Sheet (03)

(1)

Determine the gradient of the following scalar fields :

(a) $f = 5x + 10xz - xy + 6$
(b) $f = 2\sin\phi - rz + 4$
(c) $f = 2r\ \cos\theta - 5\phi + 2$

(2)

Determine the divergence of the following fields :

$(a)\ \bar{A} = x^2\bar{a}_x + yz\,\bar{a}_y + xy\,\bar{a}_z$

$(b)\ \bar{A} = r\sin\phi\,\bar{a}_r + 2r\cos\phi\ \bar{a}_\emptyset + 2z^2\,\bar{a}_z$

$(c)\ \bar{A} = 5\sin\theta\,\bar{a}_\theta + 5\sin\phi\ \bar{a}_\phi$ at $\left(0.5, \frac{\pi}{4}, \frac{\pi}{4}\right)$

(3)

Show that the vector field $\bar{F} = e^{-y}\left(\cos x\,\bar{a}_x - \sin x\,\bar{a}_y\right)$ solenoidal

(4)

If the electric field $\bar{E} = y\bar{a}_x + x\bar{a}_y$, show that the given region does not contain any electric charge .

(5)

Compute the curl of the following vector fields

a) $\bar{F} = xy\bar{a}_x + 2yz\bar{a}_y - \bar{a}_z$

b) $\bar{F} = 2\bar{a}_r + \sin\phi\,\bar{a}_\phi - z\bar{a}_z$

c) $\bar{F} = r\bar{a}_r + \bar{a}_\theta + \sin\theta\,\bar{a}_\phi$