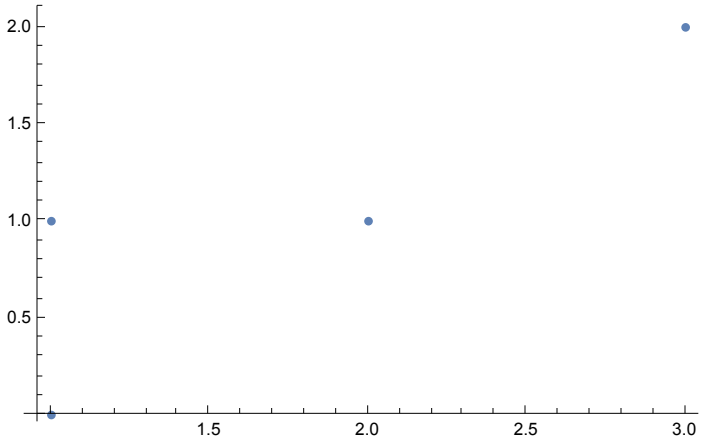
ListPlot examples

To plot a function, you use Plot. To plot a collection of points, you use ListPlot.

In[204]:=
```
list = {{1, 0}, {1, 1}, {2, 1}, {3, 2}};
ListPlot[list]
```

Out[205]=



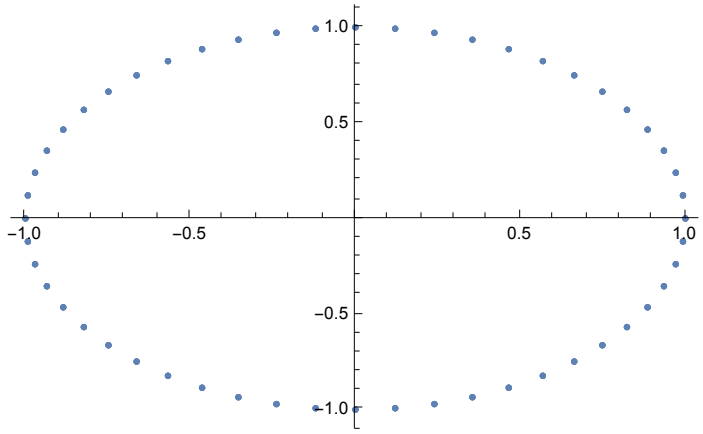
Here are examples of plotting all of the points given by (A^k)X, where A is a 2x2 matrix, and X is an initial point in the xy plane. We will let “mat” be our matrix, and we will obtain a list of points by using the Table command. By plugging this into the ListPlot command, we can get a graph of the points of the form A^k X.

(Note that in order to switch back and forth between row/column matrices, I am using the Transpose command, along with the fact that (AB)^T = B^T A^T.)

In[206]:=
```
mat = N[{{Cos[2 Pi * (1 / 52)], -Sin[2 Pi (1 / 52)]},
         {Sin[2 Pi (1 / 52)],  Cos[2 Pi (1 / 52)]}}];
```

```
ListPlot[Table[ {0, 1}.Transpose[MatrixPower[mat, k]], {k, 0, 200} ]]
```

Out[207]=



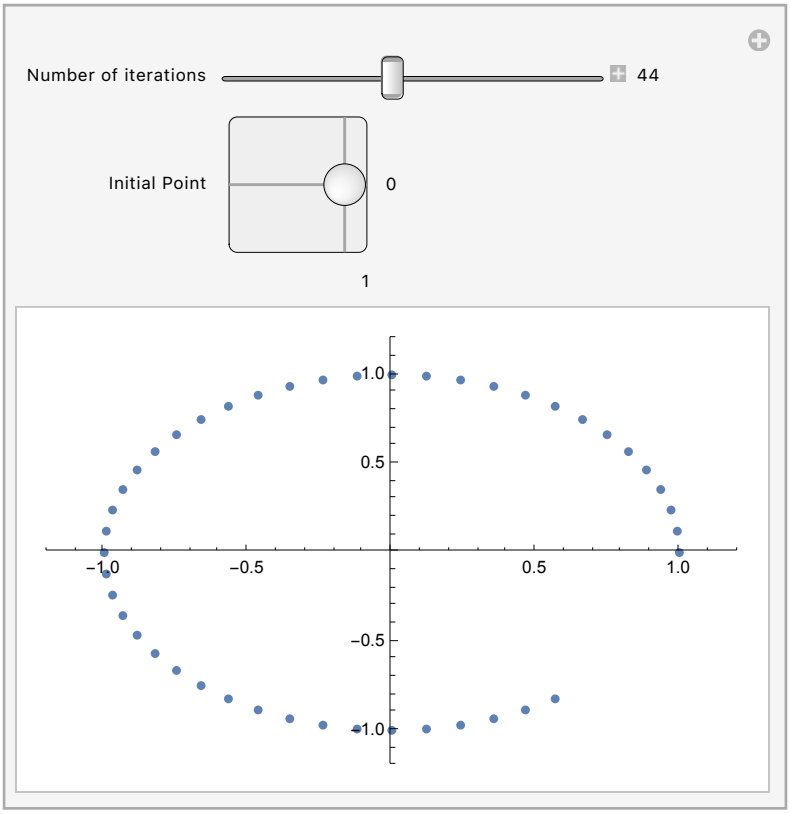
By combining the above with the Manipulate command, we can get a nice picture showing us how a

point evolves along progressive iterations along with how things change as the initial point changes.

