

Exploring Stirling's Approximation

```
In[40]:= str[n_] := n^n Exp[-n] Sqrt[2 π n]
```

```
In[41]:= N[50!, 10]
```

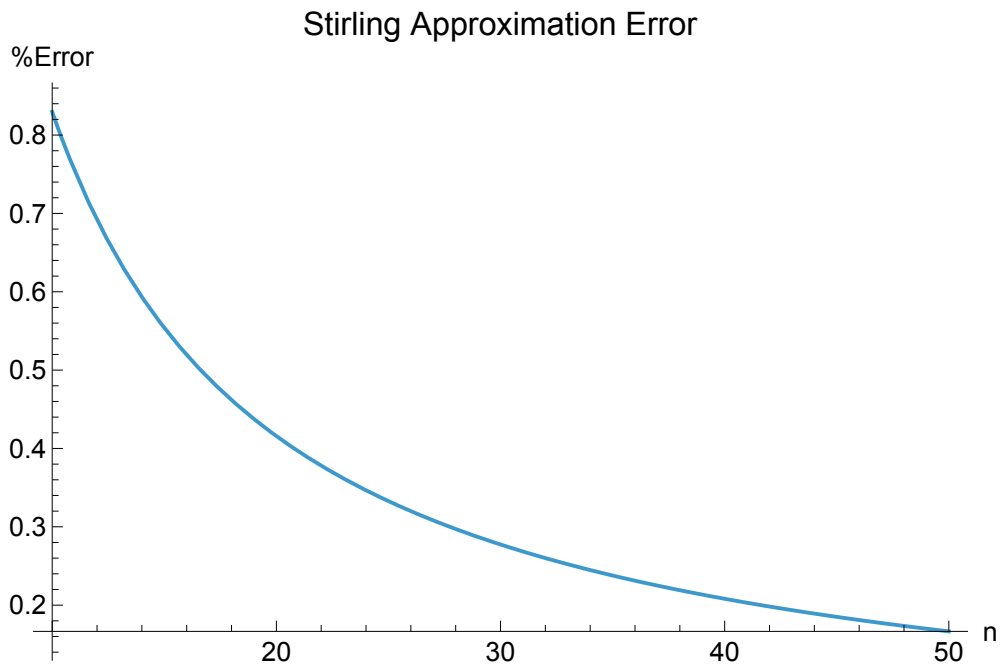
```
Out[41]= 3.041409320 × 1064
```

```
In[42]:= N[str[50], 10]
```

```
Out[42]= 3.036344594 × 1064
```

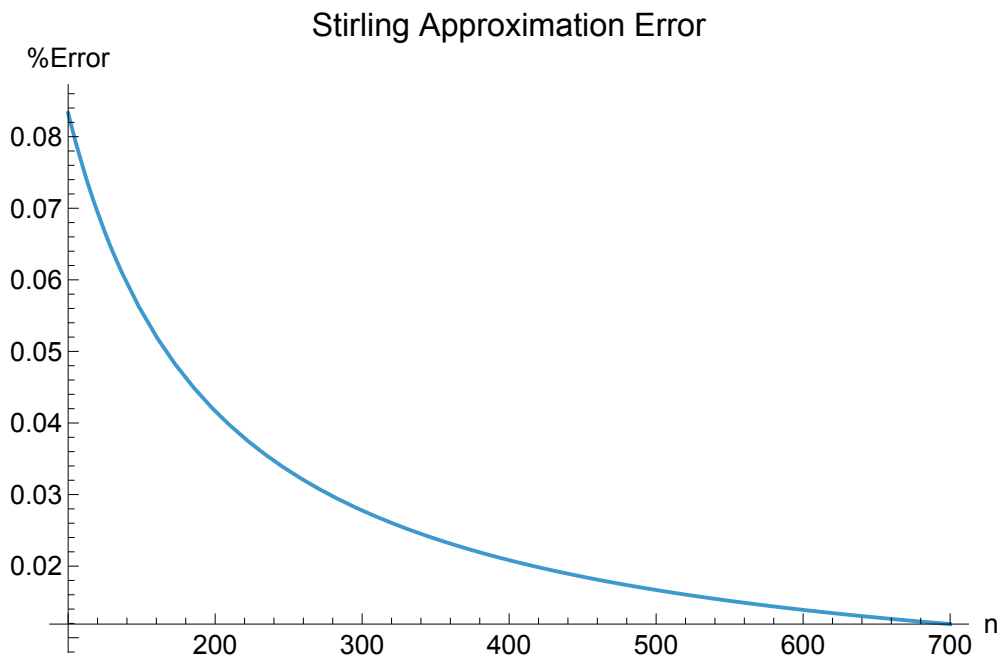
```
In[44]:= Plot[100 * (1 - str[n] / n!), {n, 10, 50}, PlotRange → All,  
  AxesLabel → {"n", "%Error"}, LabelStyle → Larger,  
  PlotLabel → "Stirling Approximation Error", ImageSize → Scaled[0.8]]
```

```
Out[44]=
```



```
In[51]:= Plot[100 * (1 - str[n] / n!), {n, 100, 700},
  PlotRange -> All, AxesLabel -> {"n", "%Error"}, LabelStyle -> Larger,
  PlotLabel -> "Stirling Approximation Error", ImageSize -> Scaled[0.8]]
```

