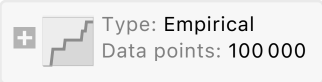
scale free network and power law

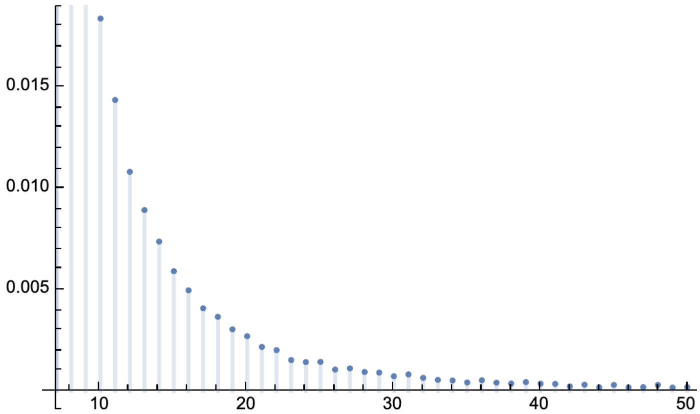
In[1]:=
```
ba3 = RandomGraph[BarabasiAlbertGraphDistribution[10^5, 3]];
```

In[2]:=
```
empddistrBA3 = EmpiricalDistribution[VertexDegree[ba3]]
```

Out[2]= DataDistribution[]

In[4]:=
```
DiscretePlot[PDF[empddistrBA3, k], {k, 7, 50}]
```

Out[4]=



In[5]:=
```
Take[Table[PDF[empddistrBA3, k], {k, 7, 50}], 10]
{4737 / 100 000, 1659 / 50 000, 2419 / 100 000, 1897 / 100 000,
 697 / 50 000, 253 / 25 000, 223 / 25 000, 363 / 50 000, 18 / 3125, 499 / 100 000}
```

Out[5]= $\left\{\frac{37}{800}, \frac{3301}{100\,000}, \frac{19}{800}, \frac{921}{50\,000}, \frac{1439}{100\,000}, \frac{271}{25\,000}, \frac{179}{20\,000}, \frac{739}{100\,000}, \frac{37}{6250}, \frac{249}{50\,000}\right\}$

Out[6]= $\left\{\frac{4737}{100\,000}, \frac{1659}{50\,000}, \frac{2419}{100\,000}, \frac{1897}{100\,000}, \frac{697}{50\,000}, \frac{253}{25\,000}, \frac{223}{25\,000}, \frac{363}{50\,000}, \frac{18}{3125}, \frac{499}{100\,000}\right\}$

In[7]:=
```
loglogba3 = Table[{Log[PDF[empddistrBA3, k]], Log[k]}, {k, 7, 50}];
```

In[12]:=
```
a = Take[loglogba3, 10]
{{-Log[100 000 / 4737], Log[7]}, {-Log[50 000 / 1659], Log[8]},
 {-Log[100 000 / 2419], Log[9]}, {-Log[100 000 / 1897], Log[10]},
 {-Log[50 000 / 697], Log[11]}, {-Log[25 000 / 253], Log[12]},
 {-Log[25 000 / 223], Log[13]}, {-Log[50 000 / 363], Log[14]},
 {-Log[3125 / 18], Log[15]}, {-Log[100 000 / 499], Log[16]}}
```

Out[12]=

$$\left\{\left\{-\text{Log}\left[\frac{800}{37}\right], \text{Log}[7]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{3301}\right], \text{Log}[8]\right\}, \left\{-\text{Log}\left[\frac{800}{19}\right], \text{Log}[9]\right\}, \left\{-\text{Log}\left[\frac{50\,000}{921}\right], \text{Log}[10]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{1439}\right], \text{Log}[11]\right\}, \left\{-\text{Log}\left[\frac{25\,000}{271}\right], \text{Log}[12]\right\}, \left\{-\text{Log}\left[\frac{20\,000}{179}\right], \text{Log}[13]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{739}\right], \text{Log}[14]\right\}, \left\{-\text{Log}\left[\frac{6250}{37}\right], \text{Log}[15]\right\}, \left\{-\text{Log}\left[\frac{50\,000}{249}\right], \text{Log}[16]\right\}\right\}$$

