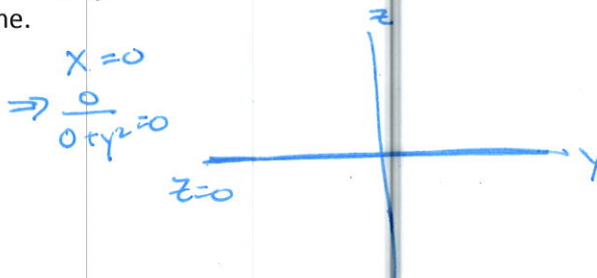**Instructions**: Show all work. Use exact answers unless otherwise asked to round.
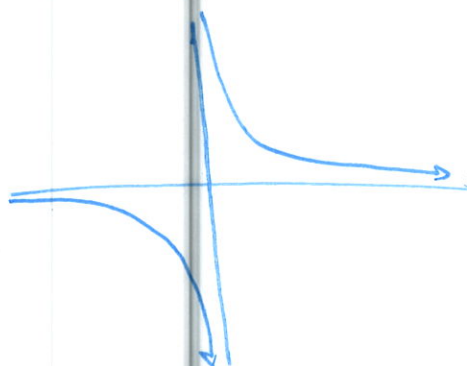
1. Consider the function $f(x,y) = \dfrac{x}{x^2+y^2}$. Sketch the following:
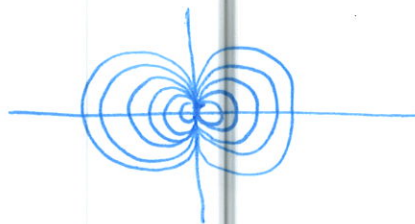
   a. The trace on the yz-plane.

   $X = 0$

   $\Rightarrow \dfrac{0}{0+y^2} = 0$

   $z = 0$

   b. The trace on the xz-plane.

   $Y = 0$

   $z = \dfrac{x}{x^2+0} = \dfrac{x}{x^2} = \dfrac{1}{x}$

   c. 10 level curves.

   $z = \dfrac{x}{x^2+y^2}$

   $x^2 + y^2 = \dfrac{x}{z}$

   circle centered at $\dfrac{1}{2z} = x$

   d. Use technology to verify your level curves and produce a 3D graph of the function to verify your results. Attach the graphs to your submission.
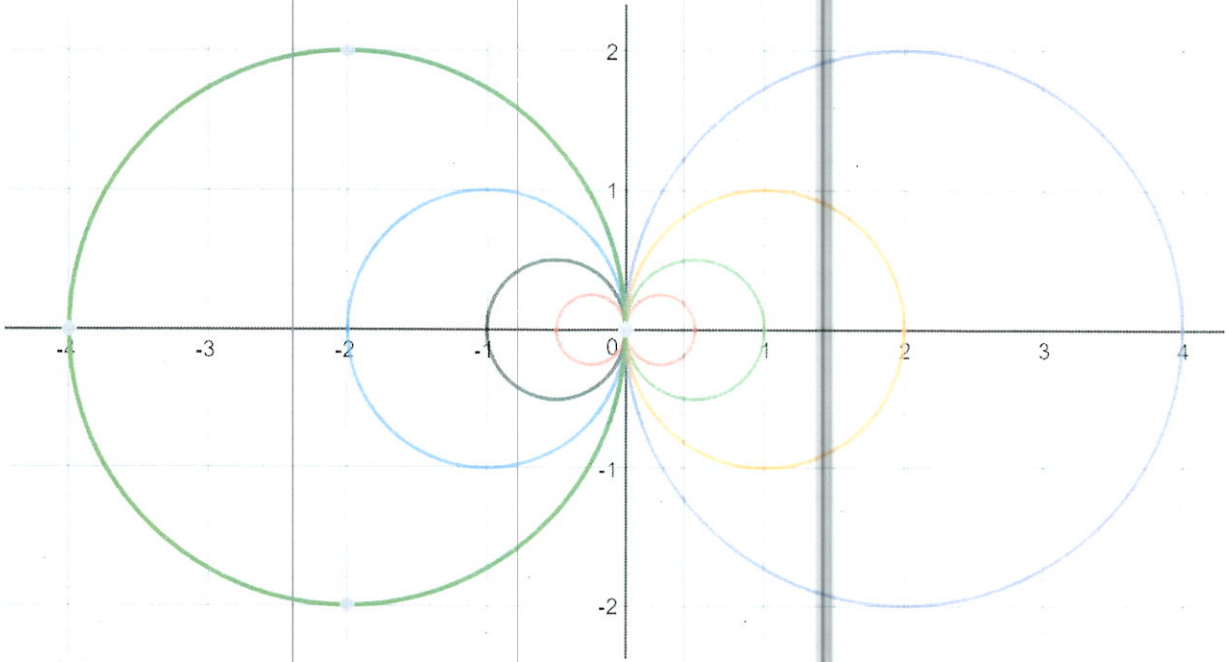
2. Find the potential function, if it exists, for the vector field $\vec{F}(x,y,z) = (2xy + yz^2)\hat{\imath} + (x^2 - 2yz + xz^2)\hat{\jmath} + (2xyz - y^2 + \cos z)\hat{k}$. If not potential function exists, show work to prove that it is not.

   $\int 2xy + yz^2 \, dx = x^2y + xyz^2 + f(y,z)$

   $\int x^2 - 2yz + xz^2 \, dy = x^2y - y^2z + xyz^2 + g(x,z)$

   $\int 2xyz - y^2 + \cos z \, dz = xyz^2 - zy^2 + \sin z + h(x,y)$

   $\varphi(x,y,z) = x^2y - y^2z + xyz^2 + \sin z + K$

Level Curves

Trace on xz-plane