Worksheet 4

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I. Find the length of the curves

1. $y = \ln\left(\dfrac{e^x+1}{e^x-1}\right)$, $a \le x \le b,\ a > 0$.
2. $y = \displaystyle\int_0^x \sqrt{t^3-1}\,dt,\ 1 \le x \le 4$.
3. Find the arc length function for the curve $y = \sin^{-1}(x) + \sqrt{1-x^2}$ with starting point $(0,1)$.
4. Find the arc length function for the curve $y = 2x^{3/2}$ with starting point $P_0(1,2)$.

II. Find the area of the surface obtained by rotating

5. The curve $y = \sin(\pi x)$, $0 \le x \le 1$ about the x-axis.
6. The curve $y = 1 - x^2,\ 0 \le x \le 1$ about the y-axis.
7. The curve $y = \dfrac{1}{4}x^2 - \dfrac{1}{2}\ln(x)$, $1 \le x \le 2$ about the y-axis.
8. The infinite curve $y = e^{-x}$, $x \ge 0$ about the x-axis.

III.

9. Find the centroid of the region bounded by the curves $y = x^3,\ x + y = 2,\ y = 0$.
10. A large tank is designed with ends in the shape of the region between the curves $y = \frac{1}{2}x^2$ and $y = 12$, measured in feet. Find the hydrostatic force on one end of the tank if it is filled to a depth of 8 ft with gasoline. (Assume the gasoline's density is 42.0 lb/ft^3.)
11. Use the Theorem of Pappus to find the volume of a cone with height h and base radius r.