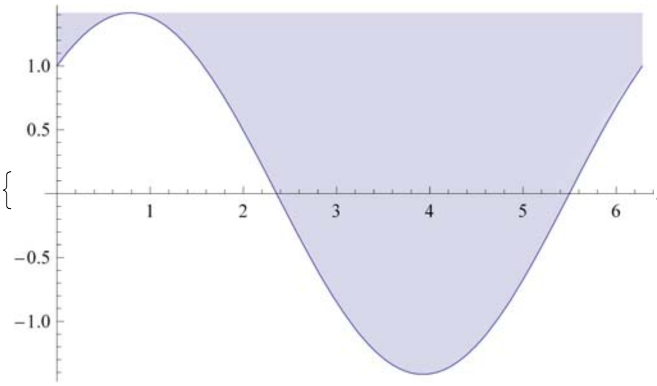
Filling

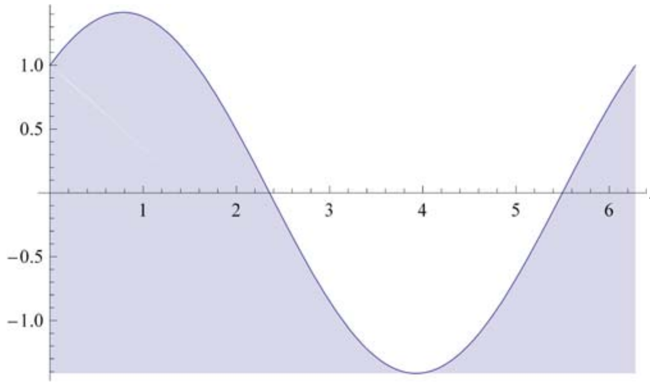
is an option for `ListPlot`, `Plot`, `Plot3D` and related functions which specifies what filling to add under points, curves and surfaces.

In[1]:= `Table[Plot[Sin[x] + Cos[x], {x, 0, 2 Pi}, Filling → f], {f, {Top, Bottom, Axis, 0.3}}]`

