Math 227 Queen's University, Department of Mathematics

**Vector Analysis, Homeworkz 3**

September 2013

**1.** Evaluate the triple integral $\int\int\int_{\mathbf{W}} \frac{dV}{\sqrt{x^2+y^2+z^2}}$ where $\mathbf{W}$ is the solid region between the upper hemispheres of two concentric spheres of radii $a < b$.

**2.**Consider the vector field $\mathbf{F}(x, y) = (-2y, 2x)$.

**a**. Show that the parameterized curve $(\cos(2t), \sin(2t))$ is a flow line of this vector field. Show that the family of parameterized curves $(a\cos(2t), a\sin(2t))$ are flow lines of $\mathbf{F}$. What curve does this parameterization describe?

**b.** Find a vector field $\mathbf{G}(x, y)$ which is everywhere perpendicular to the field $\mathbf{F}$.

**c.** Find the l flow line of the vector field $\mathbf{G}$ which goes through the point $(x, y)$, $x^2 + y^2 > 0$, at $t = 0$.

**3.** Using spherical coordinates, find the volume of the spherical cap: the solid region $x^2 + y^2 + z^2 \leq 10$ which lies above the plane $z = 1$.