Special Problem 5-2.6

The electric field within some material with conductivity $\sigma = 2 \ \ (\Omega m)^{-1}$ is:

$$\mathbf{E}(\bar{r}) = -\rho^2 \, \hat{a}_\rho - \rho z^2 \, \hat{a}_z \qquad \left[V/m \right]$$

At the point $\bar{r}_a = 4 \, \hat{a}_x + 3 \, \hat{a}_y$, the free-charge density at one moment in time ($t = 0$, say) is:

$$\rho_v \left(\bar{r} = \bar{r}_a, \, t = 0 \right) = 10.0 \qquad C/m^3$$

At a time **3 seconds** later (i.e., at time $t = 3$), what is the charge density at point $\bar{r}_a$?