Section 9 Math 2202

1. (Based on *Stewart 11.8 #6*) Consider the function $f(x, y) = e^{xy}$, and the constraint $x^3 + y^3 = 16$.

   (a) Use Lagrange multipliers to find the coordinates (x, y) of any points on the constraint where the function f could attain a maximum or minimum.

   (b) For each point you found in part (a), is the point a maximum, a minimum, both or neither? Explain your answer carefully. What are the minimum and maximum values of f on the constraint? Please explain your answers carefully.

   (c) The extreme value theorem which we discussed in class (See 11.7 in Stewart) guarantees that under the right circumstances, we are guaranteed to find absolute minima and maxima for a function f on a certain constraint. Explain why parts (a) and (b) don't violate the extreme value theorem.

(d) Here we show the constraint $g(x, y) = 16$ and a number of level curves $f(x, y)$. These level curves are all powers of 2. In the first and third quadrant they are positive powers, increasing as we come out from the origin. In the second and fourth quadrants they are negative powers of 2, decreasing as we come out from the origin.

How does this figure match with what you determined above?

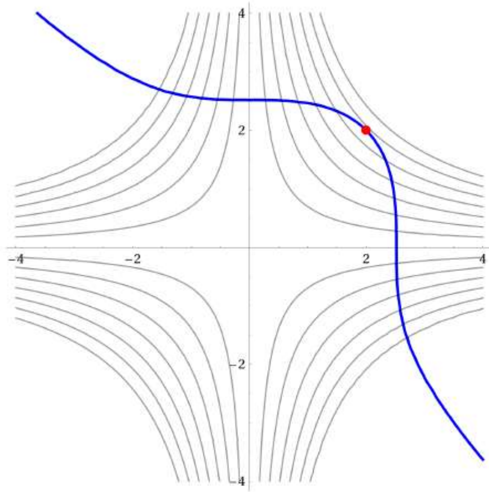

Figure 1: The constraint and level curves for Problem 1

1. $\int \frac{1}{x^{2/3}}\, dx$
2. $\int \sin x\, dx$
3. $\int \tan x\, dx$
4. $\int_e^{e^4} \frac{3}{x \ln x}\, dx$
5. $\int_0^1 xe^x\, dx$
6. $\int (\sin x + \cos x)^2\, dx$
7. $\int \frac{x}{\sqrt{1-x^2}}\, dx$
8. $\int \frac{1}{\sqrt{1-x^2}}\, dx$