Out[51]=



Logarithmic approximation

```
In[52]:= lnstr[n_] := n Log[n] - n
```

```
In[53]:= N[Log[50!], 10]
```

Out[53]=

148.4777670

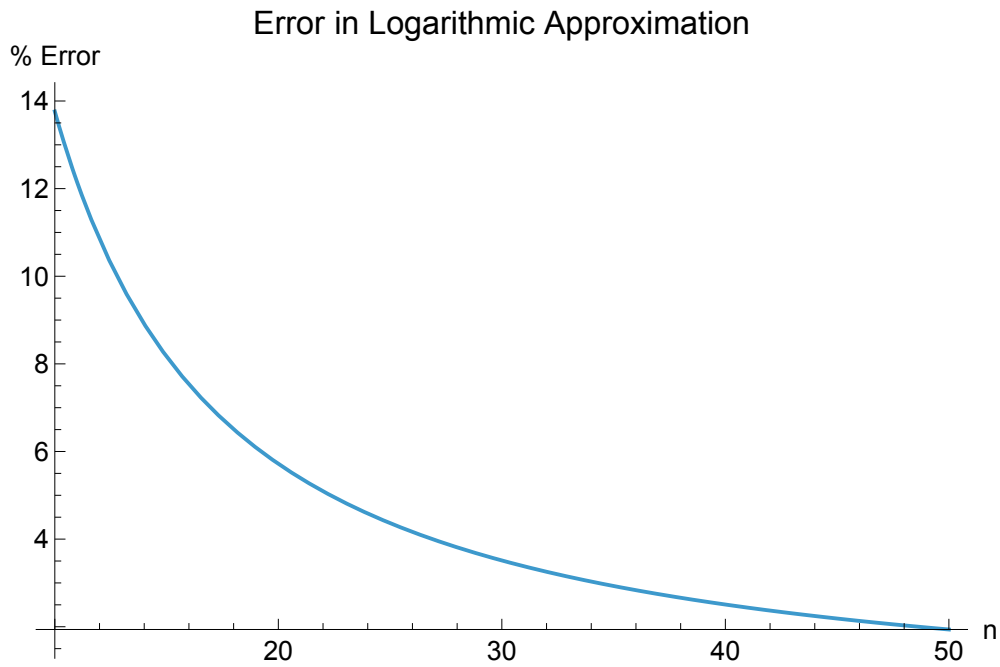
```
In[54]:= N[lnstr[50], 10]
```

Out[54]=

145.6011503

```
In[56]:= Plot[100 * (1 - lnstr[n] / Log[n!]), {n, 10, 50}, PlotRange -> All,
  AxesLabel -> {"n", "% Error"}, PlotLabel -> "Error in Logarithmic Approximation",
  LabelStyle -> Larger, ImageSize -> Scaled[0.8]]
```

Out[56]=



```
In[57]:= Plot[100 * (1 - lnstr[n] / Log[n!]), {n, 100, 700}, PlotRange -> All,
  AxesLabel -> {"n", "% Error"}, PlotLabel -> "Error in Logarithmic Approximation",
  LabelStyle -> Larger, ImageSize -> Scaled[0.8]]
```

Out[57]=