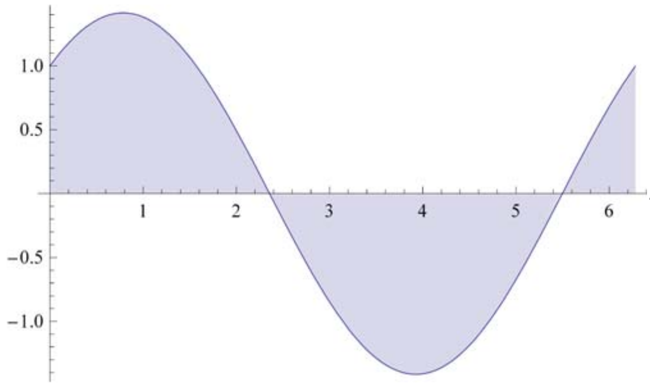
Out[1]= {



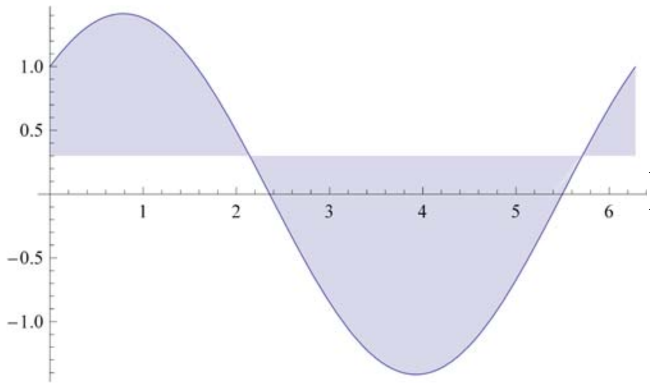
,



,



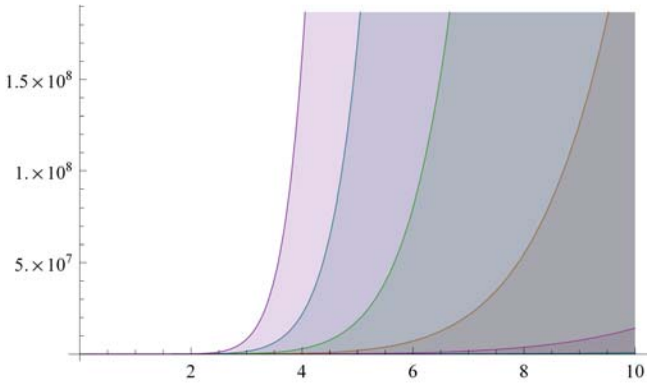
,



}

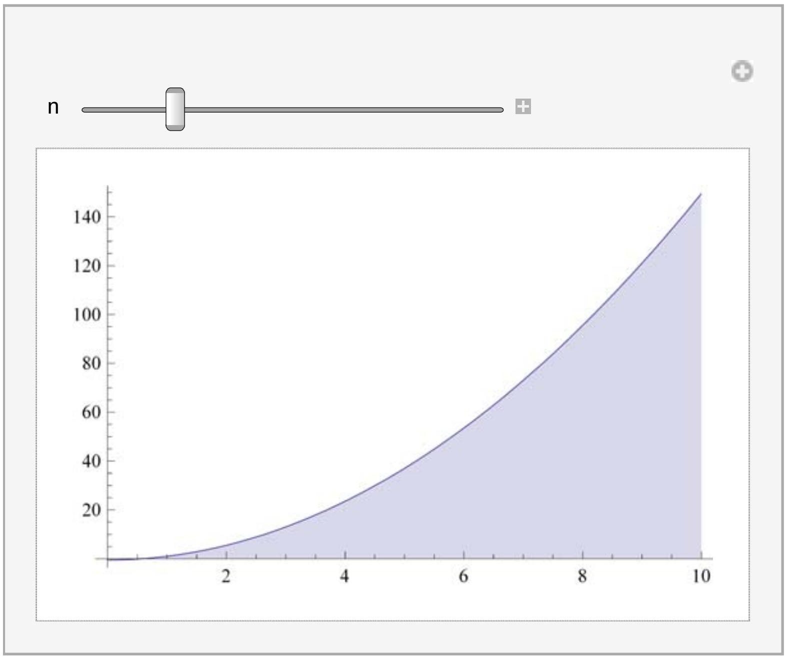
In[2]:=
```
Plot[Evaluate[Table[LegendreP[n, x], {n, 10}]], {x, 0, 10}, Filling → Axis]
```

Out[2]=



In[3]:=
```
Manipulate[Plot[LegendreP[n, x], {x, 0, 10}, Filling → Axis], {n, 0, 10, 1}]
```

Out[3]=



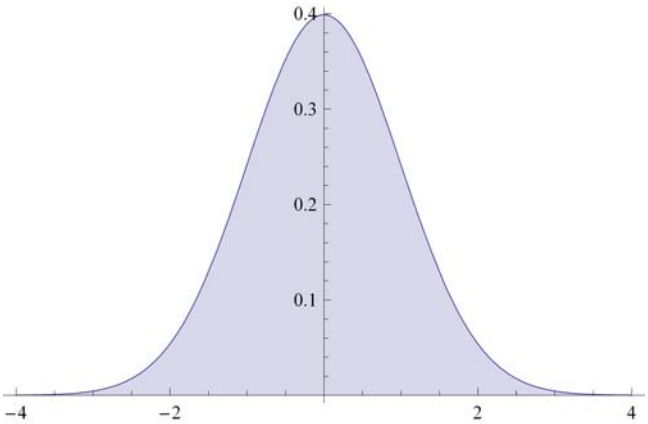
PDF[*dist***,** *x***]** gives the probability density function for the symbolic distribution *dist* evaluated at *x*.
For continuous distributions, PDF[*dist*, *x*] *dx* gives the probability that an observed value will lie between *x* and *x* + *dx* for infinitesimal *dx*.
For discrete distributions, PDF[*dist*, *x*] gives the probability that an observed value will be *x*.
PDF[*dist***]** gives the PDF as a pure function.

NormalDistribution[μ**,** σ**]**
represents a normal (Gaussian) distribution with mean μ and standard deviation σ.
The probability density for value x in a normal distribution is proportional to $e^{-(x-\mu)^2/(2\sigma^2)}$.

