Weekly Assignment 4

Instructions: All integrations must be evaluated by hand. Show your work.

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1. Area

Consider the curve $y = \frac{3x-x^2}{x^2+1}$

a. Determine the x-intercepts for this curve.

b. Find the area of the region bounded by $y = \frac{3x-x^2}{x^2+1}$ and the x-axis using an integration technique we have discussed in class.

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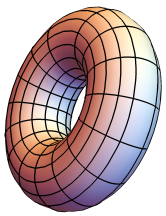
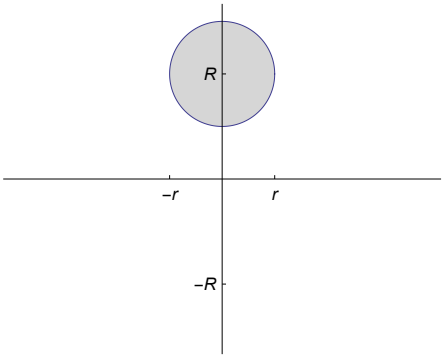
2. Volume

A torus is the geometric shape of an inner tube.



It can be generated as a solid of revolution by rotating the disk bounded by the circle $x^2 + (y - R)^2 = r^2$ about the x-axis.



1. Solve $x^2 + (y - R)^2 = r^2$ for y to get two solutions, one for the outer radius and one for the inner radius, to use in the washer method. Set up the appropriate integral that gives the volume. (So you'll be slicing the donut from $-r$ to r, generating cross-sections that are washers. Ask me if you have questions!)
2. Evaluate the integral from part (1.) using an integration technique we have discussed in class.

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3. Integral of secant

We computed $\int \sec(x)\, dx$ in class using a favorite trick -- multiplication by a special form of 1. I want you to re-compute it using some of the techniques we have recently considered. (There's always more than one way to do a problem!)

1. Write $\sec(x)$ in terms of sines and cosines, and use the technique for evaluating trigonometric integrals where one of sine or cosine has an odd power.
2. The resulting integral will be a rational function. Rewrite the integrand using partial fraction decomposition.
3. Finish the integration to find what $\int \sec(x)\, dx$ is equal to.