Quiz 3
Math 2350
Fall 2007

Name and section Solution

Consider the function

$$f(x,y) = x^3 - 3xy.$$

1. (20%) Find the partial derivatives f_x and f_y.
2. (10%) Show that $P(2,1,2)$ is a point of the graph of f.
3. (30%) Find the equation of the tangent plane at P.
4. (10%) Find the equation of a line through P that is normal (perpendicular) to the tangent plane.
5. (30%) Let $x = \cos t$ and $y = \sin t$. Find the derivative $\frac{df}{dt}$.

① $f_x(x,y) = 3x^2 - 3y = 3(x^2 - y)$; $f_y(x,y) = -3x$

② $f(2,1) = 8 - 3\cdot 2 = 2$

③ $f_x(2,1) = 3(4-1) = 9$; $f_y(2,1) = -6$

Tangent plane:

$9(x-2) + (-6)(y-1) = z - 2 \iff$

$9x - 6y - 10 = 0$

④ $x = 2 + 9t$, $y = 1 - 6t$, $z = 2 - t$

⑤ $\frac{dx}{dt} = -\sin t$, $\frac{dy}{dt} = \cos t$

$\frac{df}{dt} = 3(\cos^2 t - \sin t)(-\sin t) - 3\cos t \cos t$

$= -3\cos^2 t(1 + \sin t) + 3\sin^2 t$