Math 1321 Week 12 Lab Worksheet Due Thursday 04/24

1. **Green's Theorem** Find the work which is done by the force field $(3x+4y)\mathbf{i}+(8x+9y)\mathbf{j}$ on a particle that moves once around the ellipse $4x^2 + 9y^2 = 36$ by
   (a) Directly evaluating the line integral. Hint: an ellipse given by $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is parameterized by $(a\cos t, b\sin t)$ for $0 \leq t \leq 2\pi$.
   (b) Using Green's Theorem

2. **Stokes' Theorem** Verify that Stokes' Theorem is true for the vector field $\mathbf{F} = x^2\mathbf{i} + y^2\mathbf{j} + z^2\mathbf{k}$ and the region S is bounded by the paraboloid $z = 1 - x^2 - y^2$ and the plane $z = 0$.
   (a) Write down Stokes' Theorem.
   (b) Compute both sides of the equation for Stokes' Theorem.

3. **Divergence Theorem** S is the solid bounded by $0 \leq y^2 + z^2 \leq 1$ and $0 \leq x \leq 2$. Use the Divergence Theorem to calculate the flux of $\mathbf{F} = (x + z^2)\mathbf{i} + (y - z^2)\mathbf{j} + x\mathbf{k}$ through ∂S.