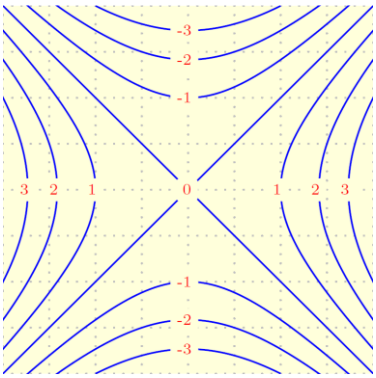
M408D Final Exam Review – Day 4

1) Determine $f_x - f_y$ when $f(x,y) = x^2 + 3xy + y^2$

2) Determine f_{xy} when $f(x,y) = \sin(xy) + e^{\frac{x}{y}}$

3) Suppose $w = f(x,y,z)$ where f is some function. Suppose that x, y and z are functions of t. Further suppose that $f_x = yz + 2x$, $f_y = ze^{yz} + xz + 2y$, and $f_z = ye^{yz} + xy$. If $x(0) = 2$, $y(0) = 1, z(0) = 1, x'(0) = 3, y'(0) = 4$, and $z'(0) = 5$, find the derivative of w with respect to t when $t = 0$.

4) Suppose the following contour map for a conic section function $f(x,y)$ was centered at the origin.



A) What is the name for the graph of $f(x,y)$?

B) If you were standing at the point $P(3,0,f(3,0))$, what would the values of f_x and f_y be (positive, negative or zero)?

C) If you were standing at the point $P(0,2,f(0,2))$, what would the values of f_x and f_y be (positive, negative or zero)?

5) The radius of a right circular cone is increasing at a rate of 2 inches per minute while the height is decreasing at a rate of 1 inch per minute. Determine the rate of change of the volume when $r = 3$ and $h = 4$

6) Evaluate the double integral $\iint_{\Omega} x^2 + y \, dxdy$

where $\Omega = \{(x,y) \mid 0 \le x \le 1, 0 \le y \le 2\}$

7) Evaluate the iterated integral $I = \int_0^1 \int_0^3 \frac{3y + x^2}{1 + y^2}\, dx dy$

8) Evaluate the double integral $\int_0^1 \int_0^x (x + 2y)\, dy dx$

9) Find the volume of the solid bounded by the coordinate planes and the plane $x + y + z = 1$

10) Find the volume, *V*, of the solid under the graph of the function $f(x, y) = 2x + y$ and over the region *A* in the first octant enclosed by a circle with center at the origin and radius 3.

11) Evaluate the double integral $I = \iint_D y\, dA$

when D is the region bounded by $x - y = 2$ and $y^2 = x$

12) Evaluate the double integral $\int_0^1 \int_x^1 x \sin(y^3)\, dy dx$

13) Use conversion to polar coordinates to evaluate the integral $\iint_D e^{-x^2 - y^2}\, dA$ where *D* is the region in the first quadrant of the *xy*-plane inside the graph of $x = \sqrt{4 - y^2}$

14) The solid shown lies inside the sphere $x^2 + y^2 + z^2 = 16$ and outside the cylinder $x^2 + y^2 = 9$

Find the volume of the part of this solid lying above the *xy*-plane.