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%% MAE 208 Project Launcher
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%% Equations
% solve for the distance d required to pull the double spring so that we
% reach a specified range, "x1"

x1 = 12;  % desired range variable
k =  1.54;  % input given k value
m = 2.717e-3; % average mass of raquetball

% solve for the desired stretch of both springs to reach a
% certain range
d =(sqrt((16.1*x1^2)/(1.5*sqrt(2) + tan(60)*x1))/(-cos(60)))/sqrt((24*k)/m);
%d is currently in ft and will need to be converted to inches once on the
%calibration sheet
d_in = d*12;  % distance in inches

% Initial velocity at launch
v_i = d*sqrt((2*k)/m);

fprintf('\nTrial: k = %.4f\n',k)
fprintf('The spring must stretch %.3f inches\n', d_in)
fprintf('The initial velocity is %.3f ft/s\n',v_i);

%% Launch Path approach
% plot trajectory of the racquetball

% Givens passed from previous section
    % d, m, k

% Desired Format of PMeq
%ax^2 + bx + c

%Coefficients
a = -16.1/((24*k*d^2*cos(60)^2)/m);
b = tan(60);
c = 1.5*sqrt(2);

% Projectile Motion Equation "PMeq"
    % t = x/(v_0 * cos(60))
    % v_0 = sqrt((2kd^2cos(60)^2)/m) - conservation of energy

% x range
x = 0:0.1:20;
% preallocated vector of PMeq
PMeq = zeros(1,201);


for i = 1:201
    PMeq(i) = a*x(i)^2 + b*x(i) + c;
end
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% Plot of projectile
figure(1)
plot(x, PMeq)
% Formatting
    ylim([0,10])
    xlim([0,20])
    xticks(1:20)
    xlabel('Range (ft)')
    ylabel('Height (ft)')
    title('Projectile Motion of Raquetball')
```