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 \( \mathbf{E} = 4yz^2 \cos2x \mathbf{a}_x + 2zy \sin2x \mathbf{a}_y + y^2 \sin2x \mathbf{a}_z \) 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 \( \mathbf{G} = \frac{25}{(x^2 + y^2)}(x \mathbf{a}_x + y \mathbf{a}_y) \). 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 \( \mathbf{D} = (x^2 + y^2)^{-1}(xa_x + ya_y) \) 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 $P$. 