In[4]:=
```
PDF[NormalDistribution[0, 2], x]
```

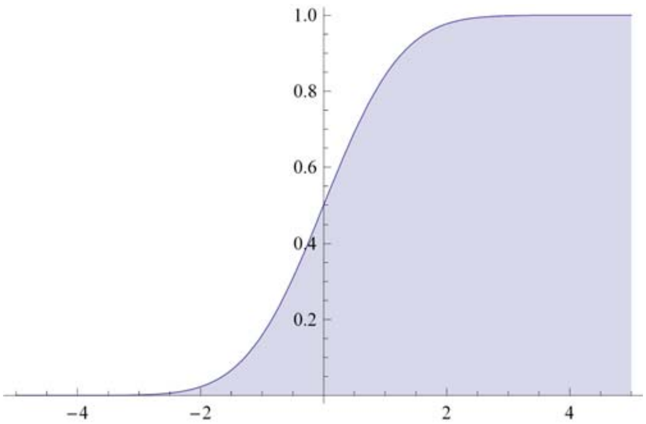
Out[4]=
$$\frac{e^{-\frac{x^2}{8}}}{2\sqrt{2\pi}}$$

In[5]:=
```
Plot[PDF[NormalDistribution[0, 1], x], {x, -4, 4}, Filling -> Axis]
```

Out[5]= 

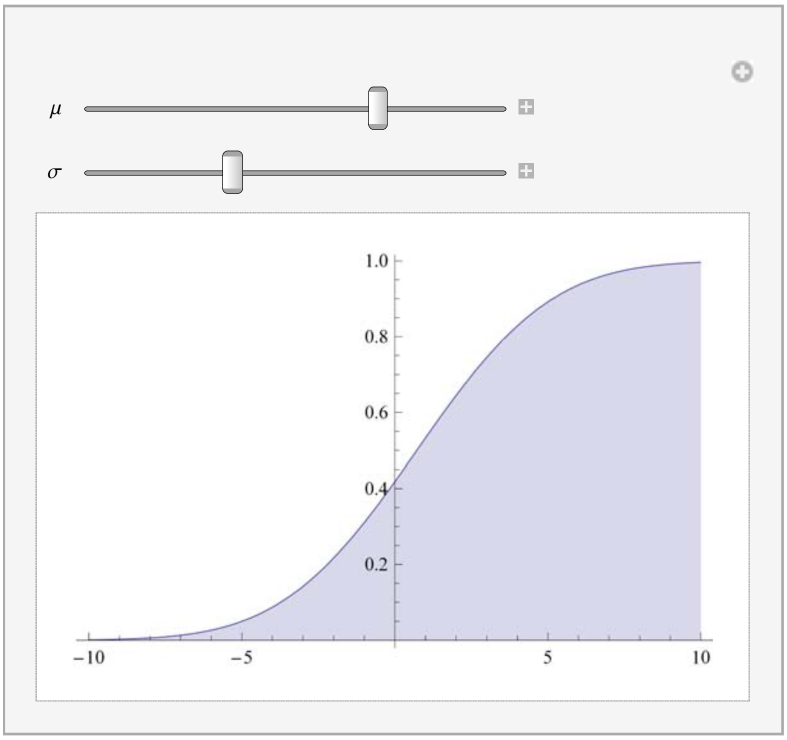
Plot the cumulative distribution function of the random variable:

In[6]:=
```
Plot[CDF[NormalDistribution[0, 1], x], {x, -5, 5}, Filling -> Axis]
```

Out[6]= 

In[7]:= **Manipulate[Plot[CDF[NormalDistribution[μ, σ], x], {x, −10, 10}, Filling −> Axis], {μ, 0, 1}, {σ, 1/10, 10}]**

