[1]. A ball of mass $m_1$ and velocity $v$ moves in the direction of $+x$ and makes a central elastic collision with another ball, which is initially at rest and has mass $m_2$, as shown in Figure. Write MATLAB GUI, to perform a simulation and animation of the system for the given $m_1$, $m_2$, and $v$.

[2]. Write a program to fit the function $y = ax^2 + bx + c$ to following data.
   (a) by using cftool
   (b) by using fminsearch() function
   (c) by using Monte Carlo method

Your program must plot both the data and fitting functions on the same axis.

[3]. Write to perform the following task:
- read a single variable function from keyboard (in MATLAB format)
- read the range of the function
- plot both function and its first derivative on the same canvas.

[4]. Figure shows a prism with apex angle $A$ and refractive index $n$. A light ray falls on the prism from left with angle beta as shown. Outgoing ray leaves the prism from right and makes an angle $D$ with respect to original direction of the incident ray.

(a) Assume that $A = 45^\circ$ and $n = 1.48$. Using MATLAB fminsearch function, write a program to find optimum value of beta that minimizes the value of $D$ (called minimum deviation angle, $D_{\text{min}}$).

(b) Write another program to plot $D_{\text{min}}$ vs apex angle $A = 0:120$ in degrees. ($n = 1.48$).

[5]. A flat piece of glass can be used to displace a light ray laterally without changing its direction. The displacement varies with the angle of incidence. Assume that $h = 10.0$ mm and $d = 2.4$ mm. (Do not use small angle approximation).

(a) Write a program to find the angle of incidence ($\theta$) for $n_1 = 1$ and $n_2 = 1.52$.

(b) Now, assume that, the incidence angle is $\theta = 45^\circ$. Write another program to draw $n_2/n_1 = 1:0.1:2$ vs beam displacement $d$ plot.