https://en.wikipedia.org/wiki/Sum_of_normally_distributed_random_variables

In[1]:=
```
mu1 = Random[Real, {0, 10}]
```

Out[1]=
```
9.08417
```

In[3]:=
```
sig1 = Random[Real, {1, 5}]
```

Out[3]=
```
3.62536
```

In[4]:=
```
mu2 = Random[Real, {0, 10}]
```

Out[4]=
```
9.62347
```

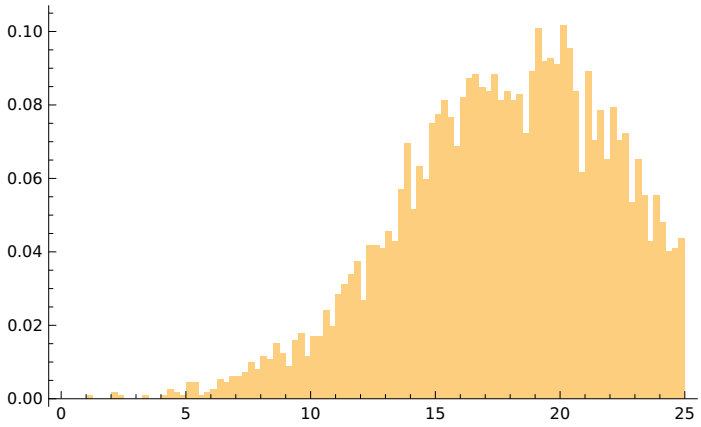
In[5]:=
```
sig2 = Random[Real, {1, 5}]
```

Out[5]=
```
3.26008
```

In[6]:=
```
myList = {}; For[i = 1, i ≤ 5000, i++,
combo = RandomVariate[NormalDistribution[mu1, sig1]] +
   RandomVariate[NormalDistribution[mu2, sig2]];
AppendTo[myList, combo]
];
```

In[7]:=
```
h1 = Histogram[myList, {0, 25, 0.25}, PDF]
```

Out[7]=



In[8]:=
```
ave = Mean[myList]
```

Out[8]=
```
18.7125
```

In[9]:=
```
TheoryAve = mu1 + mu2
```

Out[9]=
```
18.7076
```

In[10]:=
```
StandardDeviation[myList]
```

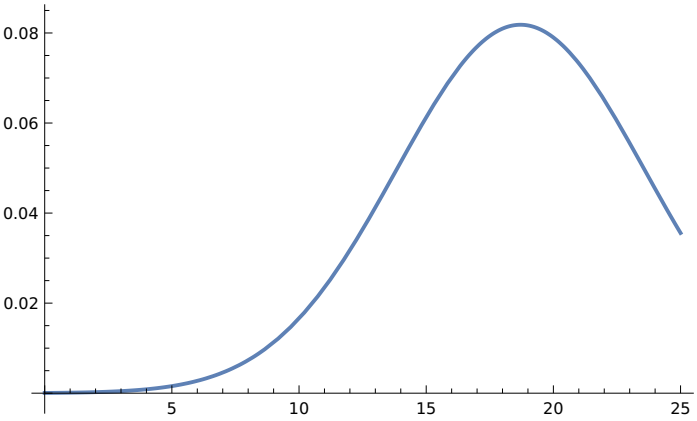
Out[10]=
```
4.94802
```

In[11]:=
```
TheorySD = Sqrt[sig1^2 + sig2^2]
```

Out[11]=
```
4.87559
```

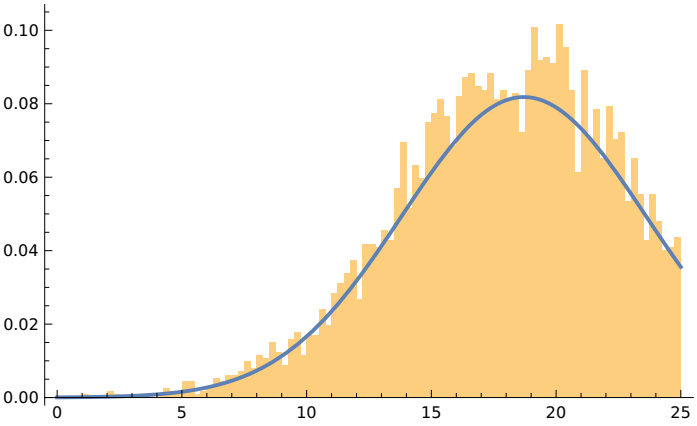
In[12]:=
```
h2 = Plot[PDF[NormalDistribution[TheoryAve, TheorySD], x], {x, 0, 25}]
```

