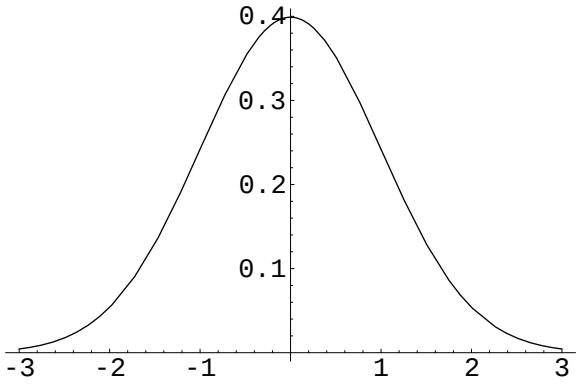
(* EXAMPLE OF LIKELIHOOD CALCULATION FOR A MIXTURE DISTRIBUTION *)

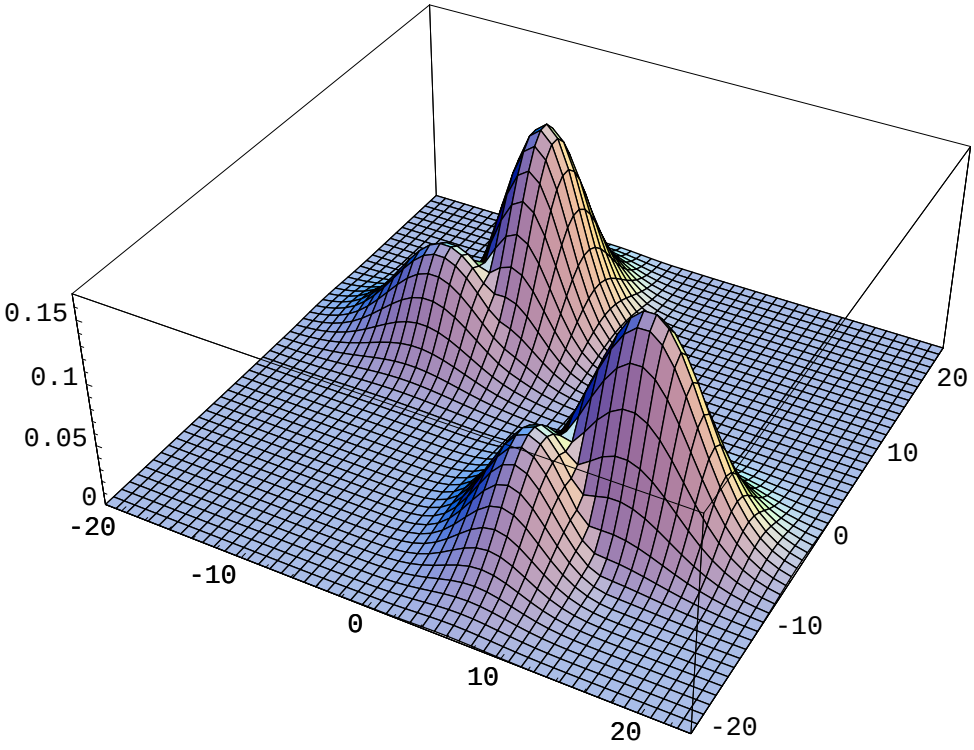
```
(* Probability Density Function for
  univariate normal with mean mu and variance var *)
NormalPdf[x_, mu_, var_] := 1 / Sqrt[2 * Pi * var] * Exp[-(x - mu)^2 / (2 * var)]

Plot[NormalPdf[x, 0, 1], {x, -3, 3}];
```




```
(* Likelihood of data x arising from a mixture of two normals with means m[[1]],
 m[[2]], both with unit variance, and equal mixing proportions *)
Likelihood[x_, m_] :=
 Product[Sum[NormalPdf[x[[i]], m[[j]], 1] / 2, {j, 1, 2}], {i, 1, Length[x]}]
```

```
(* Plot of likelihood for 9 points (x) in 3 clusters.  Small power
  of Likelihood[...] just to scale it for better visualization. *)
z = List[-.2, 0, .2];
x = Join [z - 10, z, z + 12]
margin = .5 * (Max[x] - Min[x]);
Plot3D[Likelihood[x, {m1, m2}]^.02, {m1, Min[x] - margin, Max[x] + margin},
  {m2, Min[x] - margin, Max[x] + margin}, PlotPoints → 50, PlotRange → {0, .17}];
```

```
{-10.2, -10, -9.8, -0.2, 0, 0.2, 11.8, 12, 12.2}
```




```
(* Save plot as .pdf *)
Display["~/Desktop/likelihood.pdf", %, "PDF"];
```

(* Find 4 modes: *)

```
Maximize[{Likelihood[x, {m1, m2}]^.02, m1 < m2 && m2 > 11}, {m1, m2}]
```

```
{0.166531, {m1 → -5., m2 → 12.}}
```

```
Maximize[{Likelihood[x, {m1, m2}]^.02, m1 < m2 && m2 < 08}, {m1, m2}]
```

```
{0.0860716, {m1 → -10., m2 → 6.}}
```

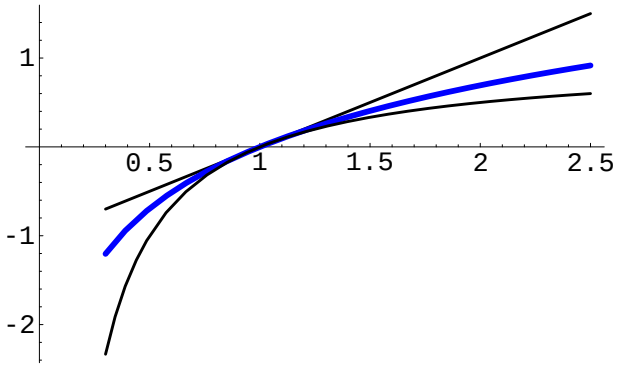
```
Maximize[{Likelihood[x, {m1, m2}]^.02, m1 > m2 && m1 < 06}, {m1, m2}]
```

```
{0.0860716, {m1 → 6., m2 → -10.}}
```

```
Maximize[{Likelihood[x, {m1, m2}]^.02, m1 > m2 && m1 > 11}, {m1, m2}]
```

```
{0.166531, {m1 → 12., m2 → -5.}}
```

```
Plot[{x - 1, Log[x], 1 - 1 / x}, {x, .3, 2.5},
 PlotStyle → {{Thickness[.005]}, {Thickness[.01], RGBColor[0, 0, 1]}}]
```




```
- Graphics -
```

```
Display["~/Desktop/ln.pdf", %, "PDF"];
```