For every real value of the parameter $\alpha$, consider the field

$$F(r) = |r|^\alpha r, \quad r = xi + yj + zk.$$  

(1) Find div $F$. Simplify as much as possible. For which $\alpha$ do we have: $\text{div} F = 0$?

(2) Find curl $F$. Simplify as much as possible. For which $\alpha$ do we have: $\text{curl} F = 0$?