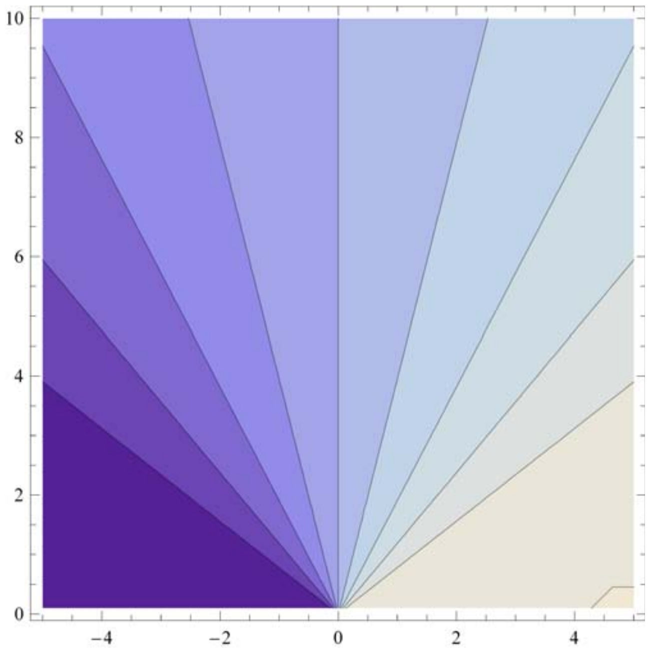
Out[7]=



A contour plot as both x and σ are varied:

In[8]:= **ContourPlot[
CDF[NormalDistribution[0, σ], x], {x, −5, 5}, {σ, 1/10, 10}]**

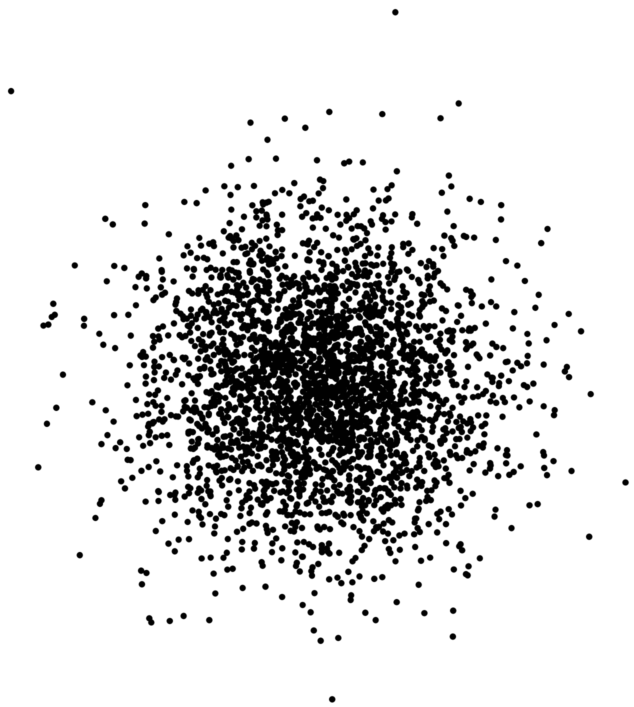
Out[8]=



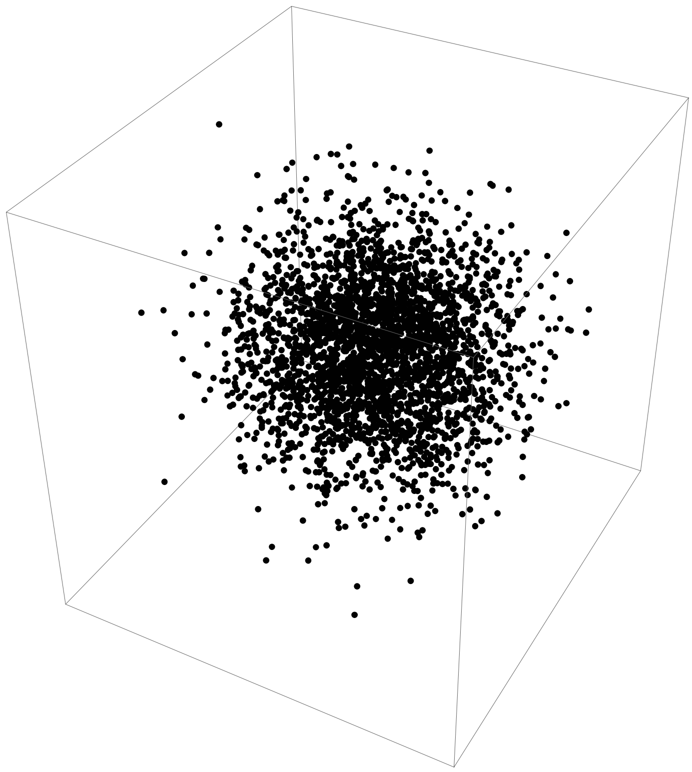
Normally distributed points in the plane and normally distributed points in 3D:

