MATH 335 S2019
Quiz I

2019-03-07

Read the problems carefully and be sure to show your work. No cell phones or calculators are allowed. Please turn off your phone to avoid any disturbances.

1. (10 pts) Compute the gradient of $\phi(x, y, z) = x^2 + y^2 + z^2 + xy - 3x$ and hence find the minimum value of ϕ.

Solution

The gradient of ϕ is $(2x + y - 3, 2y + x, 2z)$. To find the minimum, we must find values of x, y, z such that the gradient is zero. this gives the system

$$\begin{aligned} 2x + y - 3 &= 0 \\ 2y + x &= 0 \\ 2z &= 0 \end{aligned}$$

Immediately, we see that $z = 0$. Subtracting twice the second equation from the first, we get $-3y - 3 = 0$ or $y = -1$. Plugging back in, we get that $x = 2$. At $(2, -1, 0)$ we have $\phi = 4 + 1 + 0 - 2 - 6 = -3$.