

## Exercises

**Chapter 11.3** # 1, 3, 7

**Chapter 11.4** # 1,5,7,9,11

**Problem A:** Sketch the direction field for  $\mathbf{F} = xy\mathbf{i} + \mathbf{j}$  (the direction field is just the vector field  $\mathbf{F}$  drawn with all vectors the same, short, length). Find an equation for the streamline through the point  $(1, 0)$  and draw it on the same sketch.

**Problem B:** Let  $\varphi(x, y) = 2x - y$ . Draw level curves for  $\varphi$ . On the same sketch, draw the gradient vector field  $\nabla\varphi$ .

**Problem C:** Let  $\varphi(x, y) = xy$ . Draw level curves for  $\varphi$ . On the same sketch, draw the gradient vector field  $\nabla\varphi$ .

**Problem D:** Describe the level surfaces of  $\varphi(x, y, z) = y^2 + z^2$ .

**Problem E:** Level curves of a function  $\varphi(x, y)$  are shown below. Draw five streamlines of  $\mathbf{F} = \nabla\varphi$  through the five marked points.

