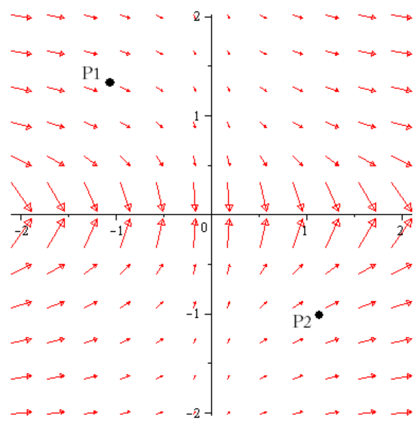
Homework Section 16.9

1. A vector field **F** is shown. Determine whether div **F** is positive or negative at P_1 and P_2 and label both points as either a source or a sink.



2. Use the Divergence Theorem to calculate the flux integral, $\iint_S \mathbf{F} \bullet \mathbf{N} dS$.

   a) $\mathbf{F}(x, y, z) = zx^2\mathbf{i} + \cos y\mathbf{j} + e^x \sin y\mathbf{k}$, S is the surface of the box bounded by the planes $x = 0$, $x = 1$, $y = 0$, $y = 2$, $z = 0$, and $z = 1$. (Note that if you didn't use the Divergence Theorem, then you would have to sum the values of the flux integrals over all six faces of the box, a tedious calculation.)

   b) $\mathbf{F}(x, y, z) = ye^z\mathbf{i} + 3x^2y\mathbf{j} + 3y^2z\mathbf{k}$, S is the surface of the solid bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = -1$ and $z = 2$.

   c) $\mathbf{F}(x, y, z) = z\mathbf{i} + y\mathbf{j} + x\mathbf{k}$, S is the unit sphere. (This was the last example from the 16.7 lecture. It is also Example 4, section 16.7, from Stewart's 6th Edition of *Multivariable Calculus: Early Transcendentals*). Note how much easier it is to calculate flux using the Divergence Theorem.)

3. Redo problem 2(d) from section 16.7 using the Divergence Theorem.