Out[12]=



In[13]:=
```
Show[h1, h2]
```

Out[13]=



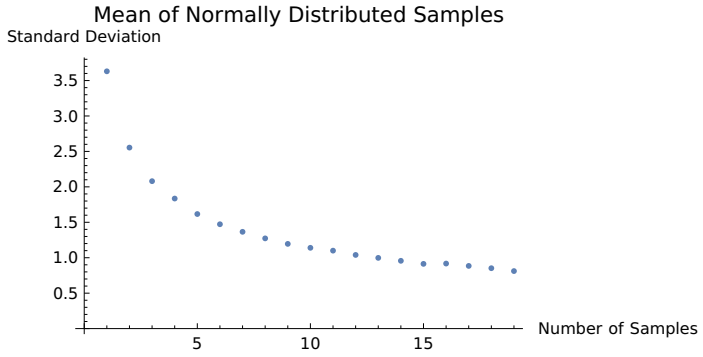
Instead of summing different normal distributions, let's take the average of independent samples from the same normal distribution

In[14]:=
```
mySD = {}; For[j = 1, j < 20, j++,
sampleNum = j; myList = {}; For[i = 1, i ≤ 5000, i++,
combo = Mean[RandomVariate[NormalDistribution[mu1, sig1], sampleNum]];
AppendTo[myList, combo]
]; sd = StandardDeviation[myList]; DataPoint = {};
AppendTo[DataPoint, j]; AppendTo[DataPoint, sd];
AppendTo[mySD, DataPoint];
];
Print[mySD]
```

```
{{1, 3.63038}, {2, 2.55394}, {3, 2.08028}, {4, 1.83499}, {5, 1.61655}, {6, 1.47243}, {7, 1.36559},
 {8, 1.273}, {9, 1.1953}, {10, 1.1399}, {11, 1.09985}, {12, 1.03937}, {13, 0.997829},
 {14, 0.956484}, {15, 0.913371}, {16, 0.917626}, {17, 0.884475}, {18, 0.852154}, {19, 0.811675}}
```

In[15]:=
```
lp = ListPlot[mySD, PlotLabel → "Mean of Normally Distributed Samples",
  AxesLabel → {"Number of Samples", "Standard Deviation"}]
```

Out[15]=



In[16]:=
```
myFit = FindFit[mySD, a * x ^ n, {a, n}, x]
```

Out[16]=
```
{a → 3.62912, n → -0.502566}
```

In[17]:=
```
coeff = a /. myFit
```

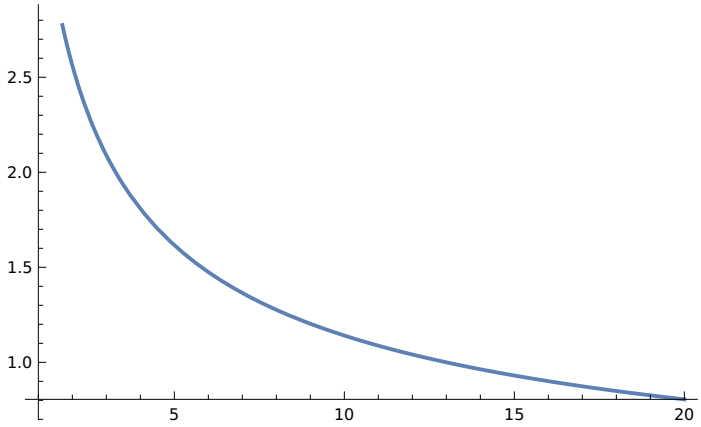
Out[17]=
```
3.62912
```

In[18]:=
```
power = n /. myFit
```

Out[18]=
```
-0.502566
```

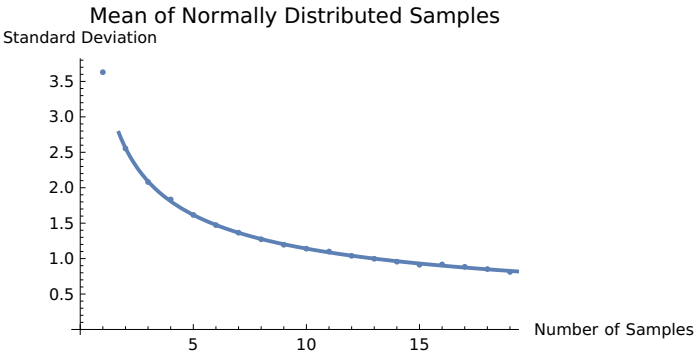
In[19]:=
```
fitplot = Plot[coeff * x ^ power, {x, 1, 20}]
```

Out[19]=



In[20]:=
```
Show[lp, fitplot]
```

Out[20]=



In[24]:=
```
AmIn = 0; sampleNum = 5; conf = 1.96; result = {}; For[i = 1, i ≤ 1000, i++,
mu = Random[Real, {0, 10}]; sig = Random[Real, {1, 5}];
ave = Mean[RandomVariate[NormalDistribution[mu, sig], sampleNum]];
DataPoint = {}; AppendTo[DataPoint, mu]; AppendTo[DataPoint, sig];
AppendTo[DataPoint, ave];
within =
  If[mu > ave + sig * conf / Sqrt[sampleNum], 0, If[mu < ave - sig * conf / Sqrt[sampleNum], 0, 1]];
AmIn = AmIn + within;
AppendTo[DataPoint, within];
 AppendTo[result, DataPoint];
]; Print[AmIn]
```

```
950
```