Out[13]=

$$\left\{\left\{-\text{Log}\left[\frac{100\,000}{4737}\right], \text{Log}[7]\right\}, \left\{-\text{Log}\left[\frac{50\,000}{1659}\right], \text{Log}[8]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{2419}\right], \text{Log}[9]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{1897}\right], \text{Log}[10]\right\}, \left\{-\text{Log}\left[\frac{50\,000}{697}\right], \text{Log}[11]\right\}, \left\{-\text{Log}\left[\frac{25\,000}{253}\right], \text{Log}[12]\right\}, \left\{-\text{Log}\left[\frac{25\,000}{223}\right], \text{Log}[13]\right\}, \left\{-\text{Log}\left[\frac{50\,000}{363}\right], \text{Log}[14]\right\}, \left\{-\text{Log}\left[\frac{3125}{18}\right], \text{Log}[15]\right\}, \left\{-\text{Log}\left[\frac{100\,000}{499}\right], \text{Log}[16]\right\}\right\}$$

In[10]:=
```
line = Fit[loglogba3, {1, x}, x]
```

Out[10]=

$0.929112 - 0.345376\,x$

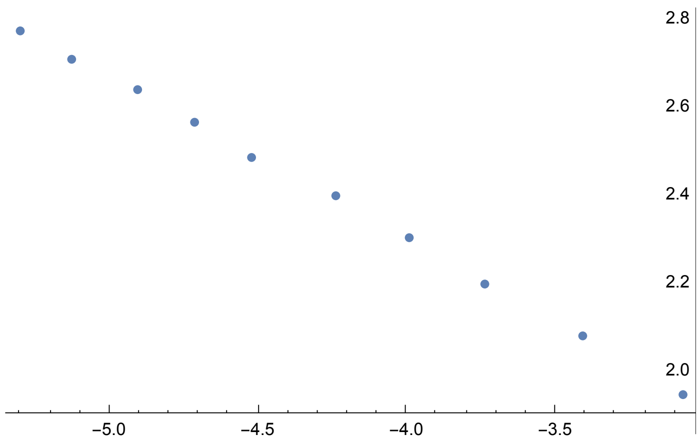
In[11]:=
```
parabola = Fit[loglogba3, {1, x, x^2}, x]
```

Out[11]=

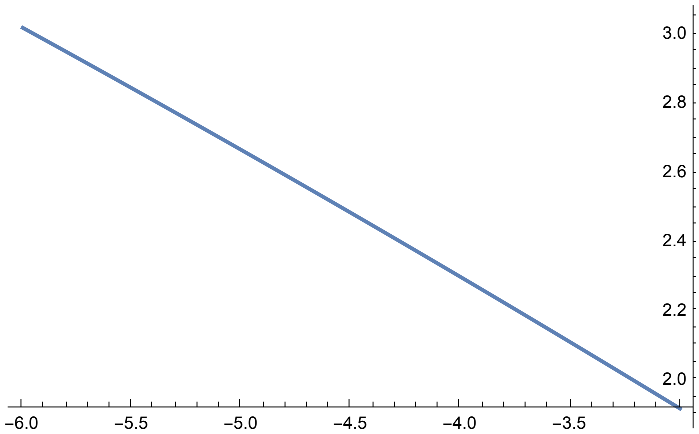
$0.702009 - 0.424623\,x - 0.00643417\,x^2$

