Physics 2

Set no. 3

1. Let **F** = [F_x, F_y, F_z]. Please determine (if it makes sense):
   a) $\nabla(\nabla\vec{F})$
   b) $\nabla\times(\nabla\times\vec{F})$
   c) $\nabla\times(\nabla\vec{F})$
   d) $\Delta\vec{F}=\nabla^2\vec{F}=(\nabla\circ\nabla)\vec{F}$

2. Please determine (if possible) gradient, divergence and rotation for [f – scalar field function, **v** – vector field function]:
   a) f(x,y,z) = 2xy + x^2yz + z
   b) f(x,y,z) = sin(x+y) + xycos(z)
   c) **v** = [x,y]
   d) **v** = [x,-y]
   e) **v** = [y,x]
   f) **v** = [12xy, 16x^2yz, x-y]

3. Let us assume that f(x,y,z) = 2xy + x^2yz + z is a potential function for some vector field **v**. Please find **v.**

4. Assume that **F** is a harmonic force field (3D case with radial symmetry), $\boldsymbol{F} = -k\mathbf{r}$, $k > 0$. Please check if $V(r) = 0{,}5kr^2$ could be a potential of this field.

5. Please determine rotation of **E** = [$8x^{-2}$; $6\cos^2(y-z)$]