In[9]:=
```
Graphics[Point[RandomReal[NormalDistribution[], {3000, 2}]]]
Graphics3D[Point[RandomReal[NormalDistribution[], {3000, 3}]]]
```

Out[9]=



Out[10]=



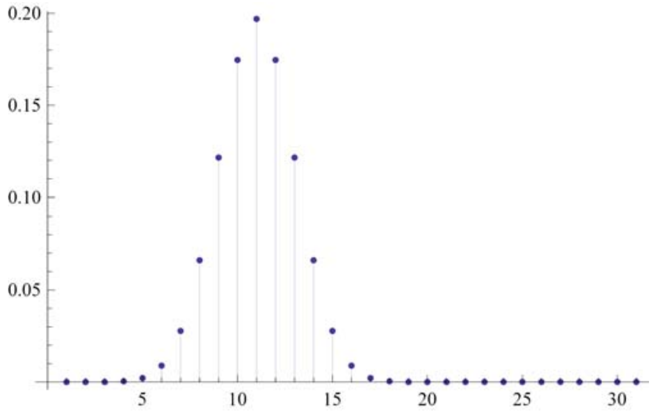
A hypergeometric distribution gives the distribution of the number of successes in n draws from a population of size n_{tot} containing n_{succ} successes.

In[11]:=
```
PDF[HypergeometricDistribution[1 n, nsucc, ntotal], k]
```

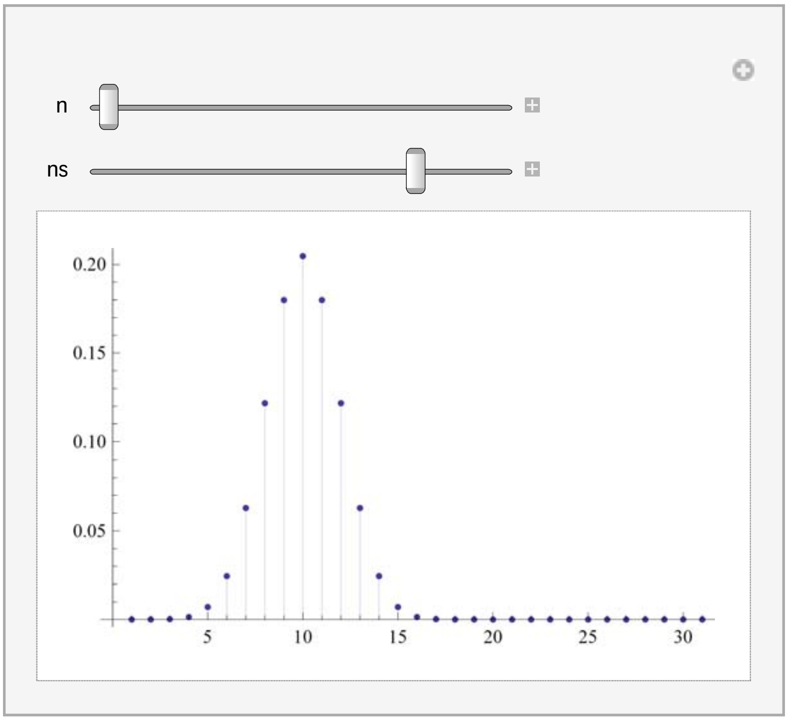
Out[11]=

```
Binomial[nsucc, k] Binomial[-nsucc + ntotal, -k + n]
----------------------------------------------------
               Binomial[ntotal, n]
```

In[12]:=
```
ListPlot[Table[PDF[HypergeometricDistribution[50, 20, 100], k], {k, 0, 30}], Filling -> Axis]
```

Out[12]=


In[13]:=
```
Manipulate[ListPlot[Table[PDF[HypergeometricDistribution[5 n, ns, 100], k], {k, 0, 30}], Filling -> Axis],
  {n, 10, 50, 10}, {ns, 10, 20, 2}]
```

Out[13]=


PoissonDistribution[μ]

represents a Poisson distribution with mean μ.

The probability for integer value x in a Poisson distribution is $e^{-\mu}\mu^x / x!$ for $x \geq 0$.

