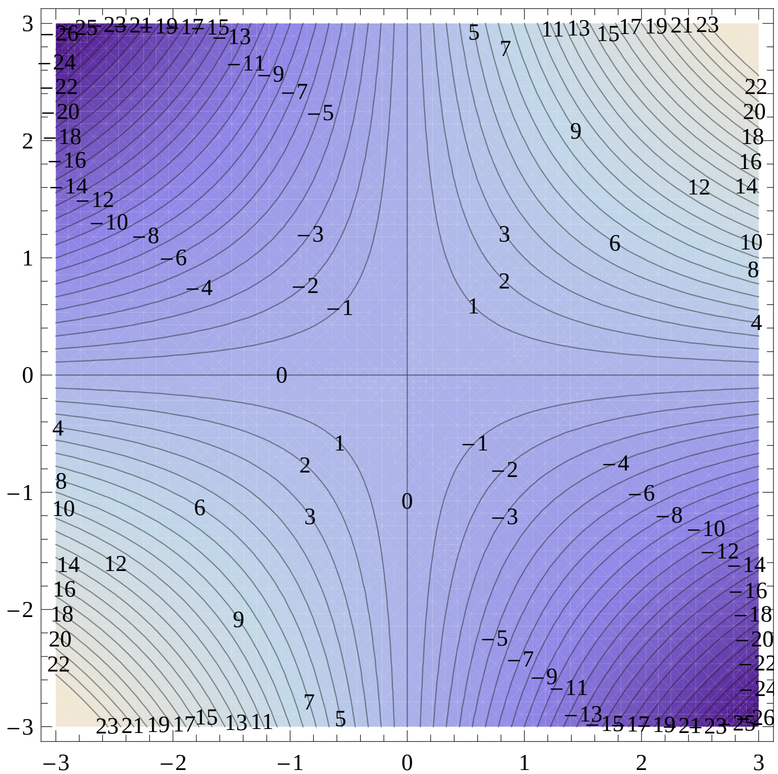
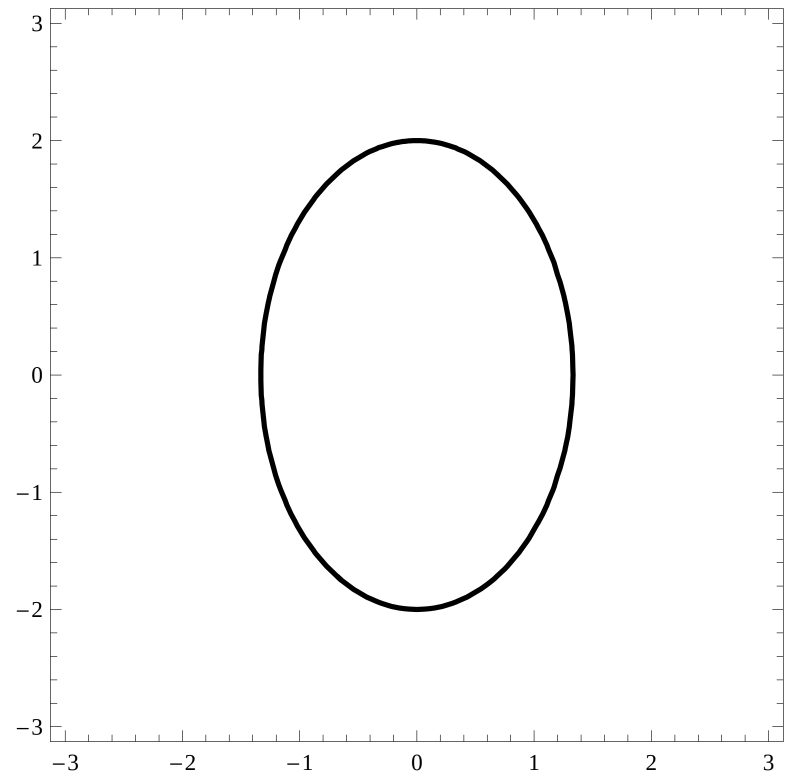
Maximize $f(x,y) = 3xy$ subject to $g(x,y) = 9x^2 + 4y^2 = 16$.

