> 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 **30mins** to complete this mini-test.

Q.1 **(a)** With Gauss' Law, we know the relation between charge and static electric field is $\oint \vec{E} \cdot d\vec{A} = \frac{q_{enc}}{\varepsilon_0}$. Using divergence theorem to prove the differential form $(\nabla \cdot \vec{E} = \frac{\rho_e}{\varepsilon_0})$ of Gauss' law for electricity. (6 point) **(b)** There's a solid ball with uniform charge density ρ and radius R, if the electric field inside the ball is $\vec{E} = \frac{24\vec{r}}{\varepsilon_0} \, \hat{r} \, [V/m]$, using **(a)** to find the charge density in this ball. (4 point)

Q.2 There is a radio station (regard it as a point source) transmits a FM radio signal ($\sim 100 \, MHz$). The average power is 10 kW. **(a)** Please derive the average intensity of Poynting vector is $\frac{E_0 B_0}{2\mu_0}$. Where E_0 and B_0 are the amplitude of the electric and magnetic field, respectively. (5 points) **(b)** What is the amplitude of the electric field strength at a distance of 1 km from the antenna of that radio station. (5 points)