In[208]:=
```
mat1 = N[{{Cos[2 Pi * (1 / 52)]  -Sin[2 Pi (1 / 52)]},
          {Sin[2 Pi (1 / 52)]    Cos[2 Pi (1 / 52)]}}];
```

```
Manipulate[
 ListPlot[Table[ x.Transpose[MatrixPower[mat1, k]], {k, 0, n} ],
  PlotRange → {{-1.2, 1.2}, {-1.2, 1.2}}],
 {{n, 0, "Number of iterations"}, 0, 100, 1, Appearance → "Labeled"},
 {{x, {1, 0}, "Initial Point"}, -1, 1,
  ControlType → Slider2D, Appearance → "Labeled"} ]
```

Out[209]=

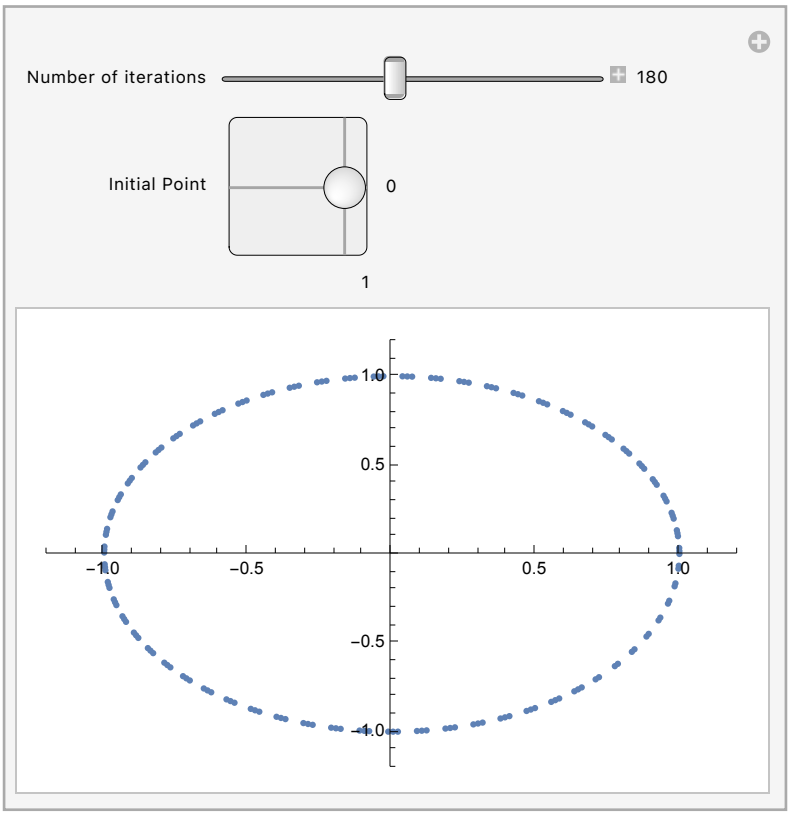


Here’s another example, but the matrix has been changed slightly.

In[210]:=
```
mat2 = N[{{Cos[.1], -Sin[.1]}, {Sin[.1], Cos[.1]}}];

Manipulate[
 ListPlot[Table[ x.Transpose[MatrixPower[mat2, k]], {k, 0, n} ],
  PlotRange → {{-1.2, 1.2}, {-1.2, 1.2}}],
 {{n, 0, "Number of iterations"}, 0, 400, 1, Appearance → "Labeled"},
 {{x, {1, 0}, "Initial Point"}, -1, 1,
  ControlType → Slider2D, Appearance → "Labeled"} ]
```

Out[211]=



Here is a visualization of the example we did at the beginning of class, where the linear transformation satisfied

T(2,1) = 2(2,1) and T(0,1) = .5 (0,1).

In[212]:=
```
mat3 = N[{{2, 0}, {3/4, 1/2}}];
```

```
Manipulate[
 ListPlot[Table[ x.Transpose[MatrixPower[mat3, k]], {k, 0, n} ],
  PlotRange → {{-10, 10}, {-5, 5}}],
 {{n, 0, "Number of iterations"}, 0, 20, 1, Appearance → "Labeled"},
 {{x, {0, 1}, "Initial Point"}, -1, 1,
  ControlType → Slider2D, Appearance → "Labeled"} ]
```

Out[213]=