```
% ### LadderOPT.m ###   5.21.09

% simple code to numerically verify solution to Neuhaser's ladder
% optimization problem

clear
% ----------
d= 20;  % length of space between fence and house
h= 13;  % height of fence
% ---------

theta= linspace(0,pi/2,1000);       % create range of possible angles

% length of ladder as a function of theta (this is the function to
minimize)
L= d./cos(theta) + h./sin(theta);
Lprime= d*(sin(theta))./(cos(theta).^2) - h*(cos(theta))./
(sin(theta).^2); % derivative of above function

% analytically derived solution for optimal angle; should match where
F = 0 (which it does)
thetaOPT= atan( (h/d)^(1/3) );
Lopt = h/sin(thetaOPT) + d/cos(thetaOPT);   % corresponding minimum
ladder length

% ====
figure(1); clf;
h1= plot(theta,L); grid on; hold on;
h2= plot(theta,Lprime,'r-');
axis([-0.1 pi/2+0.1 -5 100]);
ylabel('Length or deriv. [arb]'); xlabel('angle re fence [deg]');
title('Numerical check re ladder optimization problem');
%h3= plot(thetaOPT,Lopt,'kx','MarkerSize',8,'LineWidth',2);
h3= stem(thetaOPT,Lopt,'k--');
legend([h1 h2 h3],'ladder length','deriv. of length','shortest
length','Location','SouthWest')
```