This is called the Barnsley Fern. Barnsley is a pioneer in the use of self-similar computer generated sets. He wrote a book called Fractal measure Theory. This work is often used for computer simulation of natural structures.

We first define 4 affine transforms in 2D.   An affine transform is a linear matrix transform and a translation: A. (x, y) + b

Each transform has a probability associated with it.

In[◦]:=
```
<< "barnsley.wdx";
```

In[◦]:=
```
p1 = 0.01;
t1 = AffineTransform[{{{0, 0}, {0, 0.16}}, {0, 0}}];
p2 = 0.85;
t2 = AffineTransform[{{{0.85, 0.04}, {-0.04, 0.85}}, {0, 1.6}}];
p3 = 0.07;
t3 = AffineTransform[{{{0.2, -0.26}, {0.23, 0.22}}, {0, 1.6}}];
p4 = 0.07;
t4 = AffineTransform[{{{-0.15, 0.28}, {0.26, 0.24}}, {0, 0.44}}];
xlo = -3.0; xhi = 3.0 ; ylo = 0; yhi = 10.;
```

This evaluates the next point given the current point. It first throws a random number and selects on the upper transformations. Each of the transformations is
meant for drawing one of the 4 attributes of the picture. Stem, within the leaflet,
one leaflet to the opposite leaflet, across the main stem.

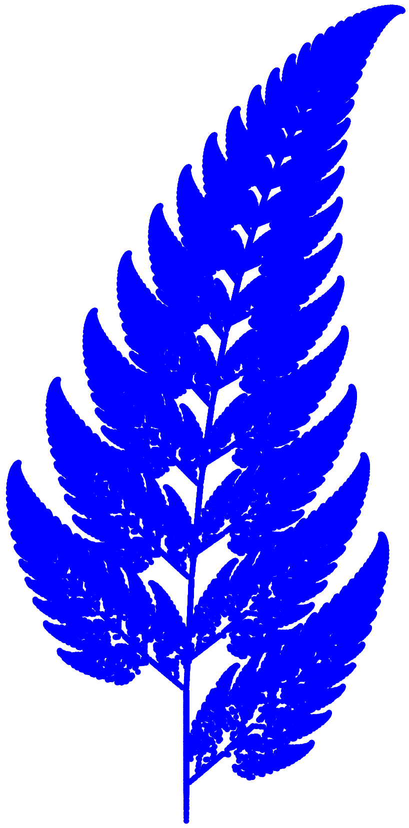
```
In[]:= nextpoint = Compile[{{x, _Real}, {y, _Real}}, Module[{r, xnew, ynew },
         r = Random[] ;  (* make a random number from 0 to 1 *)
         {xnew, ynew} = Which[r < p1, t1[{x, y}], r ≥ p1 && r < (p1 + p2) , t2[{x, y}],
                              r ≥ (p1 + p2) && r < (p1 + p2 + p3), t3[{x, y}],
                              r ≥ (p1 + p2 + p3), t4[{x, y}]] ;
         Return[{xnew, ynew}]] ]

Out[]= CompiledFunction[ [+] WVM  Argument count: 2
                                  Argument types: {_Real, _Real} ]
```

Now we calculate 100000 points starting from {0,0}. Notice that each leaflet and subleaflet has the same structure.

```
In[]:= fernpoints = Module[{i, tmp, plist},
         start = {0., 0.};
         plist = {start};
         For[i = 1, i ≤ 100 000, i++,
          tmp = nextpoint[plist[[i]][[1]], plist[[i]][[2]] ] ;
          plist = Append[plist, tmp]] ;
         plist] ;
```

In[ ]:=
```
Graphics[{Blue, Point[fernpoints] }]
```

Out[ ]=



In[ ]:=
```
Save["barnsley.wdx", "Global`"]
```