In[14]:=
```
PDF[PoissonDistribution[μ]]
```

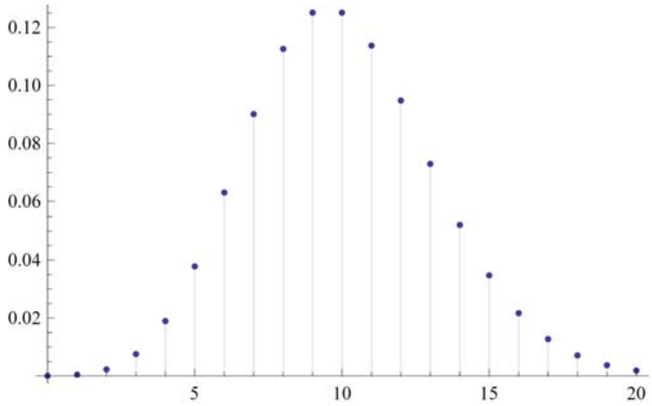
Out[14]= $\frac{e^{-\mu}\mu^{\#1}}{\#1!}$ &

Probability density function:

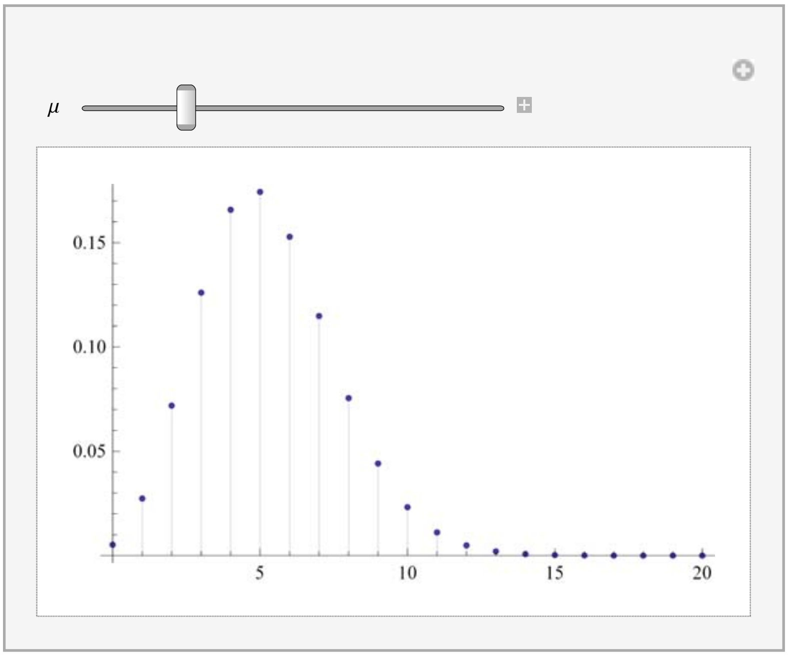
In[15]:=
```
PDF[PoissonDistribution[μ], k]
```

Out[15]= $\frac{e^{-\mu}\mu^{k}}{k!}$

In[16]:=
```
ListPlot[Table[{k, PDF[PoissonDistribution[10], k]}, {k, 0, 20}], Filling -> Axis]
```

Out[16]=


In[17]:=
```
Manipulate[ListPlot[Table[{k, PDF[PoissonDistribution[μ], k]}, {k, 0, 20}], Filling -> Axis], {μ, 1, 20}]
```

Out[17]=


BinomialDistribution[n, p]

represents a binomial distribution with n trials and success probability p.

The probability for value x in a binomial distribution is $\binom{n}{x} p^x (1-p)^{n-x}$ for integers from 0 to n

Mean and variance of a binomial distribution and teh probability density function:

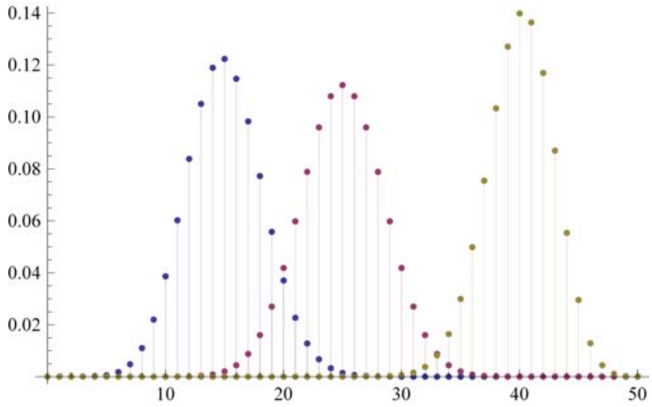
In[18]:=
```
Mean[BinomialDistribution[n, p]]
Variance[BinomialDistribution[n, p]]
```

