

Thursday, February 23 ** *Worksheet 10 - Constrained min/max via Lagrange multipliers.*

1. Let C be the curve in \mathbb{R}^2 given by $x^3 + y^3 = 16$.
 - (a) Sketch the curve C .
 - (b) Is C bounded?
 - (c) Is C closed?
2. Consider the function $f(x, y) = e^{xy}$ on C .
 - (a) Is f continuous? What does the Extreme Value Theorem tell you about the existence of global min and max of f on C ?
 - (b) Use Lagrange multipliers to determine both the min and max values of f on C .
3. Consider the surface S given by $z^2 = x^2 + y^2$
 - (a) Sketch S .
 - (b) Use Lagrange multipliers to find the points on S that are closest to $(4, 2, 0)$.
4. The contour plot of a function $f(x, y)$ is shown on the back of the sheet.
 - (a) Use the level curves to find the locations and types (min/max/saddle) of all the critical points of f .
 - (b) Use the formula
$$f(x, y) = 3x - x^3 - 2y^2 + y^4$$
and the 2nd derivative test to check your answer in part (a).
5. If the length of the diagonal of a rectangular box must be L , what is the largest possible volume?

