

Question 1:

Distance function can only be proper function if it follows the following principles:

i) $d(x,y) \geq 0$ & $d(x,y) = 0$ if $(x=y)$

ii) $d(x,y) = d(y,x)$

Distance between two places can't be negative,

$$1' : d(x,y) \text{ for } (0,0,0) \text{ \& } (0,1,0) = (0-0)^2 + (0-1)^2 + (0-0)^2 = 1$$

$$2' : d(y,x) \text{ for } (0,0,0) \text{ \& } (0,1,0) = (0-0)^2 + (1-0)^2 + (0-0)^2 = 1$$

So $1' = 2'$

Since this result didn't violates any of two conditions,

The distance between $x(0, 0, 0)$ and $y(0, 1, 0)$ is:

By proper distance formula : $D(x,y) = \sqrt{(0-0)^2 + (0-1)^2 + (0-0)^2} = 1$

So the given function is a proper distance function.