In[1]:=
```
(* 1: Adams-Bashforth 2 *)
```

In[2]:=
```
p[r_, z_] := r^2 - (r + 3 z / 2 * r - z / 2);
```

In[3]:=
```
p[r, z]
```

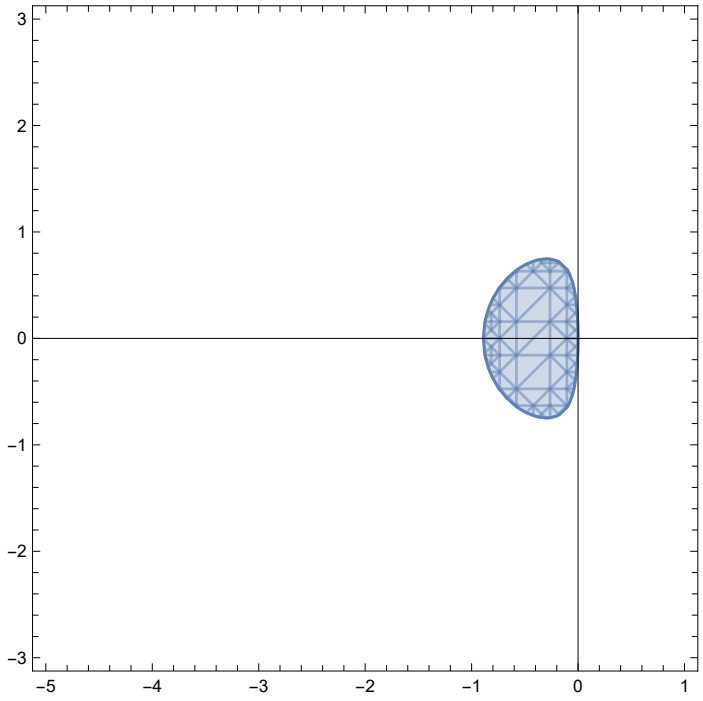
Out[3]=
$$-r + r^2 + \frac{z}{2} - \frac{3\,r\,z}{2}$$

In[4]:=
```
equns = Solve[p[r, z] == 0, r]
```

Out[4]=
$$\left\{\left\{r \to \frac{1}{4}\left(2 + 3\,z - \sqrt{4 + 4\,z + 9\,z^2}\right)\right\}, \left\{r \to \frac{1}{4}\left(2 + 3\,z + \sqrt{4 + 4\,z + 9\,z^2}\right)\right\}\right\}$$

In[5]:=
```
RegionPlot[Norm[Evaluate[r /. equns /. z → x + i y]] < 1, {x, -5, 1}, {y, -3, 3}, Axes → True]
```

Out[5]=



In[6]:=
```
(* 2 Runge Kutta 4 *)
Clear[p, r, z];
k1[z_] := z;
k2[z_] := z (1 + k1[z] / 2);
k3[z_] := z (1 + k2[z] / 2);
k4[z_] := z (1 + k3[z]);
```

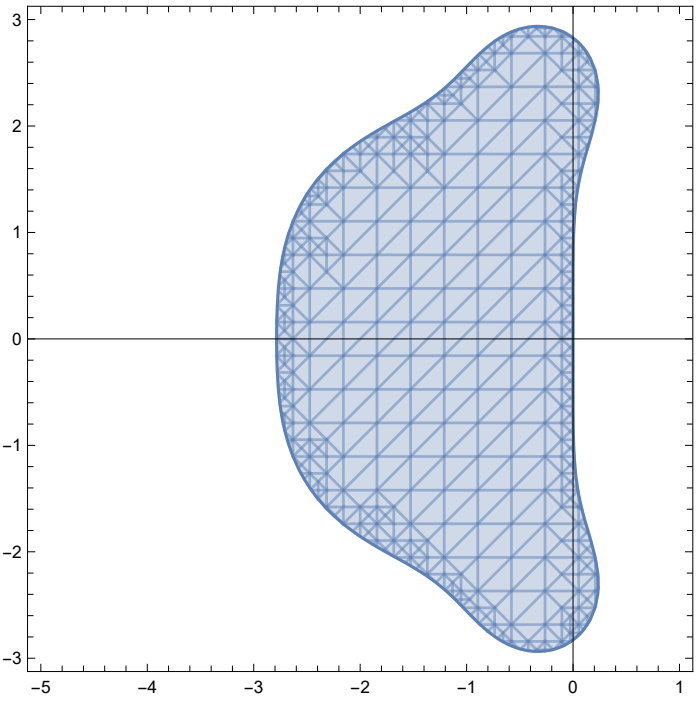
In[11]:=
```
p[r_, z_] := r - (1 + 1 / 6 * (k1[z] + 2 k2[z] + 2 k3[z] + k4[z]))
```

In[12]:=
```
eq = Solve[p[r, z] == 0, r]
```

Out[12]=
$$\left\{\left\{r \to \frac{1}{24}\left(24 + 24\,z + 12\,z^2 + 4\,z^3 + z^4\right)\right\}\right\}$$

In[13]:=
```
RegionPlot[Norm[r /. eq /. z → x + i y] < 1, {x, -5, 1}, {y, -3, 3}, Axes → True]
```

Out[13]=



In[14]:=
```
(* 3 Backwards Euler *)
```

In[15]:=
```
Clear[p, z, r, eq];
```

In[16]:=
```
p[r_, z_] := r^2 - (r + z * r^2)
```

In[17]:=
```
eq = Solve[p[r, z] == 0, r]
```

Out[17]=
$$\left\{\{r \to 0\}, \left\{r \to \frac{1}{1-z}\right\}\right\}$$

In[18]:=
```
RegionPlot[Norm[r /. eq /. z → x + ⅈ y] < 1, {x, -5, 5}, {y, -5, 5}, Axes → True]
```

Out[18]=