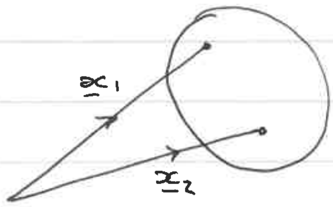
Nicer Solution to 3B:



$$\underline{\xi} = \underline{x}_2 - \underline{x}_1$$
$$\ddot{\underline{\xi}} = \ddot{\underline{x}}_2 - \ddot{\underline{x}}_1$$
$$= -\left(\underline{\nabla}\phi|_{x_2} - \underline{\nabla}\phi|_{x_1}\right)$$

And $\quad \nabla^2\phi = 4\pi\rho(x)$

so $\quad \underline{\nabla}\cdot\ddot{\underline{\xi}} = 0$

Take out one time derivative: $\dfrac{d}{dt}\,\underline{\nabla}\cdot\underline{u} = 0$ where $\underline{u} = \dot{\underline{\xi}}$

$\Rightarrow \quad \underline{\nabla}\cdot\underline{u} = a \quad$ (a = constant)

And stationary initial conditions, so $a = 0$.

$$\underline{\nabla}\cdot\underline{u} = 0$$

This is the equation of motion for an incompressible fluid flow. i.e. the volume does not change.

Courtesy of C. Moore.