

1. Use the arc length formula to find the length of the curve  $y = \sqrt{2 - x^2}$ ,  $0 \leq x \leq 1$ .  
(You can check by noting this is part of a circle.)

2. Find the length of the curve  $y = 2 \ln \left( \sin \left( \frac{x}{2} \right) \right)$ , for  $\frac{\pi}{3} \leq x \leq \pi$

3. Find the area of the surface obtained by rotating the curve

$$9x = y^2 + 18, \text{ for } 2 \leq x \leq 6$$

about the  $x$ -axis.

4. Find the area of the surface obtained by rotating the curve

$$y = \frac{x^2}{4} - \frac{\ln x}{2}, 1 \leq x \leq 7$$

about the  $x$ -axis.

Bonus – A gate in an irrigation canal is constructed in the form of a trapezoid 3 ft wide at the bottom, 5 ft wide at the top, and 2 ft high. It is placed vertically in the canal, with the water extending to its top. Find the hydrostatic force on one side of the gate.

5. A demand curve is given by  $p = \frac{33}{x+8}$ . Find the consumer surplus when the selling price is \$20.