```mathematica
In[15]:= Clear["Global`*"]

(* Initial Conditions *)
x̄ₒ = 0;           (*Initial x-position*)
ẋₒ = 6;           (*Initial x-velocity*)
ȳₒ = 18;          (*Initial y-position*)
ẏₒ = 20;          (*Initial y-velocity*)
g = 9.81;         (*Acceleration due to gravity*)
Θₒ = Pi / 2;      (*Initial angle*)
Θ̇ₒ = .9 * Pi;    (*Initial angular velocity,e.g.,rad/s*)
L = 20;


(*COM Position Equations*)
xposition[t_] := ẋₒ t + x̄ₒ
yposition[t_] := - (1 / 2) g * t² + ẏₒ t + ȳₒ
Θposition[t_] := Θ̇ₒ t + Θₒ
(*COM Velocity Equations*)
xvelocity[t_] := xposition'[t]
yvelocity[t_] := yposition'[t]
Θvelocity[t_] := Θposition'[t]
(*COM Position Equations*)
xaccel[t_] := xposition''[t]
yaccel[t_] := yposition''[t]
Θaccel[t_] := Θposition''[t]


(* Link Tip Coordinates*)
yatip[t_] := yposition[t] + (L / 2) * Sin[Θposition[t]]
ybtip[t_] := yposition[t] - (L / 2) * Sin[Θposition[t]]
xatip[t_] := xposition[t] + (L / 2) * Cos[Θposition[t]]
xbtip[t_] := xposition[t] - (L / 2) * Cos[Θposition[t]]

In[37]:= (*---Find the Time of A Tip Impact---*)
impactSolutionA = FindRoot[yatip[t] == 0, {t, 4}];
impactTimeA = t /. impactSolutionA;
impactPointA = {xatip[impactTimeA], 0};

(*---Find the Time of B Tip Impact---*)
impactSolutionB = FindRoot[ybtip[t] == 0, {t, 4}];
impactTimeB = t /. impactSolutionB;
impactPointB = {xbtip[impactTimeB], 0};


(*------What Tip Hit First------*)
If[impactTimeB > impactTimeA,
   {impactTimeFirst = impactTimeA, impactPointFirst = impactPointA, firstTip = "A"},
```

```mathematica
      {impactTimeFirst = impactTimeB, impactPointFirst = impactPointB, firstTip = "B"}
 ];

Print["Tip ", firstTip, " hits the ground first at t = ", impactTimeB, " seconds."];
Print["Impact location: ", impactPointFirst];
Print["Center of Mass Parameters: "];
Print["COM Coordines: ", impactPointFirst];
Print["Impact angle: ", θposition[impactTimeFirst]];
Print["Impact Velocities: x-velocity: ", xvelocity[impactTimeFirst], " y-velocity: ",
  yvelocity[impactTimeFirst], " θ-velocity: ", θvelocity[impactTimeFirst]];

(*------Animation------*)
Manipulate[
 Graphics[
  {(*Objects to Draw*)

    (*1. The Trajectory of the Center of Mass*)
    {Dashed, Black,
     ParametricPlot[{xposition[tau], yposition[tau]}, {tau, 0, t}, PlotStyle → Yellow]〚1〛},

    (*2. The Link Itself*)
    {White, Thickness[0.012],
     Line[{{xₐₜᵢₚ[t], yₐₜᵢₚ[t]}, {xᵦₜᵢₚ[t], yᵦₜᵢₚ[t]}}]},

    (*3. The Tips and COM points*)
    {PointSize[0.020],
     Green, Point[{xₐₜᵢₚ[t], yₐₜᵢₚ[t]}], Red, Point[{xᵦₜᵢₚ[t], yᵦₜᵢₚ[t]}],
     Black, Point[{xposition[t], yposition[t]}]},

    (*4. The Impact Markers (appears only after impact)*)
    If[t ≥ impactTimeFirst,
     If[firstTip == "A",
       {PointSize[0.015], Green, Point[impactPointFirst]}, (*Use Green for Tip A*)
       {PointSize[0.015], Red, Point[impactPointFirst]}    (*Use Red for Tip B*)
      ]
     ]
   },

   (*Graphics Options*)
   PlotRange → {{0, 65}, {-20, 75}},
   Axes → True, AxesLabel → {"x (m)", "y (m)"},
   GridLines → Automatic, ImageSize → Medium, AspectRatio → Automatic
  ],

  (*Animation Controls*)
  {{t, 0, "Time (s)"}, 0, 5.5, 0.01, Animator}
 ]
```

