In[9]:=

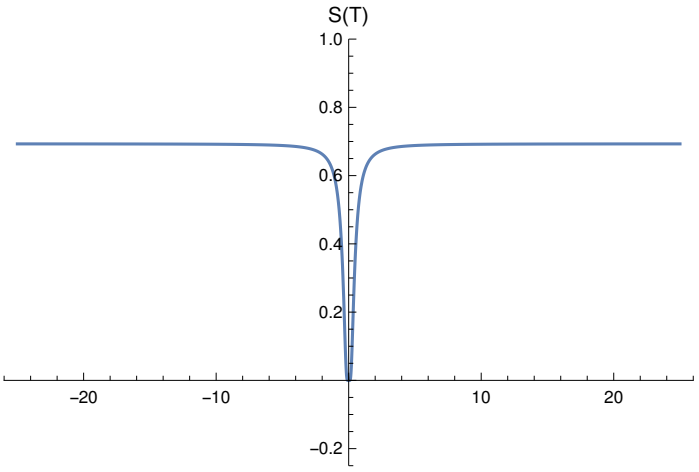
1c) Plot the entropy vs T

In[10]:=
```
k = 1;
ϵ = 1;
```

In[16]:=
$$S[T\_] := k * \text{Log}[1 + \text{Exp}[-\epsilon / (k * T)]] + \frac{\epsilon * \text{Exp}[-\epsilon / (k * T)]}{T * (1 + \text{Exp}[-\epsilon / (k * T)])}$$

In[24]:=
```
Plot[S[T], {T, -25, 25}, PlotLabel → "S(T)", PlotRange → {-.25, 1}]
```

Out[24]=

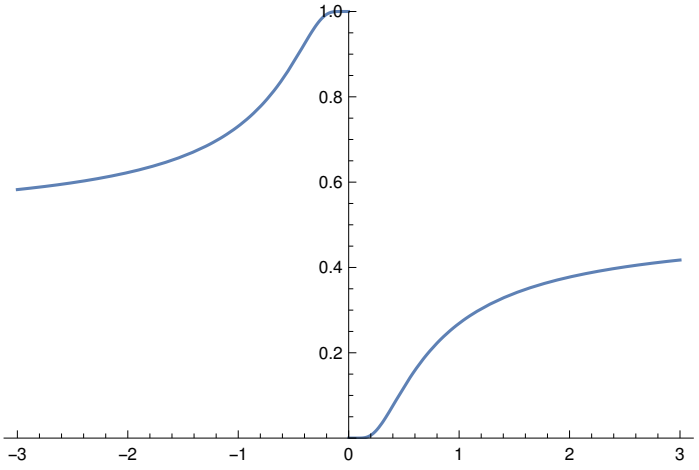


1d) Plot S(T) vs U(T). Explain maximum of U.

In[25]:=
$$U[T\_] := \frac{\epsilon * \text{Exp}[-\epsilon / (k * T)]}{(1 + \text{Exp}[-\epsilon / (k * T)])}$$

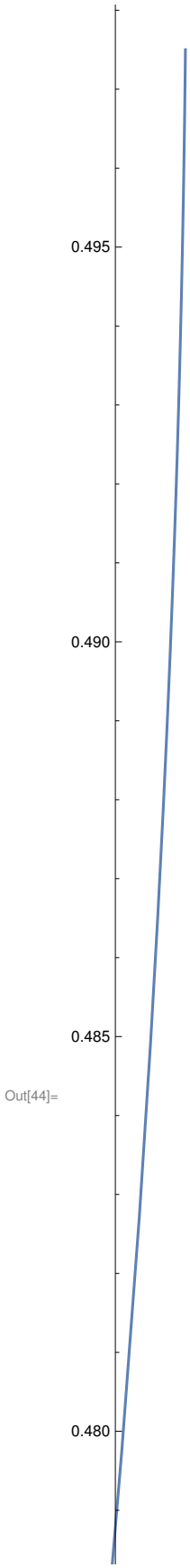
In[36]:=
```
Plot[U[T], {T, -3, 3}, PlotRange → {0, 1}]
```

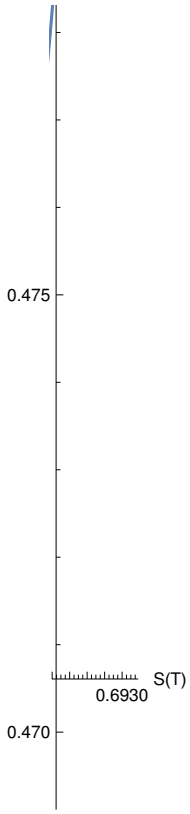
Out[36]=



In[44]:=
```
ParametricPlot[{S[T], U[T]}, {T, 0.25, 100}, AxesLabel → {"S(T)", "U(T)"}]
```

Out[44]=




0.475
S(T)
0.6930
0.470