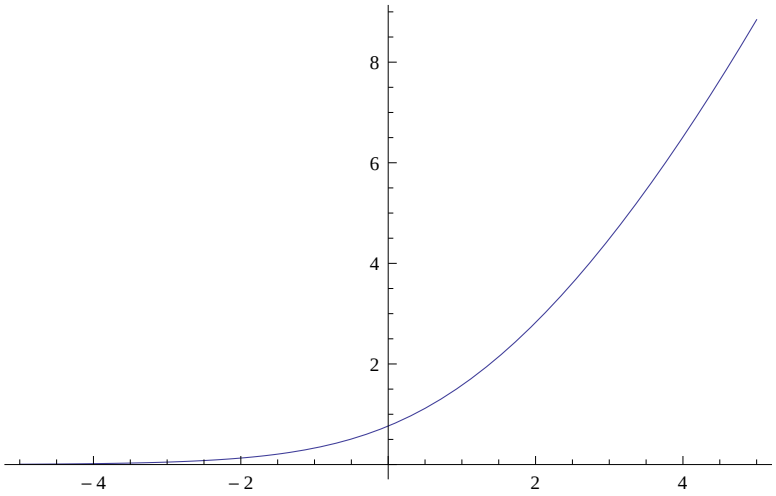
```
U[u_] := a u^2 - b u^3 + c u^4;

Integrate[Exp[-U[u] / kT], {u, -Infinity, Infinity}]
```

$$\int_{-\infty}^{\infty} e^{\frac{-a u^2 + b u^3 - c u^4}{kT}} \, du$$

```
a = 1; b = 0.5; c = 0.04; Plot[U[u], {u, -10, 10}, PlotRange → {-5, 5}]
a =.; b =.; c =.;

Plot[{}, {u, -5, 5}, PlotRange → All]
```




```
FindRoot[-PolyLog[3 / 2, -Exp[u]] == 4, {u, 0}][[1, 2]]
```

2.72977

```
cf = Compile[{{x, _Real}}, FindRoot[]
```

CompiledFunction $\left[\{x\},\right.$

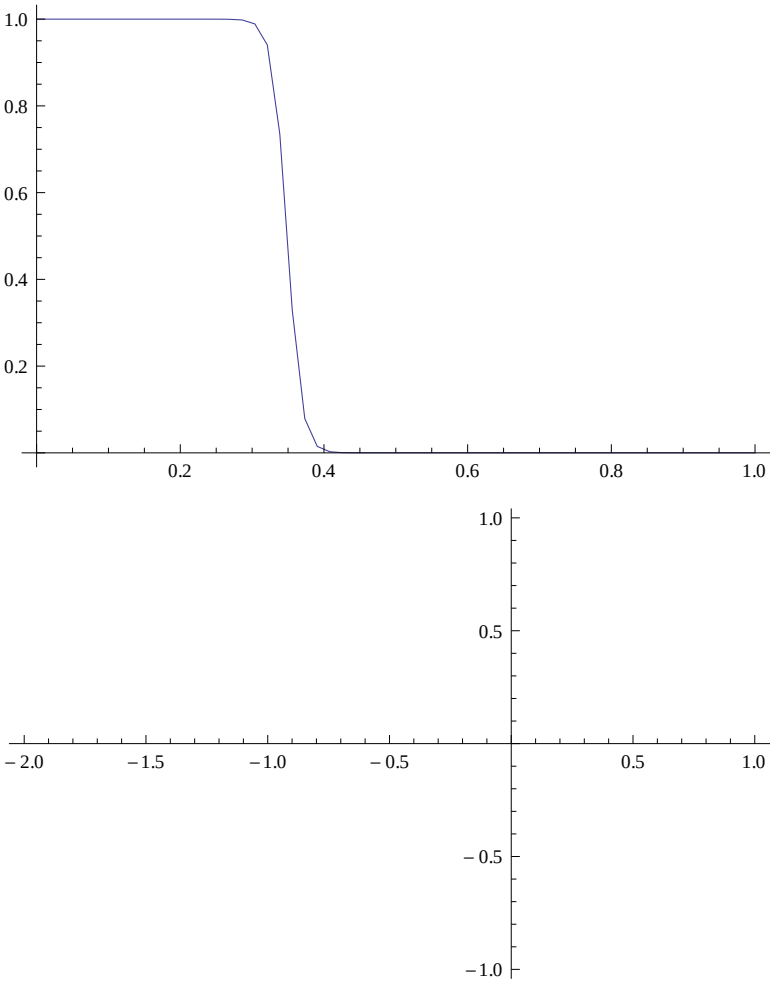
$\left.\text{FindRoot}\left[u /. \text{FindRoot}\left[-\text{PolyLog}\left[\frac{3}{2}, -e^{u}\right] == n, \{u, 0\}\right], \{u, 0\}\right], -\text{CompiledCode} \; -\right]$

```
f[e_, n_, kT_] :=
 1 / (Exp[(e - FindRoot[-PolyLog[3 / 2, -Exp[u]] == n, {u, 0}][[1, 2]]) / kT] + 1)

f[4, 0.3, 4]
```

0.218473

```
kT = 0.001; Plot[f[e, 1, kT], {e, 0, 1 },
 PlotPoints → 8, PerformanceGoal → "Speed", PlotRange → All]
kT =.
```



,

```
-PolyLog[3 / 2, -Exp[0]] // N
PolyLog[3 / 2, Exp[0]] // N
```

0.765147

2.61238

$$\text{PolyLog}\left[\frac{3}{2}, e\right]$$

```
<< PhysicalConstants`
```

BoltzmannConstant::shdw :
Symbol BoltzmannConstant appears in multiple contexts {PhysicalConstants`, Global`}; definitions in context PhysicalConstants` may shadow or be shadowed by other definitions.

BoltzmannConstant

$$\frac{1.38065 \times 10^{-23}\ \text{Joule}}{\text{Kelvin}}$$