

Math 129 - Section 001  
Exercises for sections 8.4 and 8.5

*Show all of your work.*

1. A block of ice weighing 500 lbs. is to be lifted from the ground to the top of a 200 foot tall building. In the 20 minutes it will take to do this, the block will lose 12 lbs. Assume that the weight lost due to melting is a linear function of time. Find the work need to lift the block.

**Answer:**  $\int_0^{200} (500 - \frac{12}{200}h)dh = 95200$  ft-lbs.

2. A banner in the shape of an isosceles triangle is hung over the side of a building. The banner has a base of 25 feet (at the roof line) and a height of 20 feet. It weighs 40 lbs. Find the work needed to lift the banner onto the roof of the building.

**Answer:**  $\frac{5}{4} \int_0^{20} (20h - h^2)dh = \frac{5000}{3}$  ft-lbs.

3. A cylindrical form is filled with a slow-curing concrete. The base of the form is 10 ft. in radius, and the height is 25 ft. While the concrete hardens, gravity causes the concrete to settle, so that the resulting density varies from 90 lbs./ft<sup>3</sup> at the bottom to 50 lbs./ft<sup>3</sup> at the top. Assuming that the density is a linear function of the height, compute the total weight of the resulting concrete column.

**Answer:**  $100\pi \int_0^{25} (90 - \frac{40}{25}h)dh = 5000\pi$  lbs.

4. A conical tank (oriented point down) of height 8 ft. and radius 6 ft. is filled with kerosene. Kerosene is pumped out of (the top of) the tank until the level has dropped by 5 feet. Using the fact that the density of kerosene is 51.2 lbs./ft.<sup>3</sup>, set up integrals to compute the work done if the variable is given by the following:

- a. the distance between the vertex (the point) of the cone and the "slice"

**Answer:**  $90.4 \int_3^8 h^2(8 - h)dh$  ft-lbs.

- b. the distance between the top of the cone and the "slice"

**Answer:**  $90.4 \int_0^5 h(8 - h)^2dh$  ft-lbs.