

Instructions: Write complete legible solutions to the following problems in the space provided. Be sure to supply all the necessary steps that lead to your answers.

1. Find the curl and the divergence of the given vector field

$$\mathbf{F}(x, y, z) = xyz^2\mathbf{i} + x^2yz\mathbf{j} + xy^2z\mathbf{k}$$

2. Determine whether or not the vector field is conservative. If it is conservative, find a function f such that $\mathbf{F} = \nabla f$

$$\mathbf{F}(x, y, z) = xyz^2\mathbf{i} + x^2yz^2\mathbf{j} + x^2y^2z\mathbf{k}$$

3. Does there exist a vector field such that $\text{Curl } \mathbf{G} = xyz\mathbf{i} - y^2z\mathbf{j} + yz^2\mathbf{k}$

4. The vector field \mathbf{F} is shown in the xy -plane and looks the same in all other horizontal planes. (In other words, \mathbf{F} is independent of z and its component is 0.)
- a) Is $\text{div } \mathbf{F}$ positive, negative, or zero? Explain.
- b) Determine whether curl zero. If not, in which direction does curl \mathbf{F} point.

