In a spherical region, the density varies inversely with the distance from the cent Gravitational field at a distance r from th centre is:

A Proportional to r

B Proportional to $\frac{1}{r}$

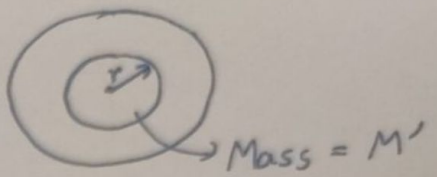
C Proportional to $\frac{1}{r^2}$

D same everywhere

Solution

① $\rho \propto \frac{1}{r}$ (Given)

Let, $\rho = \frac{k}{r}$



$$\frac{dM}{dV} = \frac{k}{r}$$

$$dM = \frac{k}{r} \times 4\pi r^2 dr$$

$$\int_0^{M'} dM = 4\pi k \int_0^r r\, dr$$

$$M' = 4\pi k \left[\frac{r^2}{2}\right]_0^r$$

$$M' = 2\pi k r \quad -(1)$$

$$g' = \frac{GM'}{r^2} = \frac{G \times 2\pi k r^2}{r^2} = G 2\pi k$$

(at r)

g' is independent of r.

Ans $\Rightarrow$ (D)