Problem 1: (Vector Fields)

a) Given the following vector field, determine graphically whether the points P_1 and P_2 are sinks, sources, or neither.

b) Determine graphically whether the circulation at points P_1 and P_2 is positive, negative, or zero.

c) Given the following options, determine the equation that produces the field:

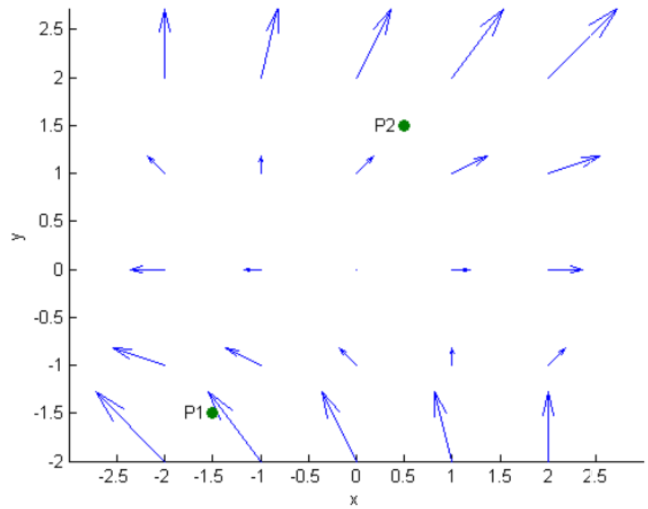
   i. $\vec{F}(x,y) = (x, y^2)$

   ii. $\vec{F}(x,y) = (y^2, x)$

   iii. $\vec{F}(x,y) = (x+y, y^2)$

   iv. $\vec{F}(x,y) = (y, x^2+y)$

d) Verify part a) and b) mathematically using the correct equation



Problem 2: (Vector Field Identities)

If f is a scalar function and $\vec{F}$ and $\vec{G}$ are vector fields, state whether the following expressions are scalar, vector, or meaningless:

a)$\nabla(\nabla f)$

b) $curl(\vec{F} - \vec{G}) \times \nabla\left(div(\vec{F})\right)$

c) $div\left(curl(\nabla f)\right)$

Problem 3: (Vector Field Identities)

For the field $\vec{F}(x,y,z) = (e^{yz})\hat{\imath} + (xze^{yz} + z\cos y)\hat{\jmath} + (xye^{yz} + \sin y)\hat{k}$

a) Verify that $curl(\vec{F}) = 0$

b) Find all scalar functions $f(x,y,z)$ such that $\vec{F} = \nabla f$