Fields and Waves
Tutorial-03 (February 2, 2016)

1. A 6-m section of 150-Ω lossless line is driven by a source with
   $$v_s(t) = 5\cos(8\pi \times 10^7\, t - 30^\circ)\ (V)$$
   and $Z_s = 150\ \Omega$. If the line, which has a relative permittivity $\varepsilon r = 2.25$, is terminated in a load $Z_L = (150 - j50)\ \Omega$, determine:
   (a) Electrical length of the line.
   (b) The reflection coefficient at the load.
   (c) The input impedance.
   (d) The input voltage $\tilde{V}_i$.
   (e) The time-domain input voltage $v_i(t)$.

2. A lossless transmission line of electrical length $l = 0.35\lambda$ and characteristic impedance of 100 Ω is terminated in a load impedance of (60+ j30) Ω. Find Γ, S, and Z_{in}.
3. A 50-Ω lossless line terminated in a purely resistive load has a voltage standing-wave ratio of 3. Find all possible values of Z_L.
4. Convert:
   a) (-1, 1, √2) from Cartesian to spherical.
   b) (1/2, (√3)/2, 5) from Cartesian to cylindrical
   c) (√6, π/4, √2) from cylindrical to spherical.

Home Assignment Questions:
(To be submitted at the start of the tutorial and be subsequently discussed)

1. A 50-Ω lossless transmission line is terminated in a load with impedance ZL = (30– j50) Ω. The wavelength is 8 cm. Find:
   a) The reflection coefficient at the load
   b) The standing-wave ratio on the line
   c) The position of the voltage maximum nearest the load
   d) The position of the current maximum nearest the load.
2. Express in the Cartesian coordinate system and mention what geometric shape/surface they signify (eg: if in Cartesian: $z^2/a+y^2/b=0$- an ellipse with semi major/minor axis = a/b at a height of x=c):
   a) r=3
   b) ρ=5; z=10