Review 3: Practice Final

Friday, May 6

1. Find the point(s) on the unit disk $\{(x, y) : x^2 + y^2 = 1\}$ that maximize the function $f(x, y) = x^2 - 2x + 2y^2$.

2. Find the volume of the solid that lies within the sphere $x^2 + y^2 + z^2 = 4$, above the xy-plane, and below the cone $z = \sqrt{x^2 + y^2}$.

3. If $\mathbf{F}(x, y) = \langle 2xe^{-y}, 2y - x^2e^{-y} \rangle$, evaluate the integral $\int \mathbf{F} \cdot d\mathbf{r}$ where C is a series of line segments from $(1, 0)$ to $(3, 3)$ to $(-4, 7)$ to $(\pi, 3\sqrt{2^\pi})$ to $(2, 1)$.

4. If $\mathbf{F}(x, y) = \langle x, 2y, 3z \rangle$, evaluate the surface integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$, where S is the cube with vertices $(\pm 1, \pm 1, \pm 1)$ (oriented outward).

5. Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}(x, y, z) = \langle yz, 2xz, e^{xy} \rangle$ and C is the circle $x^2 + y^2 = 16, z = 5$, oriented counterclockwise as viewed from above.