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Advanced Mechanics Computational Project I  
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# Sensitive dependence to initial conditions

```
SetDirectory[NotebookDirectory[]]  
/Users/danielmartinez/Documents
```

Pendulum Lengths

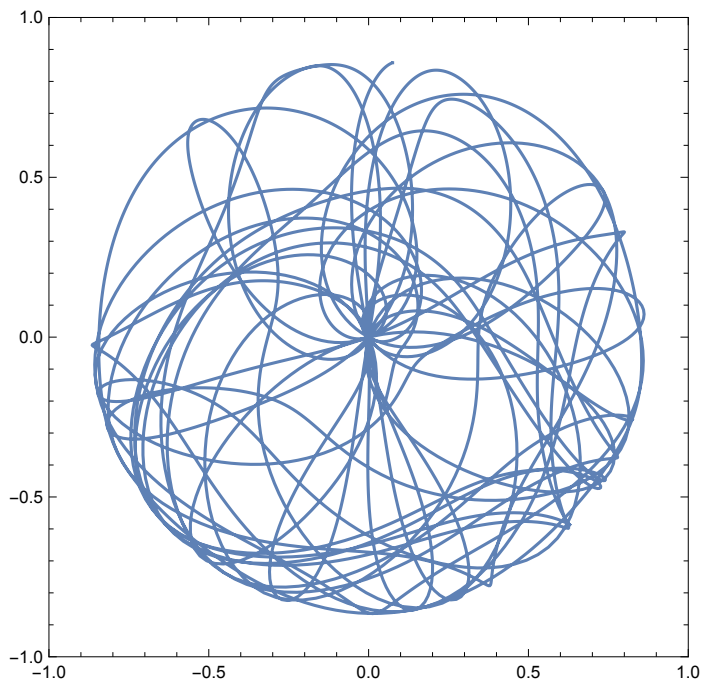
```
L1 = 0.4325;  
L2 = 0.4325;
```

Trajectory of the free end of the second pendulum with the following initial conditions:

```
q1 = 17*pi/18  
q2 = pi  
q1dot = 0  
q2dot = 0
```

```
dat = Transpose[ Import["output.dat", "table", FieldSeparators -> ","]];  
Do[dat[[i]] = Delete[dat[[i]], 1], {i, 5}]
```

```
axisOfSecondPend = ListLinePlot[Table[{L1 * Sin[dat[[2, k]]] + L2 * Sin[dat[[3, k]]],
  -L1 * Cos[dat[[2, k]]] - L2 * Cos[dat[[3, k]]]}, {k, 1, Length[dat[[1]]], 1}],
  PlotRange → {{-1, 1}, {-1, 1}}, Frame → True, Axes → False, AspectRatio → 1]
```



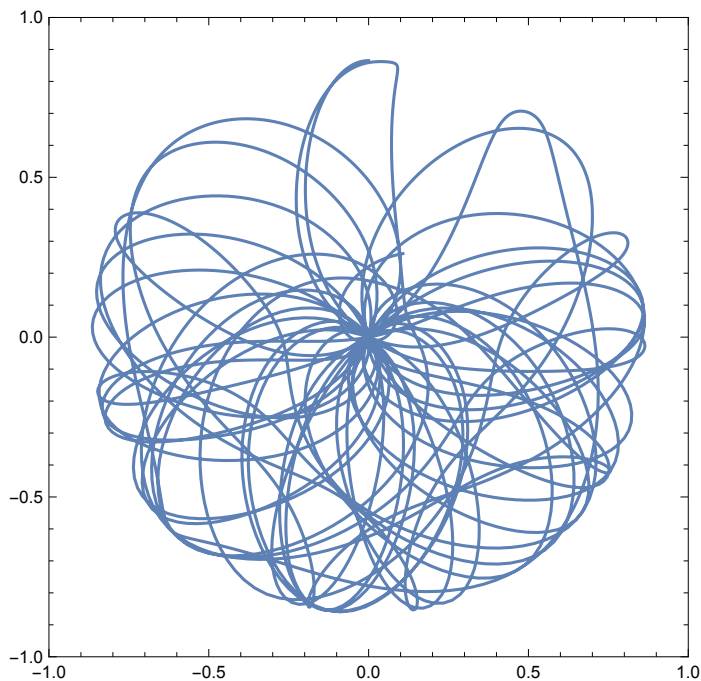
Trajectory of the free end of the second pendulum with the following initial conditions:

```
q1 = pi
q2 = pi
q1dot = 0
q2dot = 0
```

```
dat = Transpose[ Import["output2.dat", "table", FieldSeparators → "," ]];
```

```
Do[dat[[i]] = Delete[dat[[i]], 1], {i, 5}]
```

```
axisOfSecondPend = ListLinePlot[Table[{L1 * Sin[dat[[2, k]]] + L2 * Sin[dat[[3, k]]],
  -L1 * Cos[dat[[2, k]]] - L2 * Cos[dat[[3, k]]]}, {k, 1, Length[dat[[1]]], 1}],
  PlotRange → {{-1, 1}, {-1, 1}}, Frame → True, Axes → False, AspectRatio → 1]
```



After about 4 seconds of staying perfectly still, the pendulum goes crazy. Maybe round-off error is causing this? Theoretically it should stay still forever? Not sure... but the motion is really cool!

Trajectory of the free end of the second pendulum with the following initial conditions:

$q_1 = \pi/2$

$q_2 = \pi/2$

$\dot{q}_1 = 0$

$\dot{q}_2 = 0$

```
dat = Transpose[ Import["output3.dat", "table", FieldSeparators → "," ]];
```

```
Do[dat[[i]] = Delete[dat[[i]], 1], {i, 5}]
```

```
axisOfSecondPend = ListLinePlot[Table[{L1 * Sin[dat[[2, k]]] + L2 * Sin[dat[[3, k]]],  
  -L1 * Cos[dat[[2, k]]] - L2 * Cos[dat[[3, k]]]}, {k, 1, Length[dat[[1]]], 1}],  
  PlotRange → {{-1, 1}, {-1, 1}}, Frame → True, Axes → False, AspectRatio → 1]
```