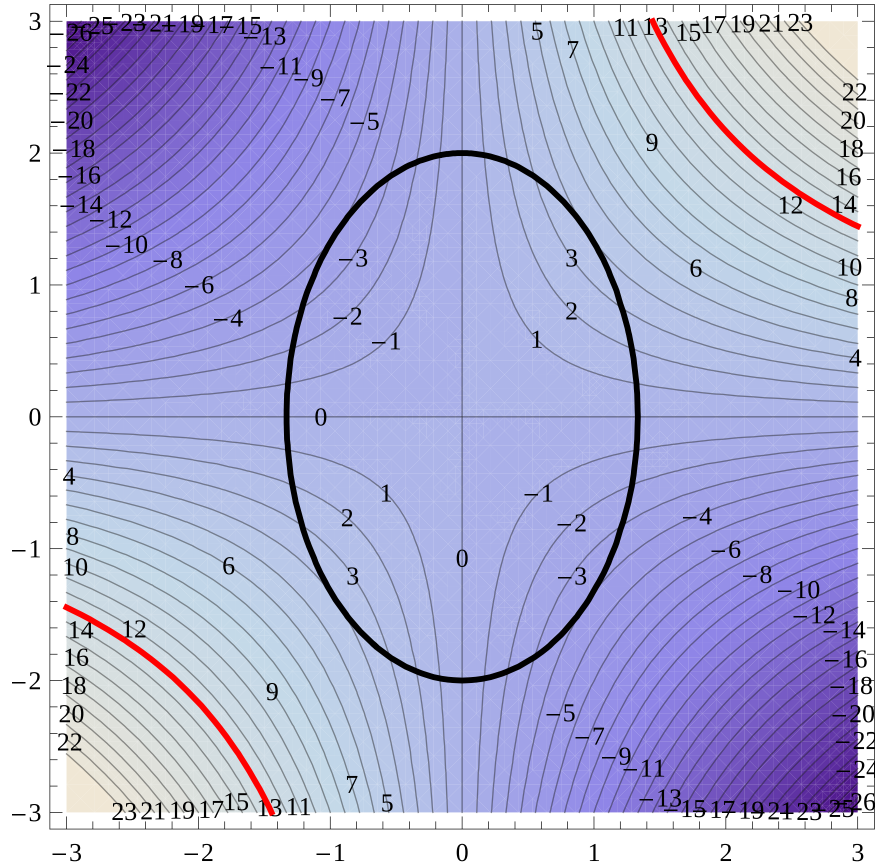
(Find (x,y) that are on the constraint and are as *large as possible on* f)



Objective function ($f(x,y)$)



