 \text{ ft/sec}^2$  and  $1 \text{ ft}^3 = 7.481 \text{ gal}$ .

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<sup>3</sup>This project was originally developed by Troy Henderson, Texas A&M Univ.