Homework 2

Exercise 1

$v(x,y,z) = v_\varphi(r)\, e_\varphi(r,\varphi,z)$

$p : \Omega \to \mathbb{R} \qquad p(x,y,z) = p(r)$

a)

i) Prove $\operatorname{div} v = 0$

Proof With the Note from Ex 1 we have

$$\operatorname{div} v = \frac{1}{r}\partial_r(r v_r) + \frac{1}{r}\partial_\varphi v_\varphi + \partial_z v_z$$

Since $v = v_\varphi e_\varphi$ we can say ~~v_φ~~ $v_r = v_z = 0$.

$$\Rightarrow \operatorname{div} v = \frac{1}{r}\partial_\varphi v_\varphi$$

Since v_φ ~~does~~ is not dependent to φ, the derivate in respect to φ is 0 ($\partial_\varphi v_\varphi = 0$)

$$\Rightarrow \operatorname{div} v = 0$$