Math 53 Final 12/18/03

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2(a) $f(x,y,z) = x^2 + y^2 + z^2 = 14$

$\nabla f(x,y,z) = \langle 2x, 2y, 2z \rangle$

$\nabla f(\langle 3,2,1 \rangle) = \boxed{\langle 6,4,2 \rangle}$

(b) $f = x^2 - y^2 - z$

$\nabla f = \langle 2x, -2y, -1 \rangle$

$\nabla f(2,1,3) \cdot \langle x-2, y-1, z-3 \rangle = 0$

$\langle 4, -2, -1 \rangle \cdot \langle x-2, y-1, z-3 \rangle = 0$

$4x - 2y - z - 8 + 2 + 3 = 0$

$\boxed{4x - 2y - z = 3}$