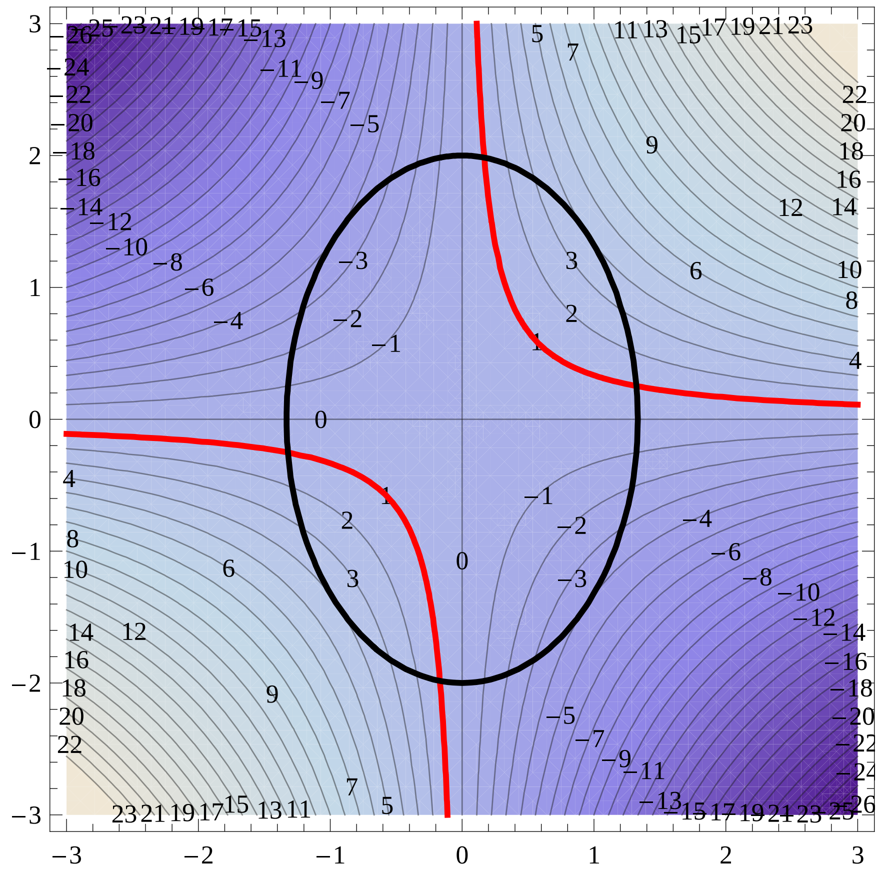
Constraint ($g = 16$)



Will the points where $f(x, y) = 13$ work?

NO! None of these points lie on the constraint!

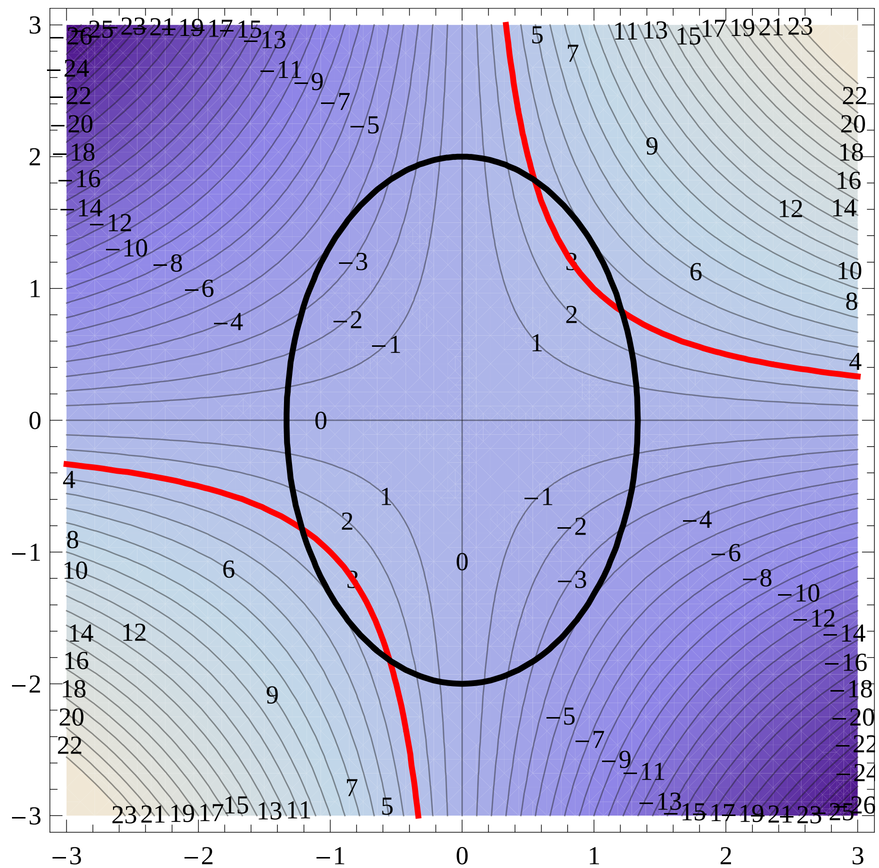
Move to a smaller f value, say $f(x, y) = 1$:



