

1. The Napkin Ring Problem. Consider a sphere of radius R with a cylindrical hole drilled through it with total length (or height) H . The shape left over can be thought of as a napkin ring.
 - (a) Which do you think will have greater volume, the case where $R=20$ and $H=10$ or the case where $R=30$ and $H=10$? Sketch a picture of each, and see how the shape changes as R changes.
 - (b) Calculate the volume of a napkin ring with radius of the sphere R and height of the hole H . (It might be helpful to call the radius of the cylinder r).
 - (c) Was your intuition in the first part correct? Do you find your answer surprising at all?

2. Show that the arc length integral gives the expected result for a linear function

$$f(x) = mx + b, \quad a \leq x \leq c.$$

3. Find the arclengths of the graphs:

(a) $f(x) = \frac{2}{3}(x - 7)^{\frac{3}{2}}$ on $[7, 14]$

(b) $f(x) = \frac{1}{4}x^2 - \frac{1}{2}\ln x$ on $[1, 2]$