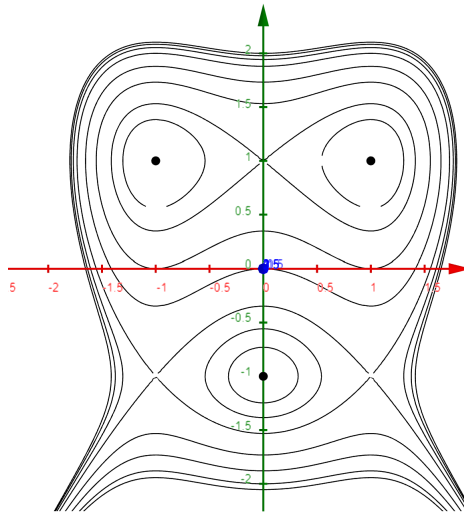


MATH 118

Local and global extrema

1. (a) The contour plot for $x = f(x, y)$ is shown below. Suppose $f_x(1.5, 1) > 0$, $f_x(-1.5, 1) < 0$, and $f_y(0, -1.5) > 0$, and that $\{(-1, 1), (0, 1), (1, 1), (-1, -1), (0, -1), (1, -1)\}$ is the set of all the critical points of $f(x, y)$. Guess the classification of the critical points of $f(x, y)$.



- (b) The function in part (a) is $f(x, y) = x^4 - 2x^2 + y^3 - 3y$. Confirm your answer in part (a) by calculating and classifying the critical points of $f(x, y)$.

2. Find the global maximum and minimum values of $f(x, y) = x^2 + y^2 - 4xy + 2$ if $0 \leq x \leq 3$ and $0 \leq y \leq 2$.

3. It's estimated that a company's profit in selling x units of good A and y units of good B is

$$\pi(x, y) = 1500 + 80x - 10x^2 + 40xy + 40y - 60y^2.$$

It costs the company \$200 to produce each unit of good A , and \$100 to produce each unit of good B , and they cannot spend more than \$1000 on production costs.

- (a) Write down the "physical" domain of the profit function.

- (b) How many units of each good should the company produce in order to maximize their profit?

- (c)