Math 1321 Week 14 Lab Worksheet

1. **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.

2. **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.

Review:

3. **(Taylor Series)** Find the Taylor Series at $a = 1$ for the antiderivative of $\dfrac{\arctan(x-1)}{x-1}$.

4. **(Optimization)** Find the extreme value of $f(x, y) = e^{-4xy}$ on the region described by $4x^2 + y^2 \leq 1$.

5. **(Multiple Integral)** Compute $\iiint_E x\,dV$, where E is bounded by the paraboloid $x = 4y^2 + 4z^2$ and the plane $x = 4$.