PROBLEMS | CURL

REFATH BARI 6/28/20

FINE

FIND THE CURL FOR THE FIELDS	
1	The curl of $\boldsymbol{F}(x,y,z) = 3x^2\boldsymbol{i} + 2z\boldsymbol{j} - x\boldsymbol{k}$ is
2	curl of $\boldsymbol{F}(x,y,z) = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$

NICE

FIND THE CURL OF THE VECTOR FIELDS	
1	(a) $\boldsymbol{F} = x\boldsymbol{i} - y\boldsymbol{j} + z\boldsymbol{k}$, (b) $\boldsymbol{F} = y^3\boldsymbol{i} + xy\boldsymbol{j} - z\boldsymbol{k}$, (c) $\boldsymbol{F} = \dfrac{x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}}{\sqrt{x^2+y^2+z^2}}$, (d) $\boldsymbol{F} = x^2\boldsymbol{i} + 2z\boldsymbol{j} - y\boldsymbol{k}$.
2	Choose the curl of $\boldsymbol{F}(x,y,z) = x^2\boldsymbol{i} + xyz\boldsymbol{j} - z\boldsymbol{k}$ at the point $(2,1,-2)$.

GREAT

1	Let f be a scalar field and $\boldsymbol{F}(x,y,z)$ and $\boldsymbol{G}(x,y,z)$ be vector fields. What, if anything, is wrong with each of the following expressions (click on the **green** letters for the solutions)? (a) $\boldsymbol{\nabla} f = x^3 - 4y\,,$ (b) $\boldsymbol{\nabla}\cdot\boldsymbol{F} = \boldsymbol{i} - x^2y\boldsymbol{j} - z\boldsymbol{k}\,,$ (c) $\boldsymbol{\nabla}\times\boldsymbol{G} = \boldsymbol{\nabla}\cdot\boldsymbol{F}\,.$
2	Let f be a C^2 function. Prove that curl grad $(f) = \nabla\times(\nabla f) = \mathbf{0}$. That is, prove that the curl of any gradient is the 0 vector.
3	Show that div curl $\boldsymbol{F} = 0$ for $\boldsymbol{F} = yz^2\hat{\boldsymbol{\imath}} + xy\hat{\boldsymbol{\jmath}} + yz\hat{\boldsymbol{k}}$.