Out[18]= n p

Out[19]= n (1 - p) p

In[20]:=
```
ListPlot[Table[{k, PDF[BinomialDistribution[50, p], k]},
  {p, {0.3, 0.5, 0.8}}, {k, 0, 50}], Filling -> Axis]
```

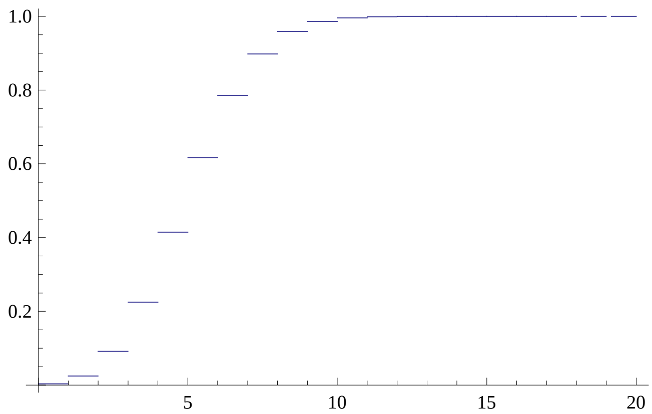
Out[20]=



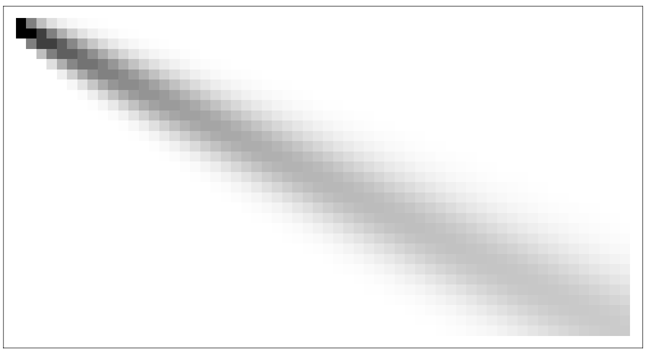
Plot the cumulative distribution function of a binomial distribution and the density functions of binomial random variables are highly concentrated about their means:

In[21]:=
```
Plot[CDF[BinomialDistribution[20, 1/4], k], {k, 0, 20}]
ArrayPlot[Table[PDF[BinomialDistribution[n, 0.5], k], {k, 0, 30}, {n, 1, 60}]]
```

Out[21]=

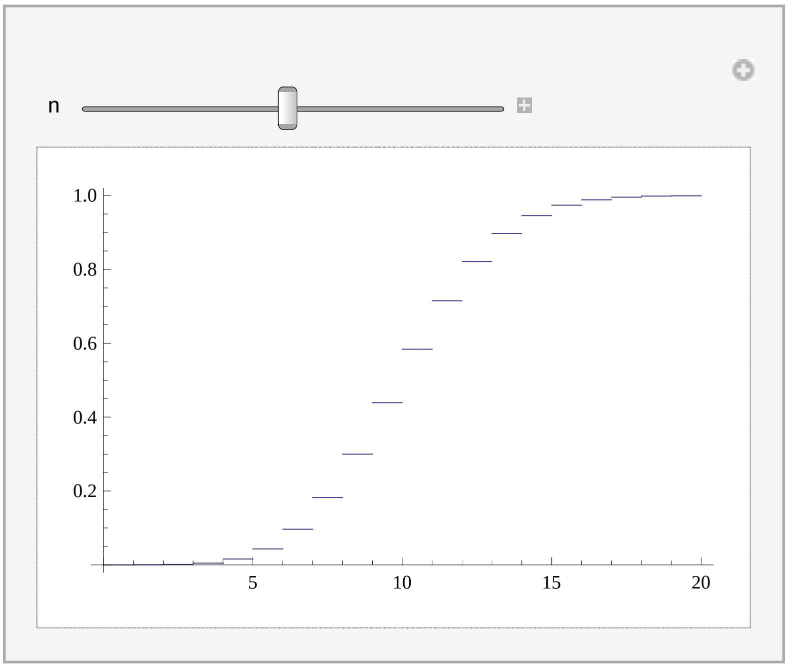


Out[22]=



In[23]:= **Manipulate[Plot[CDF[BinomialDistribution[*n*, 1 / 4], *k*], {*k*, 0, 20}], {*n*, 2, 80, 2}]**

