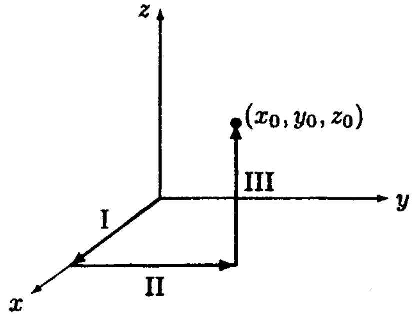
(1) $\nabla\times\mathbf{E}_1 = k\begin{vmatrix}\hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}}\\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z}\\ xy & 2yz & 3zx\end{vmatrix} = k\left[\hat{\mathbf{x}}(0-2y)+\hat{\mathbf{y}}(0-3z)+\hat{\mathbf{z}}(0-x)\right]\neq 0,$

so $\mathbf{E}_1$ is an *impossible* electrostatic field.

(2) $\nabla\times\mathbf{E}_2 = k\begin{vmatrix}\hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}}\\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z}\\ y^2 & 2xy+z^2 & 2yz\end{vmatrix} = k\left[\hat{\mathbf{x}}(2z-2z)+\hat{\mathbf{y}}(0-0)+\hat{\mathbf{z}}(2y-2y)\right] = 0,$

so $\mathbf{E}_2$ is a *possible* electrostatic field.

Let's go by the indicated path:



$$\mathbf{E}\cdot d\mathbf{l} = (y^2\,dx + (2xy+z^2)dy + 2yz\,dz)k$$

Step I: $y = z = 0$; $dy = dz = 0$. $\mathbf{E}\cdot d\mathbf{l} = ky^2\,dx = 0.$

Step II: $x = x_0$, $y: 0\to y_0$, $z = 0$. $dx = dz = 0$.

$$\mathbf{E}\cdot d\mathbf{l} = k(2xy+z^2)dy = 2kx_0y\,dy.$$

$$\int_{II}\mathbf{E}\cdot d\mathbf{l} = 2kx_0\int_0^{y_0} y\,dy = kx_0y_0^2.$$

Step III: $x = x_0$, $y = y_0$, $z: 0\to z_0$; $dx = dy = 0$.

$$\mathbf{E}\cdot d\mathbf{l} = 2kyz\,dz = 2ky_0z\,dz.$$

$$\int_{III}\mathbf{E}\cdot d\mathbf{l} = 2y_0k\int_0^{z_0} z\,dz = ky_0z_0^2.$$

$$V(x_0,y_0,z_0) = -\int_0^{(x_0,y_0,z_0)}\mathbf{E}\cdot d\mathbf{l} = -k(x_0y_0^2 + y_0z_0^2),\text{ or } \boxed{V(x,y,z) = -k(xy^2+yz^2).}$$

Check: $-\nabla V = k\left[\frac{\partial}{\partial x}(xy^2+yz^2)\,\hat{\mathbf{x}} + \frac{\partial}{\partial y}(xy^2+yz^2)\,\hat{\mathbf{y}} + \frac{\partial}{\partial z}(xy^2+yz^2)\,\hat{\mathbf{z}}\right] = k[y^2\,\hat{\mathbf{x}} + (2xy+z^2)\,\hat{\mathbf{y}} + 2yz\,\hat{\mathbf{z}}] = \mathbf{E}.$ ✓