

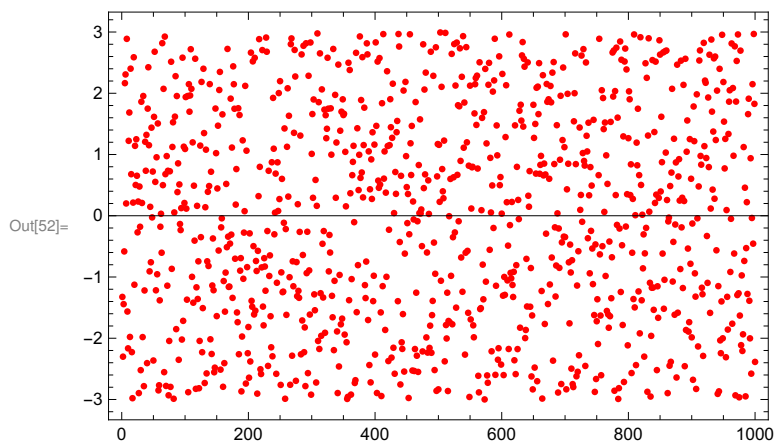
This notebook covers bare-bones basic-differences between an uniform distribution and a normal distribution. This is merely a preamble to setting up Monte - Carlo numerical integration for ordinary differential equations.

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Uniform vs Normal distribution

What is the distribution of data created by the *Mathematica* function, `RandomReal[]`?

```
In[50]:= n = 123;  
SeedRandom[n];  
(*resets the pseudorandom generator,using n as a seed.*)  
data1 = RandomVariate[UniformDistribution[{-3, 3}], 1000];  
lp1 = ListPlot[data1, Frame → True,  
  FrameStyle → Black, PlotStyle → {Red, PointSize[0.01]}]  
FindDistribution[data1]
```



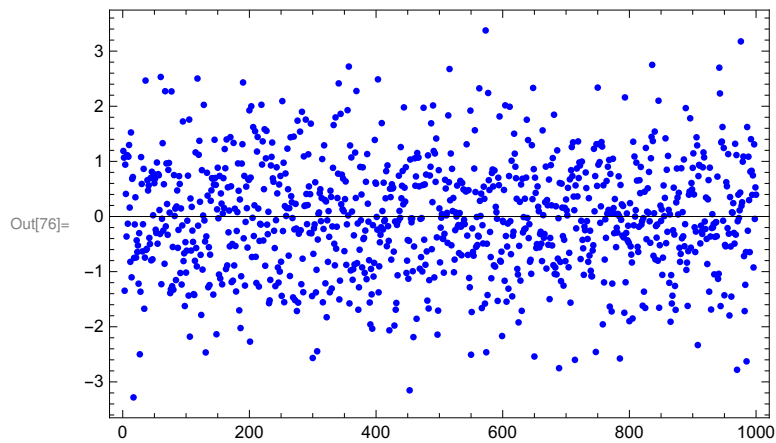
Out[53]= UniformDistribution[{-2.99903, 2.9927}]

What does a Normal distribution look like?

```

In[72]:= n = 123;
SeedRandom[n];
mu = 0.; sig = 0.5;
data2 = RandomVariate[NormalDistribution[0, 1], 1000];
lp2 = ListPlot[data2, Frame → True,
  FrameStyle → Black, PlotStyle → {Blue, PointSize[0.01]}]
FindDistribution[data2]

```



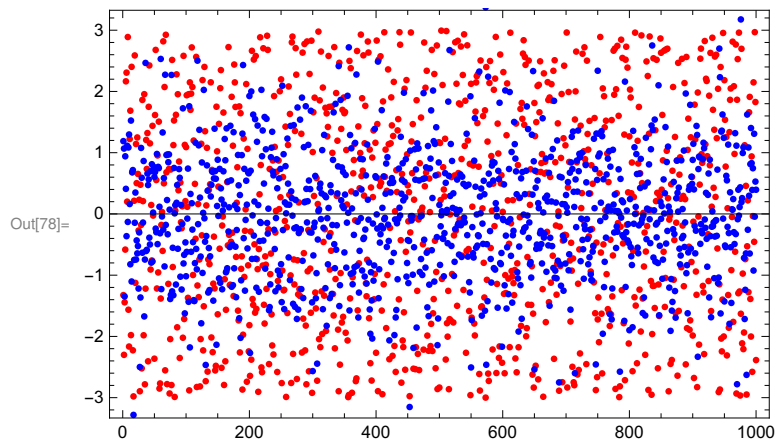
Out[77]= NormalDistribution[-0.0149788 , 1.01369]

Compare a uniform distribution with a normal distribution

```

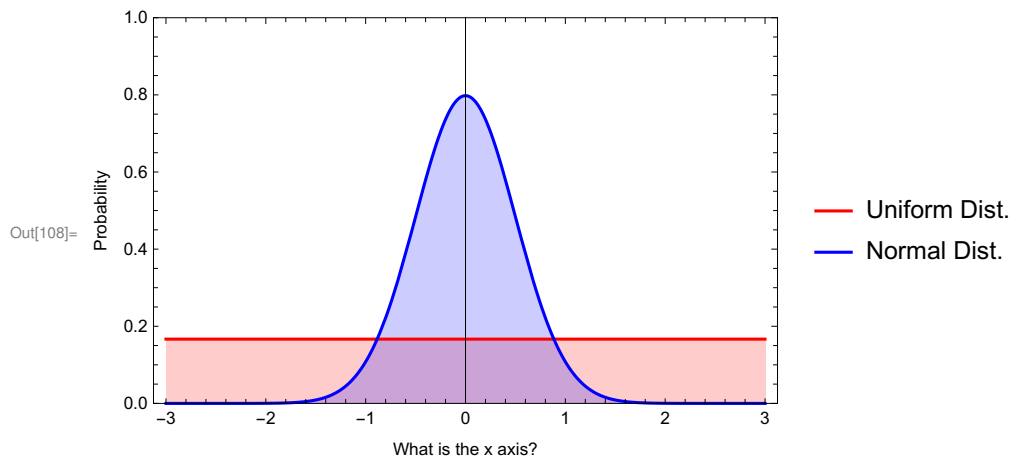
In[78]:= Show[lp1, lp2]

```



Probability distributions

```
In[105]:= mu = 0.; sig = 0.5;
n = 123;
SeedRandom[n];
Plot[
  {PDF[UniformDistribution[{-3, 3}], x],
   PDF[NormalDistribution[mu, sig], x]},
  {x, -3, 3}, Filling -> Axis, Frame -> True, FrameStyle -> Black, PlotStyle -> {Red, Blue},
  PlotRange -> {All, {0, 1}}, FrameLabel -> {"What is the x axis?", "Probability"},
  PlotLegends -> {"Uniform Dist.", "Normal Dist."}]
```



Area under the probability distribution curve should be 1

```
In[110]:= {NIntegrate[PDF[UniformDistribution[{-3, 3}], x], {x, -3, 3}],
  NIntegrate[PDF[NormalDistribution[mu, sig], x], {x, -3, 3}]}
```

Out[110]= {1., 1.}

References

Lemons, D.S., "Introduction to stochastic processes in physics".