HOMEWORK 20
CALCULUS III
DUE 04-09

Show your work!

(1) Show that the area of a 'polar block' given by $a \leq r \leq a + \mathrm{d}r$, $b \leq \theta \leq b + \mathrm{d}\theta$ is, to first order, $a\mathrm{d}r\,\mathrm{d}\theta$. (HINT: Compute the area exactly, then discard 'second-order' terms involving more than one term of the form $\mathrm{d}r$ or $\mathrm{d}\theta$.)

This is one explanation for why $\mathrm{d}A = r\mathrm{d}r\,\mathrm{d}\theta$.

(2) Remember that $x = r\cos(\theta)$ and $y = r\sin(\theta)$. Compute

$$\det \begin{pmatrix} \partial x/\partial r & \partial x/\partial \theta \\ \partial y/\partial r & \partial y/\partial \theta \end{pmatrix}.$$

The matrix above is called the *Jacobian* for the change of variables from polar to rectangular coördinates. This is another explanation for why $\mathrm{d}A = r\mathrm{d}r\,\mathrm{d}\theta$.

- **Nine** book problems: #14.2.63, 65 (2 problems); #14.3.12, 27, 29, 36 (4 problems); #14.6.27, 31, 71 (3 problems).
- Read §11.7 for Tuesday's class.