In[15]:=
```
g1 = ListPlot[a]
```

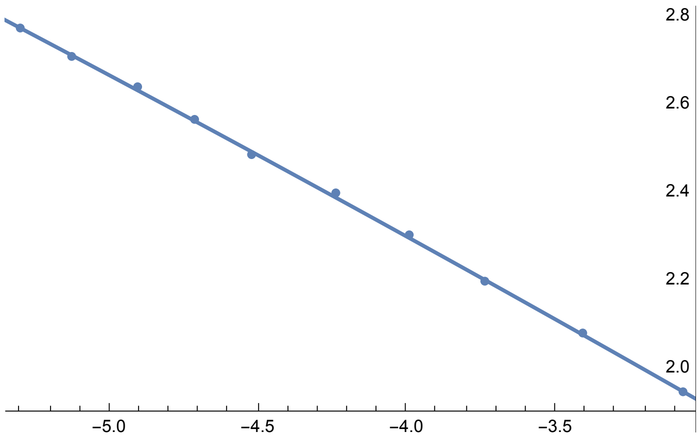
Out[15]=



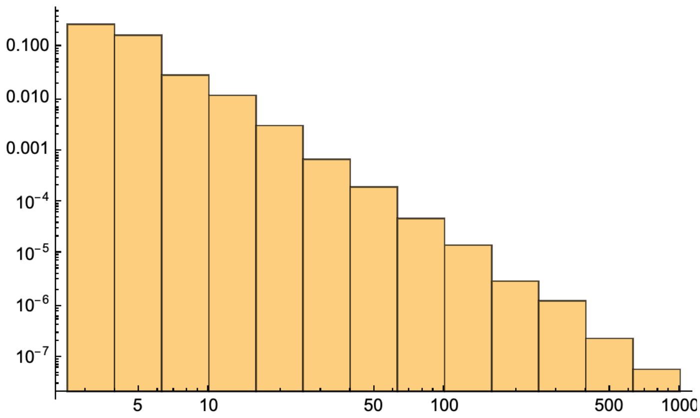
In[16]:=
```
g2 = Plot[parabola, {x, -6, -3}]
```
Out[16]=



In[17]:=
```
Show[g1, g2]
```
Out[17]=

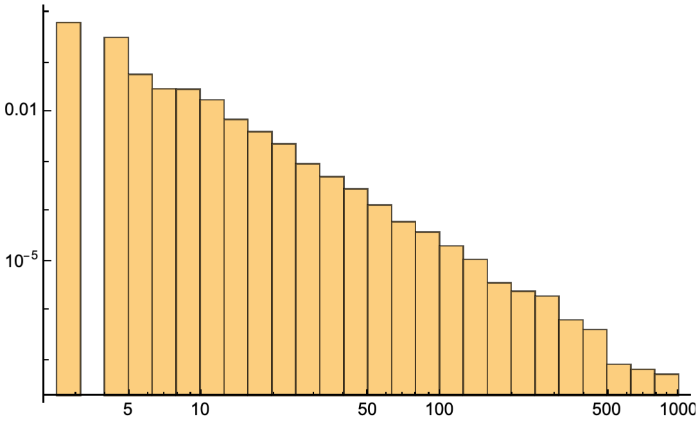


In[18]:=
```
Histogram[VertexDegree[ba3], {"Log", 10}, {"Log", "PDF"}]
```
Out[18]=



In[19]:=
```
Histogram[VertexDegree[ba3], {"Log", 25}, {"Log", "PDF"}]
```

Out[19]=



In[20]:=
```
g = ExampleData[{"NetworkGraph", "Internet"}];
```

In[21]:=
```
VertexCount[g]
```

Out[21]=

```
22 963
```

In[22]:=
```
Round[EdgeCount[g] / VertexCount[g]]
```

Out[22]=

```
2
```

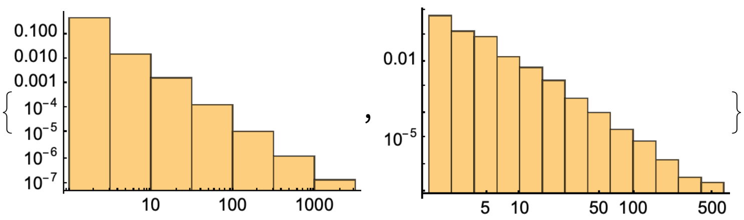
In[23]:=
```
baInternet = BarabasiAlbertGraphDistribution[
  VertexCount[g], Round[EdgeCount[g] / VertexCount[g]]]
```

Out[23]=

```
BarabasiAlbertGraphDistribution[22 963, 2]
```

In[24]:=
```
{Histogram[VertexDegree[g], {"Log", 10}, {"Log", "PDF"}],
 Histogram[VertexDegree[RandomGraph[baInternet]], {"Log", 10}, {"Log", "PDF"}]}
```

Out[24]=



In[25]:=
```
N[GlobalClusteringCoefficient[g]]
```

Out[25]=

```
0.0111464
```

In[26]:=
```
N[GlobalClusteringCoefficient[RandomGraph[baInternet]]]
```

Out[26]=

```
0.000824565
```

In[27]:=
```
ba2 = RandomGraph[BarabasiAlbertGraphDistribution[10^5, 2]];
empddistrBA2 = EmpiricalDistribution[VertexDegree[ba2]]
```

Out[28]=
```
DataDistribution[ Type: Empirical Data points: 100 000 ]
```

In[29]:=
```
ba4 = RandomGraph[BarabasiAlbertGraphDistribution[10^5, 4]];
empddistrBA4 = EmpiricalDistribution[VertexDegree[ba4]]
```

Out[30]=
```
DataDistribution[ Type: Empirical Data points: 100 000 ]
```