

Let $f(x, y) = xy$

1. Find $\nabla f(x, y)$
2. Find the directional derivative of f at the point $P = (-2, 1)$ in the direction of the given vector \mathbf{v} :

(a) $\mathbf{v} = \langle 1, 0 \rangle$

(d) $\mathbf{v} = \langle 1, -2 \rangle$

(b) $\mathbf{v} = \langle 0, 1 \rangle$

(e) $\mathbf{v} = \langle 2, 1 \rangle$

(c) $\mathbf{v} = \langle -1, 1 \rangle$

(f) $\mathbf{v} = \langle -1, 2 \rangle$

3. Verify your results by looking at a contour plot of $f(x, y)$