Answers without **supporting work** or **necessary unit** will not be given full credit. If the meaning of the question isn't clear, please ask TA! You have **25mins** to complete this mini-test.

Q.1 Figure 1. shows two deflecting plates, there is a charge particle with mass $10^{-10}\ kg$ and a negative charge of magnitude $Q = 10^{-12}\ C$ enters the region between the plates, initially moving alone the x-axis with speed $v_x = 20\ m/s$, the length of each plate is $1\ cm$. The electric field induced by plates has a magnitude of $4\times10^6\ N/C$ point downward. What's the angle between instantaneous velocity and x-axis when the particle leaving the plates? (10 points)

$F = QE,\ a_y = \frac{F}{M} = \frac{QE}{M}$

$L = V_x t,\ t = \frac{L}{V_x}$

$V_y = a_y t = \frac{QE}{M}\frac{L}{V_x} = \frac{10^{-12}\cdot 4\times10^6}{10^{-10}}\cdot\frac{10^{-2}}{20} = 20\ m/s$

$\frac{V_x}{V_y} = 1,\ \tan\theta = 1,\ \Rightarrow \theta = \frac{\pi}{4}$ ※

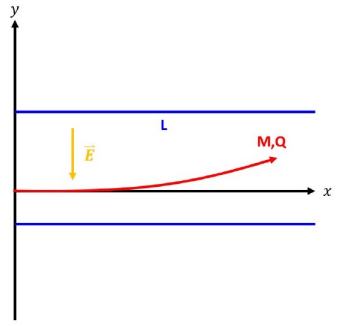

Figure 1

Q.2 There is a sphere of radius $R = 10\ (m)$ with spherically symmetric charge distribution. The volume charge density is non-uniform, which follows the function of radius r is $\rho = r^2\ (\frac{C}{m^3})$. The vacuum permittivity is ε_0. **(a)** What are the enclosed charges in the concentric spherical Gaussian surfaces of radius $r = 5\ (m)$ and $15\ (m)$? (6 points) **(b)** What are the electric fields on above two Gaussian surfaces? (4 points)