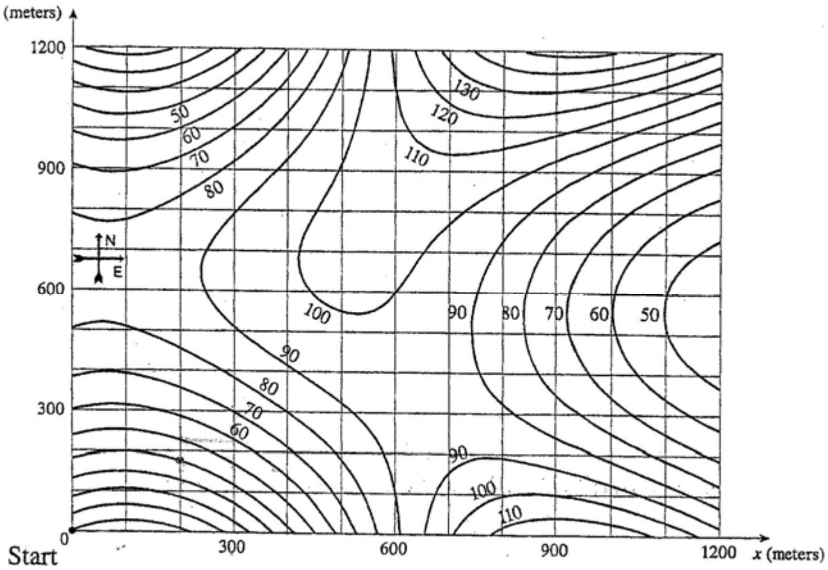
Mth 254 Lab
Partial Derivatives and Chain Rule

1. The following is a map with curves of the same elevation of a region in Orangerock National Park. We define the altitude function $A(x, y)$, as the altitude at a point x meters east and y meters north of the origin ("Start"). Estimate $A_x(200,175)$ and $A_y(200,175)$.



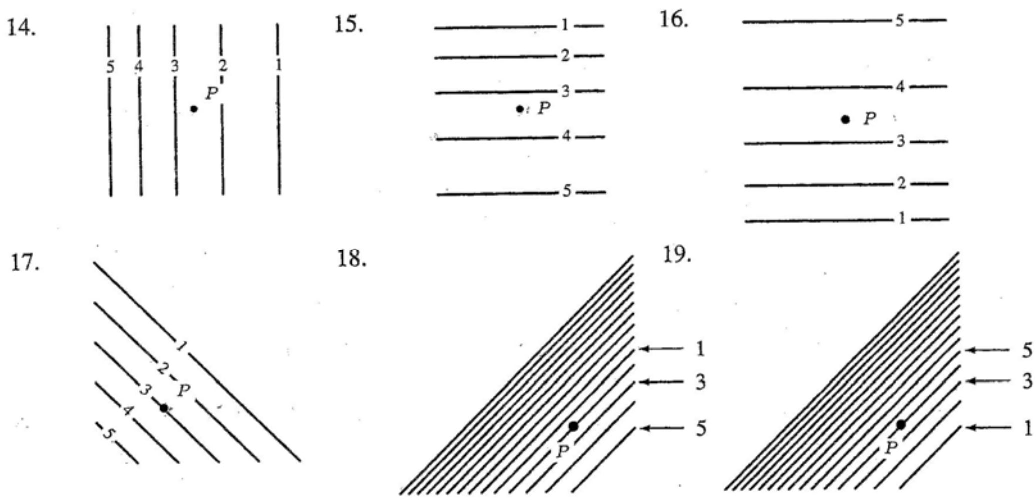
2. The following table of values is an excerpt from a table compiled by the National Weather Service. Let $f(T, H)$ be the perceived air temperature when the actual temperature is T and the relative humidity is H. Estimate $f_H(94,70)$, $f_T(94,70)$, $f_{TT}(94,70)$ and $f_{HT}(94,70)$.

Relative humidity (%)

Actual temperature (°F) T \ H	50	55	60	65	70	75	80	85	90
90	96	98	100	103	106	109	112	115	119
92	100	103	105	108	112	115	119	123	128
94	104	107	111	114	118	122	127	132	137
96	109	113	116	121	125	130	135	141	146
98	114	118	123	127	133	138	144	150	157
100	119	124	129	135	141	147	154	161	168

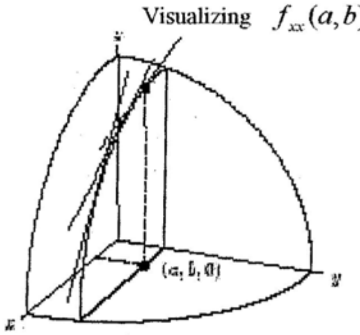
3. Use the level curves of the function $z = f(x, y)$ to decide the sign (positive, negative, or zero) of each of the following partial derivatives at the point P. Assume the x and y axes are in the usual positions. These problems came from the text so you might want to just choose a couple to work on.

a. $f_x(P)$ b. $f_y(P)$ c. $f_{xx}(P)$ d. $f_{yy}(P)$ e. $f_{xy}(P)$

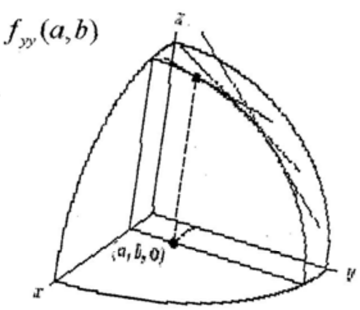


4. Below are the graphs from class. Estimate the signs of $f_x(a,b)$, $f_y(a,b)$, $f_{xx}(a,b)$, $f_{yy}(a,b)$ and $f_{xy}(a,b)$. Remember that the signs on $f_{xx}(a,b)$ and $f_{yy}(a,b)$ determine the concavity in the x and y directions respectively. In the example below, the graph of the function is concave down in both directions so the signs on $f_{xx}(a,b)$ and $f_{yy}(a,b)$ are both negative.

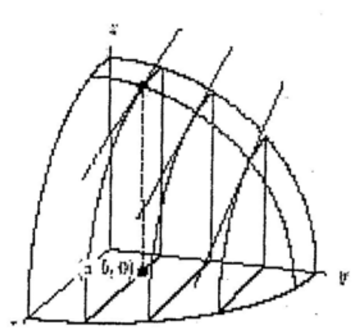
Visualizing $f_{xx}(a,b)$



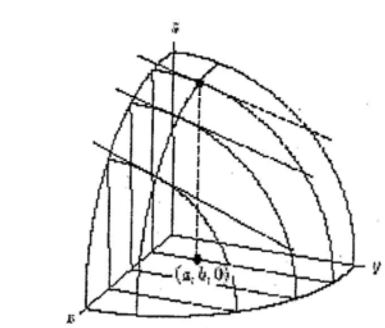
Visualizing $f_{yy}(a,b)$



Visualizing $f_{xy}(a,b)$



Visualizing $f_{yx}(a,b)$



5. Let $z = \arctan(x/y)$ and $x = \ln(u-v)$ and $y = u^2 v$. Find $\dfrac{\partial z}{\partial v}$ using the chain rule.