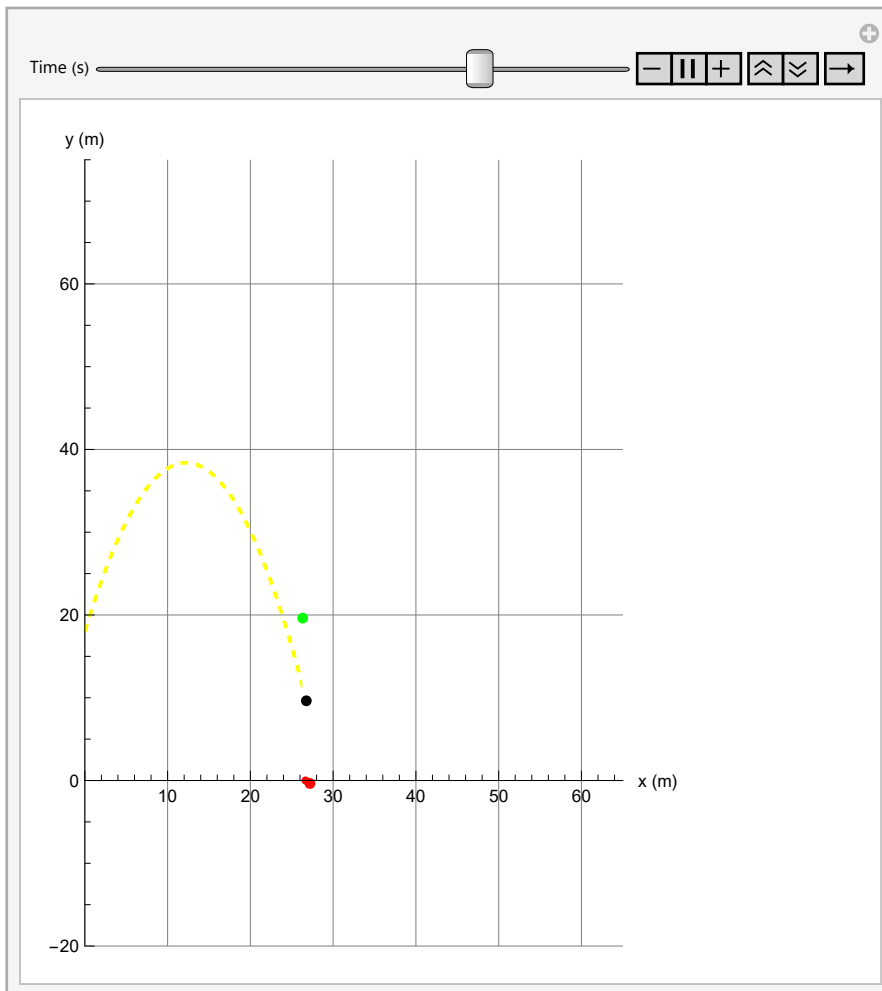Tip B hits the ground first at t = 4.44444 seconds.

Impact location: {26.6667, 0}

Center of Mass Parameters:

COM Coordines: {26.6667, 0}

Impact angle: 14.1372

Impact Velocities: x-velocity: 6 y-velocity: -23.6 Θ-velocity: 2.82743

Out[50]=

In[51]:=