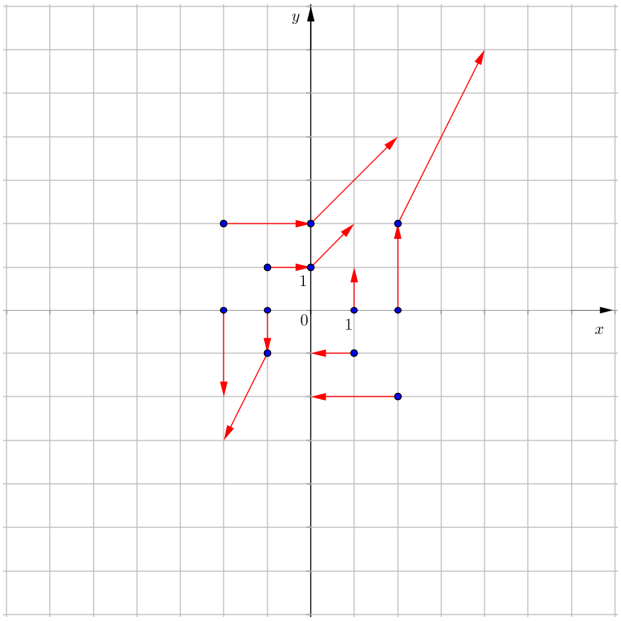
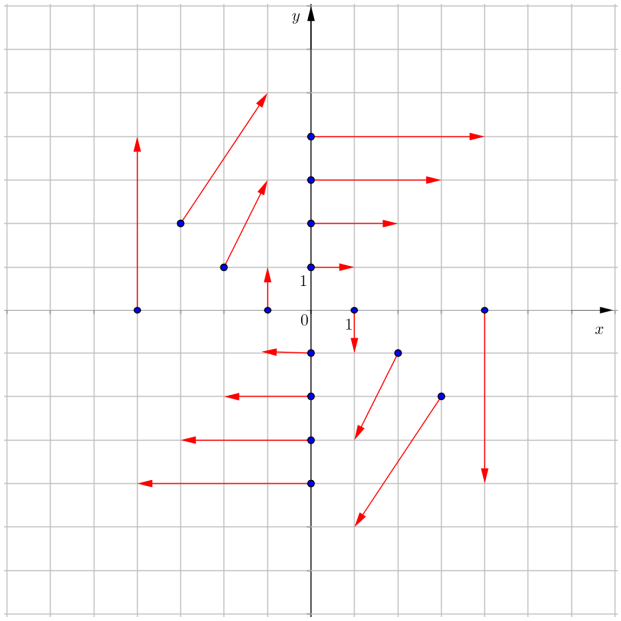
1) Sketch the vector field $\mathbf{F}$ by drawing a diagram on the graph below. Draw all vectors beginning at the points plotted.

$$\vec{\mathbf{F}}(x, y) = y\,\mathbf{i} + (x + y)\,\mathbf{j}$$



2) Sketch the vector field $\mathbf{F}$ by drawing a diagram on the graph below. Draw all vectors beginning at the points plotted.

$$\vec{\mathbf{F}}(x, y) = y\,\mathbf{i} - x\,\mathbf{j}$$



3) Find the conservative vector field for the potential function $f(x, y) = x^{\alpha} e^{-\beta x}$ by finding its gradient.

$$\boxed{\nabla f(x, y) = (\alpha - \beta x) x^{\alpha - 1} e^{-\beta x}\, \mathbf{i}}$$

4) Find the conservative vector field for the potential function $h(x, y, z) = xy \ln(x + y)$ by finding its gradient.

$$\boxed{\nabla f(x, y) = \left[\frac{xy}{x + y} + y \ln(x + y) \right] \mathbf{i} + \left[\frac{xy}{x + y} + x \ln(x + y) \right] \mathbf{j}}$$