Out[23]=



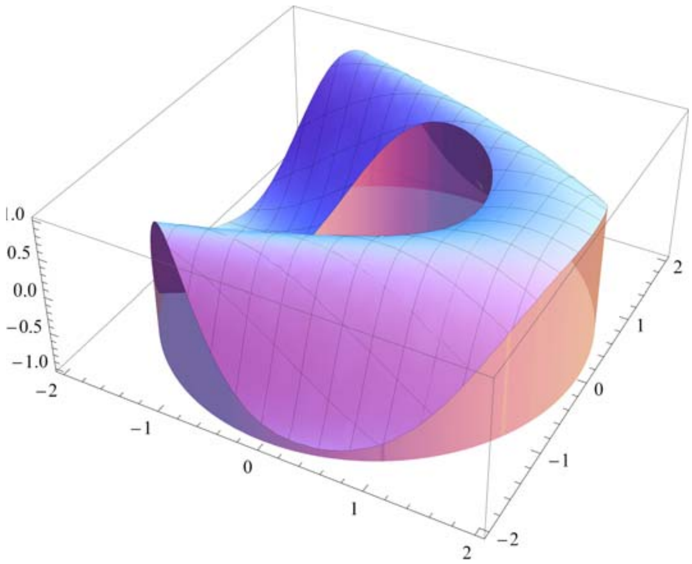
RegionFunction

is an option for plotting functions which specifies the region to include in the plo drawn.

The setting RegionFunction –> *r* specifies that a point should be included in the region when *r*[*args*] yields True.

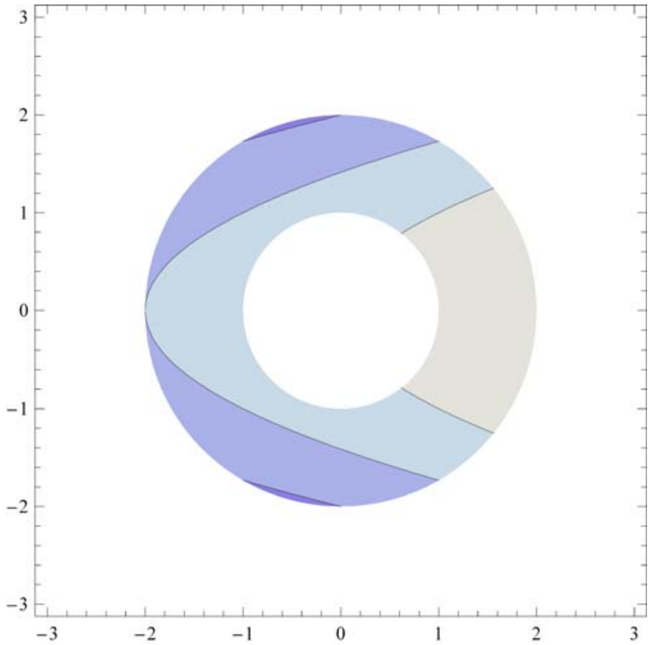
```
In[24]:= Plot3D[Sin[x + y^2], {x, -2, 2}, {y, -2, 2}, RegionFunction -> (1 < #1^2 + #2^2 < 4 &),
          Filling → Bottom, FillingStyle → Opacity[0.7], Mesh → True]
```

Out[24]=



In[25]:=
```
ContourPlot[x - y^2, {x, -3, 3}, {y, -3, 3}, RegionFunction → (1 < #1^2 + #2^2 < 4 &)]
```

Out[25]=



In[26]:=
```
Manipulate[Plot3D[Sin[a * x + b * y^2], {x, -2, 2},
  {y, -2, 2}, RegionFunction -> (1 < #1^2 + #2^2 < 4 &), Filling → Bottom,
  FillingStyle → Opacity[0.7], Mesh → True], {a, 0, 1}, {b, 2, 10}]
```

Out[26]=