

**MAT 137 (Calculus II) Prof. Swift**  
**In-class worksheet: Computing Volume by Cylindrical Shells**

Let  $f(x) = x + x^3$ , and let  $\mathcal{R}$  be the region in the  $x$ - $y$  plane bounded by the curves  $y = f(x)$ ,  $y = 0$ , and  $x = 1$ .

1. Make a rough sketch of the graph  $y = f(x)$ . Hint: Calc 1 will help to make the sketch. Note that  $f'(x) = 1 + 3x^2 > 0$  for all  $x$ .
  
2. Sketch the region  $\mathcal{R}$ . Find the coordinates of the corners of the region.
  
3. Set up the integral for the volume of the solid obtained when  $\mathcal{R}$  is rotated about the line  $x = 2$ .
  
4. What goes wrong if you try to compute the volume of that solid using washers?