EE 381 Electric & Magnetic Fields Examination #1
(Fall 2xxx)

Name __Example_______

Instructions: Place answers in indicated spaces, use notation as given in class for coordinates & vectors, and show all work for credit. Attach equation sheet and hand-in with exam.

1) Given points A(4,-2,3), B(-2,8,-5), C(9,2,7), and D(4,6,-1) and vectors $\bar{L} = -6\hat{a}_x + 3\hat{a}_y - 7\hat{a}_z$, $\bar{M} = 2\hat{a}_x - 2\hat{a}_y + 4\hat{a}_z$, and $\bar{N} = 9\hat{a}_x - 2\hat{a}_y + 7\hat{a}_z$ find:

a) the distance vector pointing from point A to C,

$5\hat{a}_x + 4\hat{a}_y + 4\hat{a}_z$

b) the angle (in degrees) that vector $\bar{L}$ makes with the positive z-axis,

$\theta_{LZ} = 136.22°$

c) the unit vector in the direction of $\bar{M} - 3\bar{N}$, and

$-0.82\hat{a}_x + 0.131\hat{a}_y - 0.557\hat{a}_z$

d) the vector product of $\bar{M}$ with $\bar{N}$.

$-6\hat{a}_x + 22\hat{a}_y + 14\hat{a}_z$

2) Given points $A_{cart}(4, -2, 3)$, $B_{cyl}(2, 130°, -8)$, & $C_{sph}(9, 130°, 50°)$, and vectors $\bar{L} = 3\hat{a}_y$, $\bar{M} = 2\hat{a}_x$, and $\bar{N} = x\hat{a}_y + 4y^2\,\hat{a}_z$ determine:

a) the location of point B in Cartesian coordinates

B_{cart} (-1.2856, 1.5321, -8)

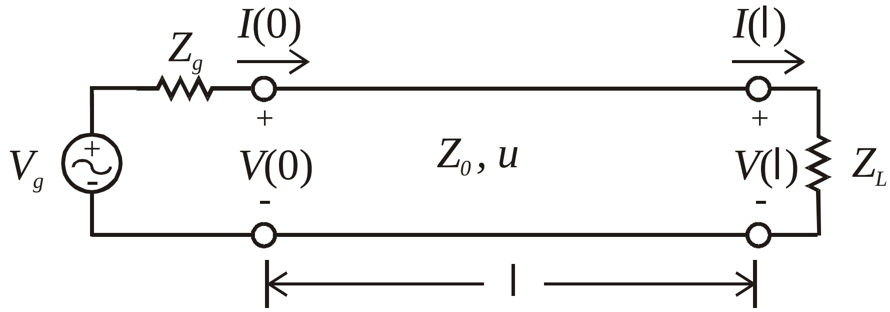
b) the vector $\bar{N}$ in cylindrical coordinates, and

$\rho\cos\phi\sin\phi\,\hat{a}_\rho + \rho\cos^2\phi\,\hat{a}_\phi + 4\rho^2\sin^2\phi\,\hat{a}_z$

c) the vector $\bar{M}$ in spherical coordinates evaluated at point C_{sph}.

$0.9848\,\hat{a}_r - 0.82635\,\hat{a}_\theta - 1.532\,\hat{a}_\phi$

3) For the lossless transmission circuit shown, Z_0 = 160 Ω, $u = 1.7 \times 10^8$ m/s, ℓ = 8 cm, f = 1830 MHz, $Z_{in}(0)$ = (110 + j 20) Ω, Z_g = 100 Ω, and $V_g = 12\ \underline{/0^\circ}$ (V). Calculate the electrical length of the transmission line $\beta\ell$ in radians, input and load reflection coefficients, input power, standing wave ratio, and load impedance. **<u>Express complex answers in A∠θ form with angle in degrees</u>**.



$\beta\ell$ = __**5.411 rad**____ input power = __**0.178 W**____

load refl. coeff. = __**0.1989∠54.01°**___ input refl. coeff. = __**0.1989∠153.96°**__

standing wave ratio = _**1.497**____ load impedance = _**201.13∠18.527° Ω**__