Math 241 X8 **Name(s):**

Homework 12 supplement

This is a written homework supplement to the homework for Unit 13: 3D Flow Along.

(1) Consider the surface R that is the cone $z = \sqrt{x^2 + y^2}$ with $z \leq 3$. Let $\mathbf{F}(x, y, z) = \langle x^3 y, xz, \sin z \rangle$.

(a) Compute $\iint_R \operatorname{curl} \mathbf{F} \cdot \mathbf{dS}$ directly. Use a downward/outward normal.

(b) Verify your answer to (a) using Stokes's Theorem. Be sure to check that your orientations match.

(2) Compute the flow of $\mathbf{G}$ along C, where $\mathbf{G}(x, y, z) = \langle x^2 y, \frac{1}{3}x^3, xy \rangle$ and C is the curve of intersection of the hyperbolic paraboloid $z = y^2 - x^2$ and the cylinder $x^2 + y^2 = 4$. Which direction is it?