From $p_\phi = m\rho^2\dot{\phi}$ we get

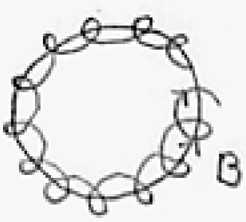
$$\dot{\phi} = \frac{p_\phi}{m\rho^2} \Rightarrow \boxed{\phi = \phi_0 + \frac{p_\phi}{m}\int_{t_0}^{t}\frac{dt'}{\rho^2(t')}}$$

From $p_z = m\dot{z} - q\frac{\mu_0 I}{2\pi}\log\rho$ we get

$$\dot{z} = \frac{p_z}{m} + \frac{q}{m}\frac{\mu_0 I}{2\pi}\log\rho \Rightarrow$$

$$\boxed{z = z_0 + \frac{p_z}{m}(t - t_0) + \frac{q\mu_0 I}{2\pi m}\int_{t_0}^{t} dt' \log\rho(t')}$$

e) The motion consists mostly of oscillations in ρ [motion in $V_{eff}(\rho)$] and z and continuous change in ϕ which produces spiralling about a field line.



In addition, if $p_\phi \neq 0$ so that ϕ is changing (actual spiralling), there is a slow drift in the $+\hat{e}_z$ direction (assuming $q>0$).