

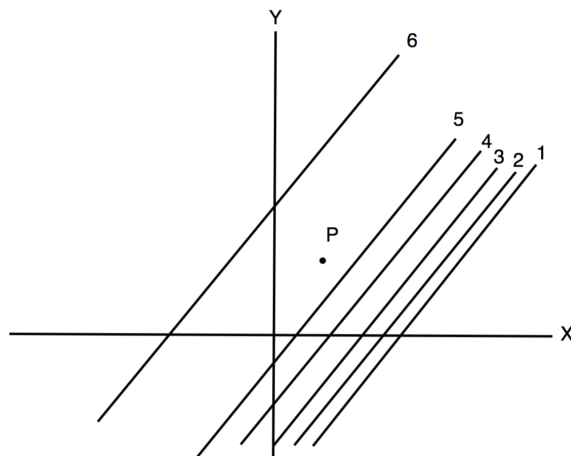
Contour Example

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Consider the contour in the following graph. Find the signs of f_x , f_y , f_{xx} , f_{xy} , f_{yy} .



Solution. Note: this is a contour graph, the function values are labeled next to each of the lines.

f_x : We need to look at the function values as we move in the x direction (to the right) from P . As we move to the right, the function values decrease, hence $f_x < 0$.

f_y : We need to look at the function values as we move in the y direction (up) from P . As we move up, the function values increase, hence $f_y > 0$.

f_{xx} : $f_{xx} = (f_x)_x$, so we need to look at f_x as we move in the x direction (to the right) from P . As we move to the right, the contours start bunching together, so that means f_x is moving at an increasing rate. But $f_x < 0$, so we are decreasing at an increasing rate. Decreasing and increasing are opposite, so $f_{xx} < 0$.

f_{xy} : $f_{xy} = (f_x)_y$, so we need to look at f_x as we move in the y direction (up) from P . As we move up, the contours spread out, so that means f_x is moving at a decreasing rate. But $f_x < 0$, so we are decreasing at a decreasing rate. Decreasing and decreasing are the same sign, so $f_{xy} > 0$.

f_{yy} : $f_{yy} = (f_y)_y$, so we need to look at f_y as we move in the y direction (up) from P . As we move up, the contours spread out, so that means f_y is moving at a decreasing rate. But $f_y > 0$, so we are increasing at a decreasing rate. Increasing and decreasing are opposite, so $f_{yy} < 0$.

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