Math 132 - October 30, 2017

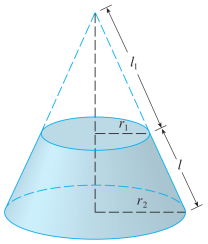
8.1 Arc Length

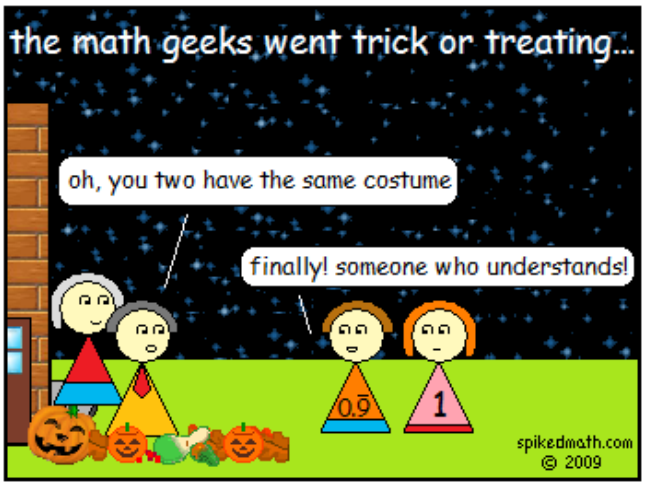
$$L = \int ds = \int_a^b \sqrt{1 + (f'(x))^2}\, dx = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

8.2 Surface Area

$$S = \int_a^b dS = \int_a^b 2\pi r\, ds = \int_a^b 2\pi r \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

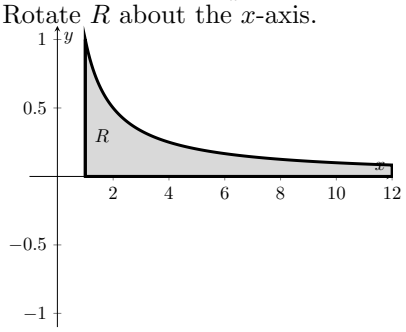
$$\text{Area(Frustum)} = 2\pi l \left(\frac{r_1 + r_2}{2}\right) = 2\pi\, r_{\text{ave}}\, l$$

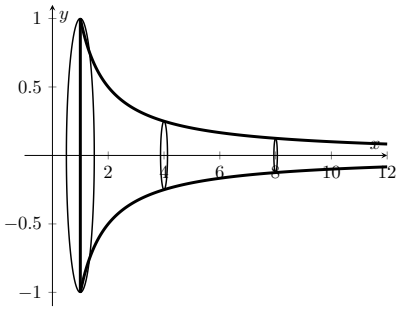




Warm-up Problems

1. **Clicker** Let $y = \frac{1}{x}$ on the interval $[1, \infty)$. Let R be the region between the graph and the x-axis about the x-axis. Rotate R about the x-axis.





A = The area of R
V = The volume of the generated solid
S = The surface area of the generated surface

Select the true statements about A, S and V.

Selection	A	V	S
A.	∞	∞	∞
B.	∞	Finite	∞
C.	∞	∞	Finite
D.	∞	Finite	Finite
E.	Finite	Finite	Finite

2. Set up arc length integral (compute if you have time!).
   (a) Length of $y = x^3$ from $x = 1$ to $x = 4$.
   (b) Length of $x = y^3$ from $y = 1$ to $y = 4$.
   (c) Length of $y = \frac{1}{6}x^3 + \frac{1}{2x}$ from $x = 1$ to $x = 2$

Class Problems

3. Find the area of $y = \sqrt{x}$ on the interval $[3/4, 15/4]$ rotated about the x-axis. (Just set up, compute if you have time.)

4. Find the area of $x = \frac{y^3}{3}$ on the interval $y = 0$ to $y = 1$ rotated about the y-axis. (Just set up, compute if you have time.)

5. Find the area of $y = \sin x$ from $x = 0$ to $x = \pi$, rotated about the x-axis. (Just set up, compute if you have time.)

6. Find the surface area of the arc $y = 4x + 1$, $1 \leq x \leq 3$, rotated about the x-axis.

7. Find the surface area of the arc $y = 4x + 1$, $1 \leq x \leq 3$, rotated about the y-axis.

8. Find the surface area of the arc $y = x^2$, $1 \leq x \leq 4$, rotated about the x-axis.

9. Find the surface area of the arc $y = x^2$, $1 \leq x \leq 4$, rotated about the axis $y = -3$.

10. Find the surface area of the arc $y = x^2$, $1 \leq x \leq 4$, rotated about the y-axis.

11. Find the surface area of the arc $y = x^2$, $1 \leq x \leq 4$, rotated about the axis $x = -5$.

12. Find the surface area of the arc $y = x^2$, $1 \leq x \leq 4$, rotated about the axis $x = 5$.