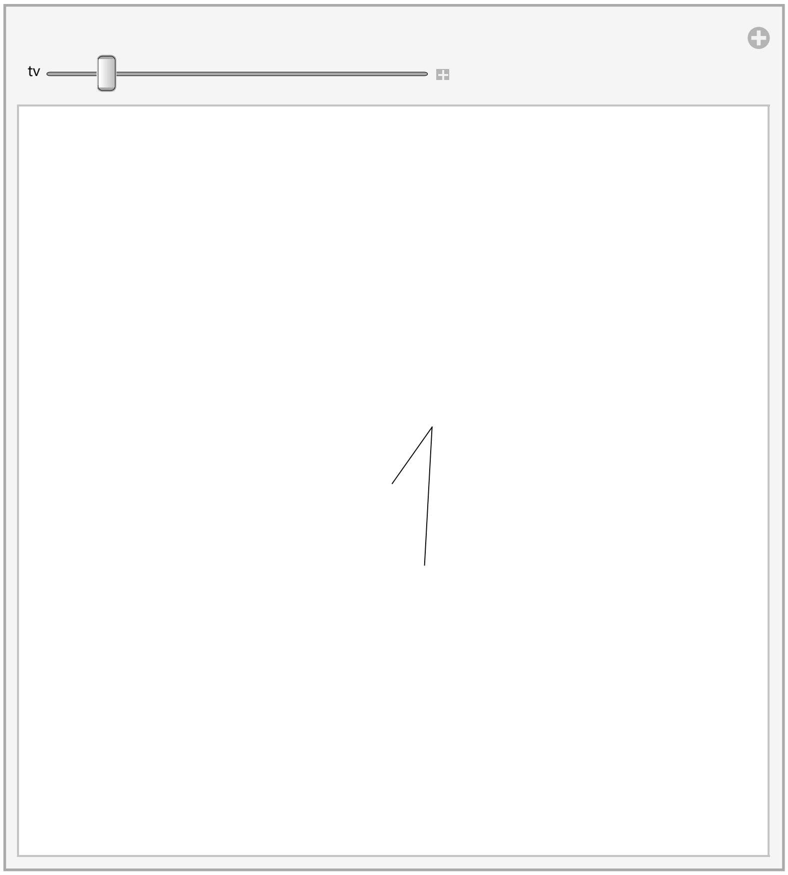
```
In[39]:= (* System of Double Pendulums. L1, L2 are the length of each pendulum,
         which l1 is attached at one end to a mass m1,
         the other to a fixed point. l2 is attached on one end to m1, the other m2. *)

In[40]:= g = -9.8;
         l1 = 1;
         l2 = 2;
         m1 = 3;
         m2 = 4;

         (* Lagrange Equations for th1 and th2. th1,
         2 are the angle of the pendulum from its initial position *)
         eq1 = (m1 + m2) * l1 * th1''[t] + m2 * l2 * th2''[t] Cos[th2[t] - th1[t]] ==
            m2 * l2 * ((th2'[t])^2) * Sin[th2[t] - th1[t]] - (m1 - m2) * g * Sin[th1[t]];
         eq2 = l2 * th2''[t] + l1 * th1''[t] * Cos[th2[t] - th1[t]] ==
            l1 * ((th1'[t])^2) * Sin[th2[t] - th1[t]] - g * Sin[th2[t]];

In[47]:= (* The Numerical Solution to the system of Lagrange Equations. From this we
          construct parametric equations to model x and y positions of each pendulum *)
         dpend1 = NDSolve[{eq1, eq2, th1[0] == Pi / 2, th1'[0] == 0, th2[0] == (Pi), th2'[0] == 0},
           {th1[t], th2[t]}, {t, 0, 50}]

Out[47]= {{th1[t] → InterpolatingFunction[ Domain: {{0., 50.}} Output: scalar ][t],
           th2[t] → InterpolatingFunction[ Domain: {{0., 50.}} Output: scalar ][t]}}

In[48]:= pos1x[t_] := l1 * Sin[th1[t]] /. dpend1[[1]];
         pos1y[t_] := l1 * Cos[th1[t]] /. dpend1[[1]];
         pos2x[t_] := pos1x[t] + l2 * Sin[th2[t]] /. dpend1[[1]];
         pos2y[t_] := pos1y[t] + l2 * Cos[th2[t]] /. dpend1[[1]];
```

In[52]:=
```
Manipulate[Graphics[{Line[{{pos1x[t] /. t → tv, pos1y[t] /. t → tv}, {0, 0}}], Line[
    {{pos2x[t] /. t → tv, pos2y[t] /. t → tv}, {pos1x[t] /. t → tv, pos1y[t] /. t → tv}}]},
  PlotRange → {{-5, 5}, {-5, 5}}], {tv, 0, 10}]
```

Out[52]=



In[53]:=

In[54]:=