18.02 Recitation
Problems to think about
07 September 2011

1. What's the length of the curve $y = x^2$ from $x = 2$ to $x = 3$? (warning: actually evaluating the integral might be the hardest part) See if you can derive the formula for the arc length of a curve, whether you remember it or not.

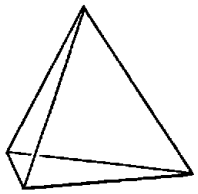
2. Define a curve in the plane by $x(t) = t\cos t$, $y(t) = t\sin t$. Sketch the curve. What is the length of the arc it traces when t ranges from 0 to a?

3. Now rotate $y = x^2$ for $2 \leq x \leq 3$ about the x-axis to obtain a surface of revolution. What is its volume? Can you compute it in more than one way? What is its surface area? How can you compute the area of a surface of revolution?

4. The volume of a cone is always $Bh/3$, where B is the area of the base and h is the height, regardless of the shape of the base. Can you prove this? Why doesn't the shape of the base matter?

5. What does the Pythagorean theorem state? Can you come up with a proof? What about the law of sines and the law of cosines?

6. A *regular tetrahedron* is a polyhedron with four sides, each an equilateral triangle.



   Suppose that the side length of a tetrahedron is a. Can you compute:

   - The surface area?
   - The height?
   - The volume?
   - The angle between two faces?
   - The radius of an inscribed sphere?

7. A *Platonic solid* is a polyhedron whose faces are regular polygons, with the same number of faces meeting at each vertex. Can you describe all the Platonic solids? (Hint: there are five types) Pick one of the Platonic solids that isn't the tetrahedron or the cube, and answer the same questions as above.