This definitely hits our constraint. (Good)

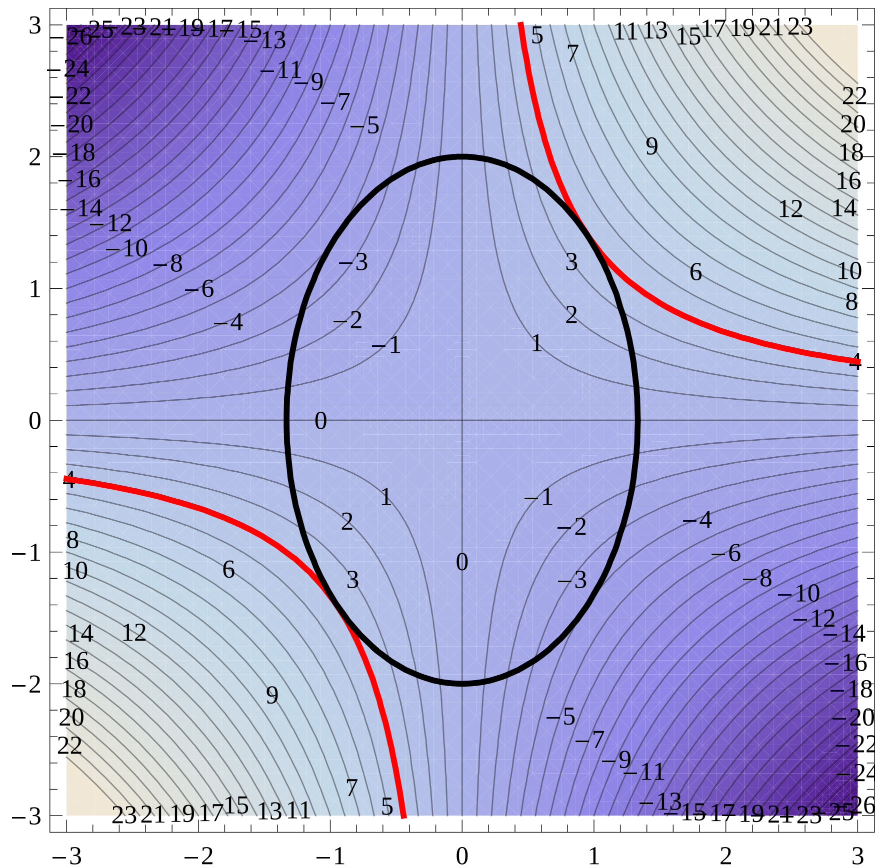
Question: Could there be other points that are *on the constraint* but are *larger* when plugged into f?

