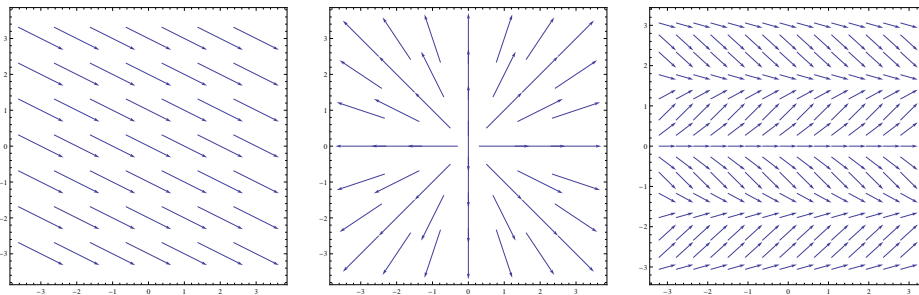1. Sketch the following vector fields:

   (a) $\vec{F}_1(x, y) = y\hat{\imath} + \hat{\jmath}$

   (b) $\vec{F}_2(x, y) = y \cos x \, \hat{\imath} + \sin x \, \hat{\jmath}$

   (c) $\vec{F}_3(x, y) = -\dfrac{y}{\sqrt{x^2+y^2}}\hat{\imath} + \dfrac{x}{\sqrt{x^2+y^2}}\hat{\jmath}$

2. Give the equation defining each of the vector fields illustrated below:

3. (4B-2) Evaluate the integral of $\vec{F} = x\hat{\imath} + y\hat{\jmath}$ along the path C which goes once counter-clockwise around a circle of radius a centered at the origin. First argue geometrically, and then check your answer by directly computing the integral.

4. For the first and second vector fields of problem 1, compute the integral along three different paths from $(0, 0)$ to $(1, 1)$:

   (a) C_1, a straight line from $(0, 0)$ to $(1, 1)$

   (b) C_2, a line from $(0, 0)$ to $(1, 0)$ and then to $(1, 1)$.

   (c) C_3, along the parabola $y = x^2$

5. One of the vector fields from the previous question is conservative. Which one? Find a function $f(x, y)$ of which it is the gradient, and evaluate the above integral using the fundamental theorem for line integrals.

6. What is the gradient field associated with the function $f(r, \theta) = r \log r$?