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 $\vec{\mathbf{v}}$:

   (a) $\vec{\mathbf{v}} = \langle 1, 0 \rangle$ (d) $\vec{\mathbf{v}} = \langle 1, -2 \rangle$

   (b) $\vec{\mathbf{v}} = \langle 0, 1 \rangle$ (e) $\vec{\mathbf{v}} = \langle 2, 1 \rangle$

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

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