$$f(x, y) = 3$$



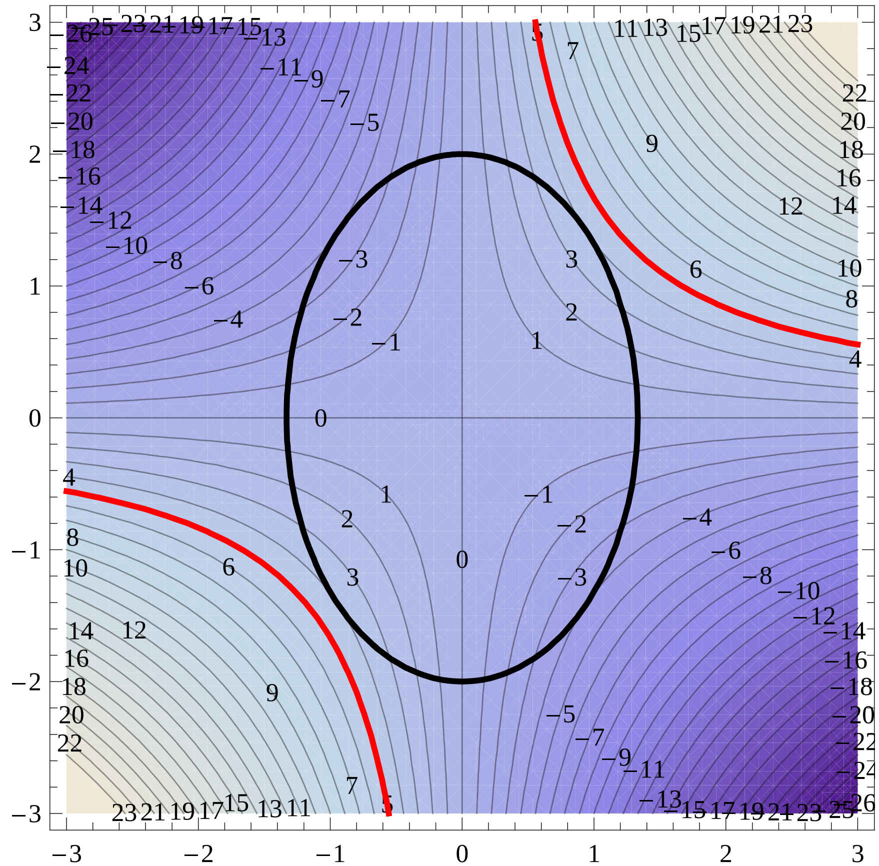
Could f still be larger?

$f(x, y) = 4$



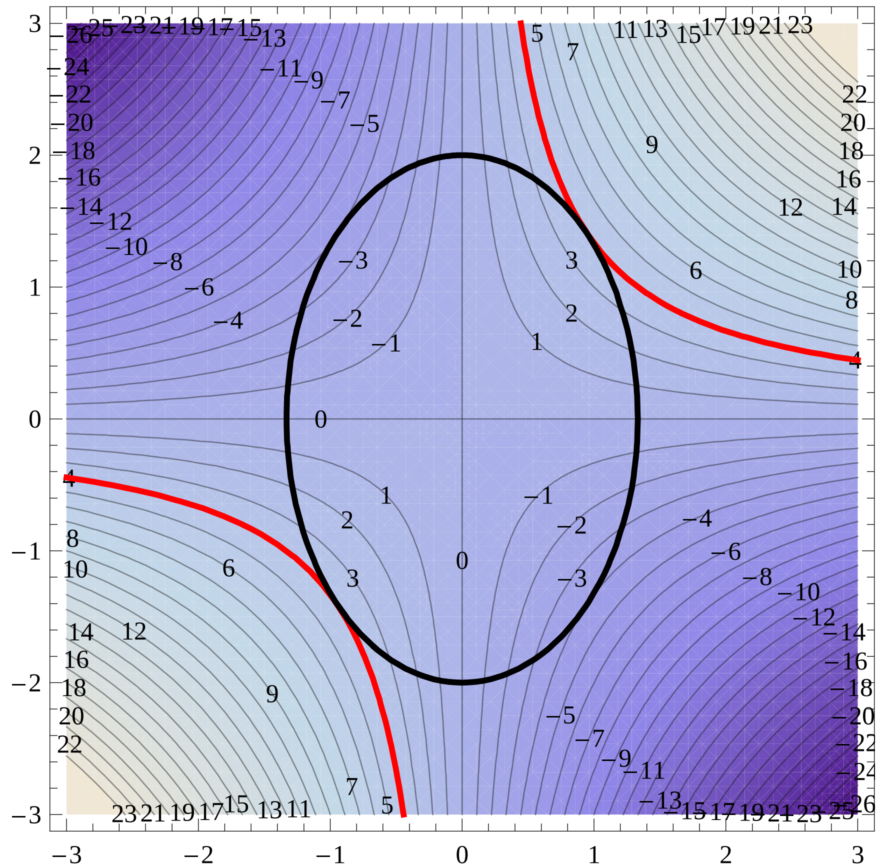
Could f still be larger?

$$f(x, y) = 5$$



Now we've gone too far.

$f(x, y) = 4$ is our optimal contour.



What geometric property does this contour have?