

Written Homework

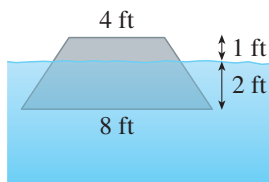
§8.1-3 and §10.1-4

due Friday 11/4

1. (8 points) Find the length of the curve $y = \frac{x^3}{12} + \frac{1}{x}$, $1 \leq x \leq 4$.
2. (10 points) A group of engineers is building a parabolic satellite dish whose shape will be formed by rotating the curve $y = ax^2$ about the y -axis. If the dish is to have a 10 ft diameter and a maximum depth of 2 ft, find the value of a and the surface area of the dish.
3. Setup (but do not evaluate) two integrals – one with respect to x and one with respect to y – for the surface area of the solid obtained by rotation the curve

$$y = e^{2x}, \quad 0 \leq x \leq 1$$

- (a) (8 points) about the x -axis.
 - (b) (8 points) about the y -axis.
- (That's a total of four integrals.)
4. (10 points) A vertical plate in the shape of a trapezoid is partially submerged in water as shown below. Calculate the hydrostatic force against one side of the plate.



5. Find parametric equations for the path of a particle that moves along the circle with center $(3, 2)$ and radius 4 in the manner described.
 - (a) (6 points) Once around clockwise starting at $(7, 2)$
 - (b) (6 points) Three times around counterclockwise starting at $(-1, 2)$
 - (c) (6 points) Halfway around clockwise starting at $(3, 6)$
6. (8 points) An ellipse is described by the parametric equations

$$x = a \cos t, \quad y = b \sin t, \quad 0 \leq t \leq 2\pi,$$

where a and b are the semi-major and semi-minor axes. Setup (but do not evaluate) a definite integral for the circumference of the ellipse.

7.
 - (a) (4 points) Sketch the polar graph $r = 1 - \cos \theta$.
 - (b) (8 points) Find the area of the region that lies inside the circle $r = 1$ and outside the cardioid $r = 1 - \cos \theta$.
8.
 - (a) (4 points) Sketch the polar graph $r = \cos(3\theta)$, called a three-leaved rose.
 - (b) (8 points) Find the area inside one petal of the three-leaved rose.
 - (c) (6 points) Setup an integral for the circumference of one petal of the three-leaved rose (do not evaluate).