# Today

1. Go over exam

2. 16.4: Green's Theorem (Understand the statement and use of Green's Theorem and recognize it as a generalization of the FTC.)

3. Homefun/Python

16.4: Green's Theorem

1. **Green's Theorem**: Let C be a positively oriented piecewise-smooth simple closed curve in the plane, and let D be the region bounded by C. If P and Q have continuous first partial derivatives in an open region containing D, then

$$\oint_C Pdx + Qdy = \iint (Q_x - P_y)dA.$$
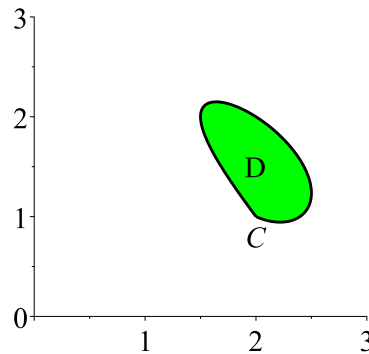
2. Notice also that if $\vec{F} = <P, Q>$, then $\oint_C \vec{F} \cdot d\vec{r} = \oint_C Pdx + Qdy$.

3. If the integrand in a double integral is 1, then the integral represents the area of the region of integration: $A(R) = \iint_R 1dA$.

4. From Green's Theorem, we get some alternative formulas for the area based on choosing P and Q so that $Q_x - P_y = 1$. Here are three popular ones:

   (a) $\iint_R 1dA = \oint_{\partial D} xdy$ (taking $P = 0, Q = x$)

   (b) $\iint_R 1dA = -\oint_{\partial D} ydx$ (taking $P = -y, Q = 0$)

   (c) $\iint_R 1dA = \dfrac{1}{2}\oint_{\partial D} xdy - ydx$ (taking $P = -y/2, Q = x/2$)

5. Examples p. 1060: #3, 7, 8, 12, 20, 9

Next Time

1. Watch 16.5 [~36 minutes]

2. Homefun/Python