Math 3202 **Due Thur April 7** **Assignment #8(extra credit)**

1. Is the following vector field irrotational or incompressible at point $(0,1,2)$?

$$\vec{F} = \left(\frac{x}{x^2+y^2+z^2}, \frac{y}{x^2+y^2+z^2}, \frac{z}{x^2+y^2+z^2}\right)$$

2. Evaluate the surface integral for given function

   (a) $\int\int_{\mathbf{S}} y\,dS$, where $\mathbf{S}$ is a surface $z = 2/3(x^{3/2} + y^{3/2})$, $0 \le x \le 1$, $0 \le y \le 1$.

   (b) $\int\int_{\mathbf{S}} \sqrt{1+x^2+y^2}\,dS$, where $\mathbf{S}$ is the helocoid with vector equation $\vec{r}(u,v) = (u\cos v, u\sin v, v)$, $0 \le u \le 1$, $0 \le v \le \pi$.

3. Evaluate the surface integral for given vector field

   (a) $\int\int_{\mathbf{S}} \vec{F}\cdot d\vec{S}$, where $\vec{F}(x,y,z) = (xy, 4x^2, yz)$ and $\mathbf{S}$ is a surface $z = xe^y$, $0 \le x \le 1$, $0 \le y \le 1$, with upward orientation.

   (b) $\int\int_{\mathbf{S}} \vec{F}\cdot d\vec{S}$, where $\vec{F}(x,y,z) = (y, x, z^2)$ and $\mathbf{S}$ is the helocoid with vector equation $\vec{r}(u,v) = (u\cos v, u\sin v, v)$, $0 \le u \le 1$, $0 \le v \le \pi$, with upward orientation.

4. Use Stokes's Theorem to evaluate surface integral $\int\int_{\mathbf{S}} \text{curl}\vec{F}\cdot d\vec{S}$, where $\vec{F}(x,y,z) = (yz, xz, xy)$, and surface $\mathbf{S}$ is a part of paraboloid $z = 9 - x^2 - y^2$ that lies above the plane $z = 5$, oriented upward.

5. Use Stokes's Theorem to evaluate line integral $\int_C \vec{F}\cdot d\vec{r}$, where $\vec{F} = (e^{-x}, e^x, e^z)$, and C is the boundary of the plane $2x+y+2z = 2$ in the first octant, oriented counterclockwise as viewed from above.

6. Verify that Divergence theorem is true for the vector field $\vec{F} = (x^2, xy, z)$ and the solid bounded by paraboloid $z = 4 - x^2 - y^2$ and xy-plane.

7. Verify that Divergence theorem is true for the vector field $\vec{F} = (x, y, z)$ and the unit ball $x^2+y^2+z^2 = 1$.