Chapter 1, Problem 1.

Given the vectors $\mathbf{M} = -10\mathbf{a}_x + 4\mathbf{a}_y - 8\mathbf{a}_z$ and $\mathbf{N} = 8\mathbf{a}_x + 7\mathbf{a}_y - 2\mathbf{a}_z$, find: (a) a unit vector in the direction of $-\mathbf{M} + 2\mathbf{N}; (b)$ the magnitude of $5\mathbf{a}_x + \mathbf{N} - 3\mathbf{M}$; (c) $|\mathbf{M}||2\mathbf{N}|(\mathbf{M} + \mathbf{N})$.

Chapter 1, Problem 5.

A vector field is specified as $\mathbf{G} = 24xy\mathbf{a}_x + 12(x^2 + 2)\mathbf{a}_y + 18z^2\mathbf{a}_z$. Given two points, $P(1,2,-1)$ and $Q(-2,1,3)$, find: (a) $\mathbf{G}$ at P; (b) a unit vector in the direction of $\mathbf{G}$ at Q; (c) a unit vector directed from Q toward P; (d) the equation of the surface on which $|\mathbf{G}| = 60$.

Chapter 1, Problem 7.

Given the vector field $\mathbf{E} = 4zy^2 \cos 2x\mathbf{a}_x + 2zy \sin 2x\mathbf{a}_y + y^2 \sin 2x\mathbf{a}_z$ for the region $|x|$, $|y|$, and $|z|$ less than 2, find: (a) the surfaces on which $E_y = 0; (b)$ the region in which $E_y = E_z; (c)$ the region in which $\mathbf{E} = 0$.

Chapter 1, Problem 9.

A field is given as $\mathbf{G} = [25/(x^2 + y^2)](x\mathbf{a}_x + y\mathbf{a}_y)$. Find: ($a$) a unit vector in the direction of $\mathbf{G}$ at $P(3,4,-2)$; (b) the angle between $\mathbf{G}$ and $\mathbf{a}_x$ at P; (c) the value of the double integral on the plane $y = 7$.

Chapter 1, Problem 13.

(*a*) Find the vector component of $\mathbf{F} = 10\mathbf{a}_x - 6\mathbf{a}_y + 5\mathbf{a}_z$ that is parallel to $\mathbf{G} = 0.1\mathbf{a}_x + 0.2\mathbf{a}_y + 0.3\mathbf{a}_z$. (*b*) Find the vector component of $\mathbf{F}$ that is perpendicular to $\mathbf{G}$. (*c*) Find the vector component of $\mathbf{G}$ that is perpendicular to $\mathbf{F}$.

Chapter 1, Problem 19.

(*a*) Express the field $\mathbf{D} = (x^2 + y^2)^{-1}(x\mathbf{a}_x + y\mathbf{a}_y)$ in cylindrical components and cylindrical variables; (*b*) Evaluate $\mathbf{D}$ at the point where $\rho = 2$, $\phi = 0.2\pi$, and $z = 5$, expressing the result in cylindrical and rectangular components.

Chapter 1, Problem 25.

Given point $P(r = 0.8, \theta = 30^\circ, \phi = 45^\circ)$, and $\mathbf{E} = 1/r^2(\cos\phi\mathbf{a}_r + \sin\phi/\sin\theta\mathbf{a}_\phi)$; ($a$) Find $\mathbf{E}$ at P; (b) Find $|\mathbf{E}|$ at P; (c) Find a unit vector in the direction of $\mathbf{E}$ at P.