ESP Math 182 **Spring 2017**

Worksheet 6

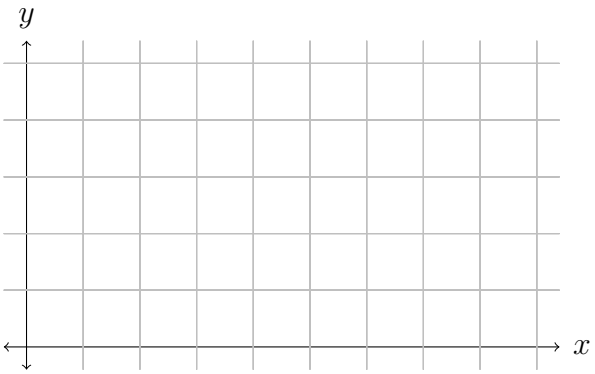
26 January 2017

---

1. **Warm up:** A strand of DNA is twisted in a double helix pattern as in the image below. If a given strand is 4mm long with a radius of $1/(10\pi)$mm and 15 full twists, how long will the helix be when unraveled and laid flat?

2. Consider the functions $y = \arctan(x)$, $y = 0$, and $x = 1$.

   (a) Draw a graph to represent the area all three functions bound.



   (b) Set up, but do not evaluate, the integral to calculate the solid of revolution (by washers) formed by rotating this region around the y-axis.

   (c) Evaluate $\int \sec^2(x)\, dx$ and express your answer from part (b) with sec.

   (d) Evaluate the integral from part (b).

3. Find volumes of the following solids using calculus.

   (a) A ball of radius r.

   (b) A right circular cone of radius r and height h.

   (c) A right circular cylinder of height h and radius r.

   (d) A torus of major radius a and minor radius b (you may use geometry for the last step).

4. A sharpened pencil is 1cm wide and 20cm long, whose writing tip makes an angle of $\pi/3$.

   (a) Using solids of revolution, write down the integral that gives the total volume of the sharpened pencil.

   (b) Evaluate the integral or use geometry to actually find the volume of this pencil.