1. (10 points) The best line of fit through the 6 data points $(x_1, y_1), \ldots, (x_6, y_6)$

$$(4,-2),\ (2,-1),\ (2,0),\ (1,5),\ (-1,7),\ (-2,9)$$

is

$$y = mx + b.$$

Find m and b.

2. (2 points) Let

$$f(x,y) = (y^2+1)\cos(x) + x\cos(y) + x$$

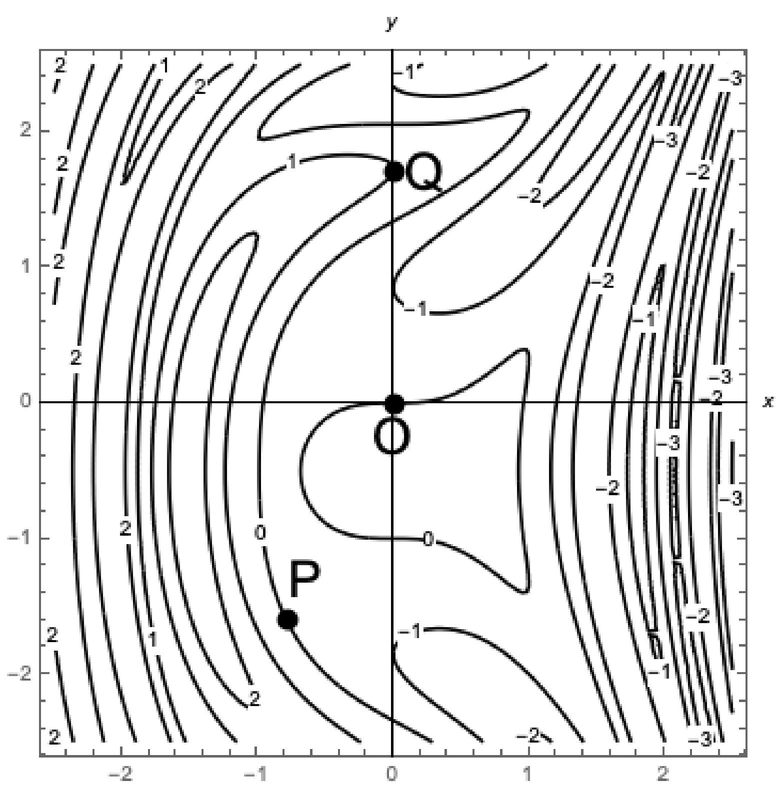
Compute $\dfrac{\partial^2 f}{\partial x \partial y}$. At which points (a,b) is the value

$$\frac{\partial^2 f}{\partial x \partial y}(a,b) > 0?$$

Select all that apply.

- $(a,b) = (0,0)$
- $(a,b) = (0,-\pi/2)$
- $(a,b) = (-\pi/2,\pi)$
- $(a,b) = (\pi/2,\pi/2)$
- None of the these four

3. (2 points) Below is a contour plot of a function $g(x,y)$ over the region of points (x,y) where $-2.5 \le x \le 2.5$ and $-2.5 \le y \le 2.5$.



For the points labeled O, P, Q, determine whether the following is negative, positive or 0.

a) $\frac{\partial g}{\partial x}(O) = g_x(O)$ b) $\frac{\partial g}{\partial y}(O) = g_y(O)$ c) $\frac{\partial g}{\partial x}(P) = g_x(P)$ d) $\frac{\partial g}{\partial y}(Q) = g_y(Q)$

4. (3 points) Define the functions $f(x, y)$ and $g(x, y)$ on $\mathbf{R}^2$ by

$$f(x, y) = e^x(x\cos(y) - y\sin(y)), \qquad g(x, y) = e^x(y\cos(y) + x\sin(y)).$$

Compute $\dfrac{\partial f}{\partial x}$, $\dfrac{\partial f}{\partial y}$, $\dfrac{\partial g}{\partial x}$, and $\dfrac{\partial g}{\partial y}$. Answer each of the following two questions:

1. Which among a, b, c, d below equals $\dfrac{\partial f}{\partial x}$?
2. Which among a, b, c, d below equals $\dfrac{\partial f}{\partial y}$?

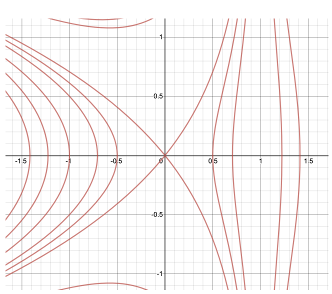
a) $\dfrac{\partial g}{\partial x}$ b) $\dfrac{\partial g}{\partial y}$ c) $-\dfrac{\partial g}{\partial x}$ d) $-\dfrac{\partial g}{\partial y}$

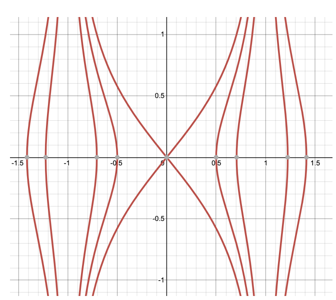
5. (3 points) Consider a function $f(x, y)$ satisfying

$$\left|\frac{\partial f}{\partial y}(a, b)\right| = \left|\frac{\partial f}{\partial y}(a, -b)\right| = \left|\frac{\partial f}{\partial y}(-a, b)\right|$$

for all $(a, b) \in \mathbf{R}^2$. Which contour plot is most likely to correspond to $f(x, y)$?

Note that the contour plots below all have uniform increments in f-values: the gaps between f-values for successive level curves are the same.

a) 

b) 

c)