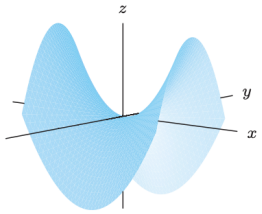
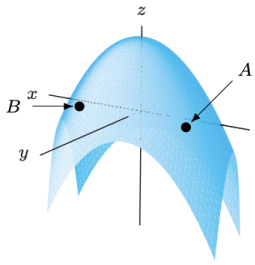
Math 203 — More partial derivatives

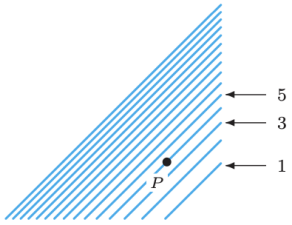
Problem 1. The figure below shows the graph of $f(x, y)$. What are the signs of $f_x(0, 0)$, $f_y(0, 0)$, $f_{xx}(0, 0)$, and $f_{yy}(0, 0)$?



Problem 2. Let P be a point on the line segment connecting A to B in the figure below. How does $f_x(P)$ change when P starts close A and moves toward B? What can you conclude about any second order partial derivatives as a result?



Problem 3. The figure below shows a contour plot of $f(x, y)$. What are the signs of $f_x(P)$, $f_y(P)$, $f_{xx}(P)$, $f_{yy}(P)$, and $f_{xy}(P)$?



Problem 4. Compute all four second order partial derivatives for each f below and check that $f_{xy} = f_{yx}$.

a. $f(x, y) = 3x^2y + 5xy^3$

b. $f(x, y) = e^{2xy}$

c. $f(x, y) = \sin(x^2 + y^2)$