

Written Homework #7**Due at start of class Monday, 5 March.**

This Written Homework has problems from sections 8.2, 8.3, and 8.5. It is also a work sheet to do during the recitation section. Please work on it with other students! The submitted version must be written by you. You must show your work for full credit.

1. Suppose a curve $y = f(x)$, $a \leq x \leq b$ is rotated about a horizontal line $y = c$. Use a sketch and brief explanation to derive a formula for the area of the resulting surface.

2. A square plate of side length a is submerged in water as shown. Express the force on the plate as an integral and evaluate it. (Assume gravity is $g = 9.8 \text{ m/s}^2$ and that the density of water is 1000 kg/m^3 .)



3. **(a)** Set up, but do not evaluate, an integral with respect to x to compute the surface area obtained by rotating the given curve around the y -axis:

$$y = x^3, \quad 0 \leq x \leq 1$$

(b) Set up, but do not evaluate, an integral with respect to y to compute the surface area of the *same* surface as in part **(a)**.

(c) Use `wolframalpha.com`, or other computer algebra system (CAS), to confirm that the surface areas above are the same. State the CAS inputs you used (e.g. "integrate ...from ...to ...") and the numerical result you get.

4. Sketch the region bounded by the curves and visually estimate the location of the centroid. Then find the exact coordinates of the centroid.

$$y = e^x, \quad y = 0, \quad x = 0, \quad x = 1$$

5. This density function is an example of a *logistic distribution*:

$$f(x) = \frac{e^{3-x}}{(1 + e^{3-x})^2}$$

- (a) Verify that f is a probability density function.

- (b) Find $P(3 \leq X \leq 4)$.

6. The speeds of vehicles on a highway with posted speed limit 100 km/h are normally distributed with mean 112 km/h and standard deviation 8 km/h. Set up integrals to answer the following questions, and then use `wolframalpha.com`, or other computer algebra system (CAS) to compute numerical values.

(a) What is the probability that a randomly chosen vehicle is traveling at a legal speed?

(b) If police are instructed to ticket motorists driving 125 km/h or more, what percentage of motorists are targeted?