

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  $\vec{v}$ :

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

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

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

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

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

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

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