

## Volumes

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**Solutions should show all of your work, not just a single final answer.**

1. Set up, but do not evaluate, a definite integral for the volume of the solid obtained by rotating the region bounded by the given curves about the specified line.
  - (a)  $y = 3 - x$ ,  $y = 0$ ,  $x = 1$ ,  $x = 2$ ; about the  $x$ -axis
  - (b)  $y = x^4 - 2x^2 + 1$ ,  $y = 2 - 2x^2$ ; about the  $x$ -axis
  - (c)  $y^2 = x$ ,  $x = 2y$ ; about the  $y$ -axis
  
2. A solid region has a circular base of radius 3 whose cross-sections perpendicular to the  $x$ -axis are equilateral triangles.
  - (a) Placing the circular base in the plane so it's centered at the origin, determine the side length of the cross-sectional triangle that passes through  $(x, 0)$ , for  $-3 \leq x \leq 3$ . (Your final answer will depend on  $x$ .) Draw a clear diagram in your solution.
  - (b) Set up, but **do not evaluate**, an integral equal to the volume of this solid region.  
Hint: the area of an equilateral triangle with side length  $s$  is  $\frac{s^2}{4}\sqrt{3}$ .