**Plotting antenna radiation patterns:**

**polar.m from MATLAB:**

```matlab
gt; help polar

POLAR Polar coordinate plot.
    POLAR(THETA, RHO) makes a plot using polar coordinates of
    the angle THETA, in radians, versus the radius RHO.
    POLAR(THETA,RHO,S) uses the linestyle specified in string S.
    See PLOT for a description of legal linestyles.
    See also PLOT, LOGLOG, SEMILOGX, SEMILOGY.

Example: (From MATLAB Command Window)
```nn>> ang1 = 0:1:359; % angles in degrees
>> rho1 = cos(ang1*pi/180).*cos(ang1*pi/180); % radial values
>> polar(ang1*pi/180,rho1,'r-') % plot (converted angles to radians)

![Antenna Radiation Pattern](image)

**Notes:** These plots are strictly linear and radial values must be positive.
function radpat(ang1,R1,st1,ang2,R2,st2,ang3,R3,st3,ang4,R4,st4)
%RADPAT  Polar coordinate plot used for antenna radiation patterns.
%   RADPAT(ANG1,R1,ST1,ANG2,R2,ST2,ANG3,R3,ST3,ANG4,R4,ST4)
%         plots up to four curves in dB format.
%
%      ANGi are angles in degrees,
%      Ri are radiation pattern values (radii for plot traces), &
%      STi are the linestyles.
%      See PLOT for a description of legal linestyles.
%      Ri can be in dB or not in dB (resulting plot is in dB).
%      Axis labels can be placed on horizontal or vertical axis.
%      Choice of normalized or unnormalized (show gains) patterns.
%      Minimum dB level at plot center can be specified.
%      Max dB level at outermost plot circle can be specified for unnormalized patterns.
%      Line width of radiation patterns can be specified.
%      Legend can be placed. To move the legend, press left mouse button on the legend
%      and drag to the desired location.
%      Grid linetype can be specified.
%      Default values are inside [], press Enter to chose default.
%      0 degrees can be at North/Top or East/Right side of plot.
%      Example:  radpat(a1,r1,'r-',a2,r2,'y--')
%
%      Based on polarpat.m by D. Liu, 9/13/1996.
%      T.J. Watson Research center, IBM
%      P.O.Box 218
%      Yorktown Heights, NY 10598
%      Email: dliu@watson.ibm.com
%
%      Updated by Thomas P. Montoya, SDSM&T, 1/23/2006
%      * allow up to four traces
%      * added degree symbols to plot spoke labels
%      * for plots vs. theta keep spoke labels in 0 to +180 deg range and
%      indicate that negative theta angles are for phi+180 deg and
%      * orient plot so that 0 degrees at the top (North)

Note:   The resulting radiation pattern plot is in dB regardless of whether the input
variable(s) (e.g., rho1) is originally in dB or not.
Example: (From MATLAB Command Window)

```matlab
>> ang = 0:1:359; % Define angles in degrees
>> rho1 = cos(ang*pi/180).*cos(ang*pi/180); % Define radiation patterns
>> rho2 = 0.5*rho1;
>> rho3 = 0.5*rho2;
>> rho4 = 0.5*rho3;
>> radpat(ang, rho1, 'r-', ang, rho2, 'b-', ang, rho3, 'y-.', ang, rho4, 'k--')
```

Are input values in dB (Y/N)? n
Normalize to the Maximum Gain Value (Y/N)? y
Minimum dB value at plot center [-40]? -20
Are the angles theta values? (Y/N)? y
Labels on Vertical or Horizontal axis (V/H)? v
Pattern line width [1.25]:
Legend for traces on graph (Y/N)? y
Enter label for trace 1: trace 1
Enter label for trace 2: trace 2
Enter label for trace 3: trace 3
Enter label for trace 4: trace 4
Put a box around the legend (Y/N)?
Line type of grid(-, --, -., :)?

Notes: You may need to move labels around on the MATLAB figure window using the mouse (click arrow icon, then left click and drag with mouse).
polarpat.m found on internet & course webpage:

function polarpat(ang1,rho1,st1,ang2,rho2,st2,ang3,rho3,st3)
% POLARPAT  Polar coordinate plot used for antenna radiation patterns.
% POLARPAT(ANG1,RHO1,ST1,ANG2,RHO2,ST2,ANG3,RHO3,ST3) plots up to
% three curves. ANGi is angles in degress, RHOi is radius, and
% STi is linestyle.
% RHOi can be in dB or not in dB.
% Axis labels can be placed horizontally or vertically.
% Choice of normalized or unnormalized (showing gains) patterns.
% Minimum level at the polar center can be specified.
% Maximum level at the polar outmost circle can be specified for
% unnormalized patterns.
% Line width of radiation patterns can be specified.
% Legend can be placed. To move the legend, press the left mouse
% button on the legend and drag to the desired location.
% Grid linetypes can be specified.
% Default value is inside [], press Enter to chose default.
% See PLOT for a description of legal linestyles.
% 0 degree can be in the East or North direction.
% Example:  polarpat(a1,r1,'r-',a2,r2,'y--')
% Written by Duixian Liu, on September 13, 1996.
% T.J. Watson Research center
% IBM
% P.O.Box 218
% Yorktown Heights, NY 10598
% Email: dliu@watson.ibm.com

Note: The resulting radiation pattern plot is in dB regardless of whether the input variable(s) (e.g., rho1) is originally in dB or not.
**Example:** (From MATLAB Command Window)

```matlab
>> ang1 = 0:1:359;        % define angles in degrees
>> rho1 = cos(ang1*pi/180).*cos(ang1*pi/180);
>> polarpat(ang1,rho1,'r-')
```

Are input values in dB (Y/N)? [Y] N

Normalize to the Maximum Gain Value (Y/N)? [Y] Y

The minimum dB value at polar center [-50]? -30

Put axis label Vertically or Horizontally (V/H)? [H]

Pattern line width [1.0]: 1

Is 0 degree in the North or East (N/E)? [E] N

Line type of grid(-, --, -., :)? [-]

>>

![Graph](image-url)

**Notes:** You may need to move labels around on the MatLab figure window using the mouse (click arrow icon, then left click and drag with mouse).