

## Exercise 30

Match the functions  $f$  with the plots of their gradient vector fields labeled I–IV. Give reasons for your choices.

$$f(x, y) = x(x + y)$$

### Solution

Take the gradient of  $f$ .

$$\begin{aligned}\nabla f &= \left\langle \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} \right\rangle \\ &= \langle 2x + y, x \rangle\end{aligned}$$

The vectors are completely vertical along the line  $y = -2x$ . This matches with plot IV.

