Problem 4

In an alternate cranberry sorter machine, cranberries are launched at a horizontal metal plate with an initial velocity of 2 m/s downwards at a 30-degree angle as shown below. The cranberries then bounce off the plate into one of two baskets, a closer one for bad cranberries and a farther one for good cranberries. If the cranberries are supposed to have a coefficient of restitution of 0.8 or greater, how far away should the edge of the good cranberry bucket be?

Before impact

\[ V_{ti} = 2 \cos(30) = 1.73 \text{ m/s} \]

\[ V_{Ni} = -2 \sin(30) = -1 \text{ m/s} \]

Impact

\[ V_{tf} = V_{ti} = 1.73 \text{ m/s} \]

\[ e = 0.8 = -\frac{V_{nf}}{V_{Ni}} \quad \Rightarrow \quad V_{nf} = 0.8 \text{ m/s} \]
Projectile motion

\[ \vec{V_i} \]

1.75 m/s

\[ 0.8 \text{ m/s} \]

\[ \ddot{x}(t) = 0 \]
\[ \dot{x}(t) = 1.73 \]
\[ x(t) = 1.73 t \]

\[ \ddot{y}(t) = -9.81 \]
\[ \dot{y}(t) = -9.81 t + .8 \]
\[ y(t) = -\frac{9.81}{2} t^2 + .8 t \]

\[ y(t) = 0 = -\frac{9.81}{2} t^2 + .8 t \Rightarrow t > 0, \ t = .163 \]

\[ x(t) = 1.73(t) = .282 \text{ m} \]

\[ d = 28.2 \text{ cm} \]