# MA205 - Integral Calculus
# Lesson 30: Polar Regions II

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- Remember, when working in polar coordinates the "$dA$" in the integral $\int\int_R f(x,y)\,dA$ is equal to $\underline{r}\,dr\,d\theta$! (or $r\,d\theta\,dr$, depending on the order you choose).

**Problems**

1. Evaluate $\displaystyle\int\int_D xy\,dA$ where $D$ is the disk centered at the origin and having radius 3.

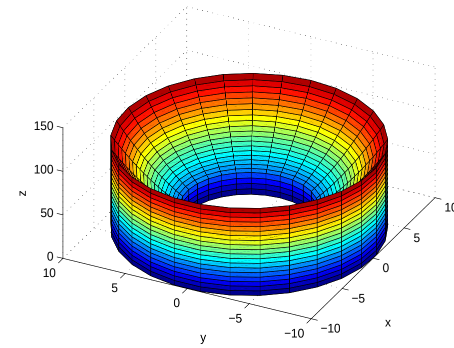
2. Let's use polar coordinates to evaluate the following integral: $\displaystyle\int_0^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} e^{x^2+y^2}\,dy\,dx.$

   (a) First sketch the region of integration. Mathematica may help.

   (b) Now describe the region in polar coordinates. This example should be a polar rectangle.

   (c) Next, re-write the integral in terms of polar coordinates, including the limits of integration. Then integrate!

3. What is the volume of the region between the circle of radius 5 and the circle of radius 10 under the function $f(x, y) = x^2 + y^2$?




4. Use polar coordinates to combine the following integrals into one. Hint: draw each region of integration.

$$\int_0^1 \int_{\sqrt{1-x^2}}^{\sqrt{4-x^2}} f(x, y)\, dy\, dx + \int_0^{\sqrt{3}} \int_1^{\sqrt{4-y^2}} f(x, y)\, dx\, dy$$

5. Work the Problems 2 and 5 in your course guide problems on polar regions. Then, if you have time, work any other unfinished problems on polar regions from your course guide.