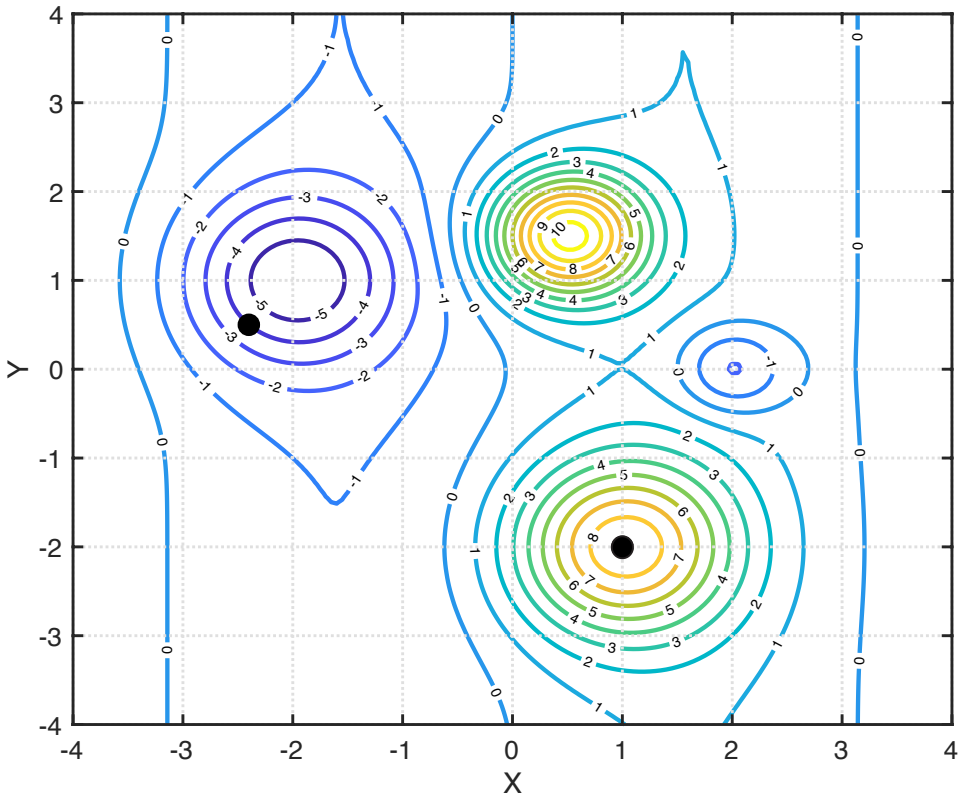
MATH 253 Name: _____

Quiz 6 March 4, 2020

Instructions: Six points total.

1. (4 pts.) Consider the contour plot for the smooth function $z = f(x, y)$ displayed below.



(a) At the black point $P(-2.4, .5)$ shown, draw a vector pointing in the direction of $\nabla f(-2.4, .5)$.

(b) Consider the black point $Q(1, -2)$ shown in the contour plot.

Estimate $f_x(1, -2)$

Give, as best you can, the equation of the tangent plane at $Q(1, -2)$. Briefly justify your answer.

(c) The function $f(x, y)$ has (at least) one saddle point at (a, b). Give the coordinates (a, b) for this saddle point and then **justify** why this is a saddle point for $f(x, y)$.

2. (2 pts.) Give the equation of the tangent plane at the point $P(3, 1, 2)$ to the surface defined implicitly by

$$\frac{x^2}{9} - y^2 + \frac{z^2}{4} = 1$$