# Fermiones no relativistas en 3D

## Densidad de particulas en funcion de z y T. Se usa densidad de estados Sqrt[eps]

In[56]:=
```
Integrate[Sqrt[x] / (z^(-1) Exp[x] + 1), {x, 0, Infinity}]
```

Out[56]=
$$-\frac{1}{2}\sqrt{\pi}\ \text{PolyLog}\left[\frac{3}{2}, -z\right]$$

In[57]:=
```
n[z_, T_] = T^(3 / 2) Integrate[Sqrt[x] / (z^(-1) Exp[x] + 1), {x, 0, Infinity}]
```

Out[57]=
$$-\frac{1}{2}\sqrt{\pi}\ T^{3/2}\ \text{PolyLog}\left[\frac{3}{2}, -z\right]$$

## Se invierte la relacion. z en funcion de n y T. Se pone n=1 (se fijan las dimensiones)

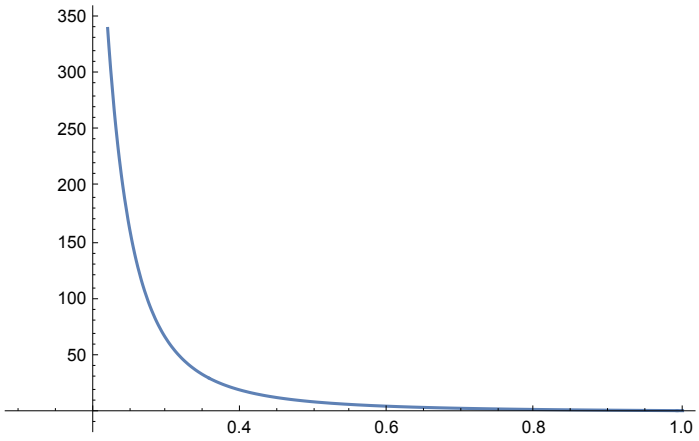
In[58]:=
```
z[n_, T_] := z /. FindRoot[-1/2 Sqrt[π] T^(3/2) PolyLog[3/2, -z] == n, {z, 0}]
```

In[60]:=
```
z[1.0, 0.1]
```

Out[60]=
$$460\,640. + 1.01031 \times 10^{-11}\ i$$

In[61]:=
```
Plot[Re[z[1., T]], {T, 0.1, 1}]
```

Out[61]=

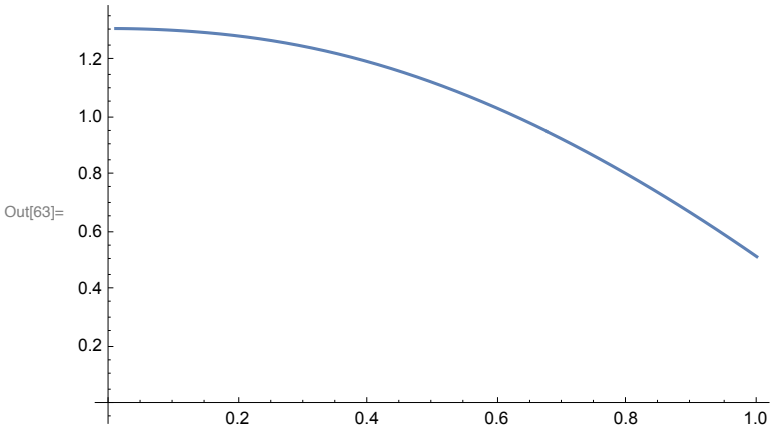



## Se calcula el potencial quimico en funcion de z y T. Definido por la inversion de z=Exp[mu/T]

In[62]:=
```
mu[n_, T_] := T Log[Re[z[n, T]]]
```

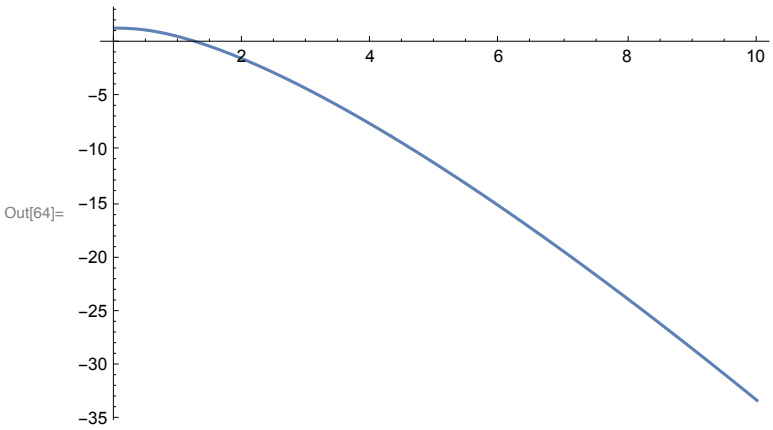
In[63]:=
```
Plot[Re[mu[1., T]], {T, 0.01, 1}, PlotRange → All, AxesOrigin → {0, 0}]
```

Out[63]=




In[64]:=
```
Plot[Re[mu[1., T]], {T, 0.01, 10}, PlotRange → All, AxesOrigin → {0, 0}]
```

Out[64]=




## Funcion distribucion de Fermi Dirac en funcion de mu-T y en funcion de n-T

In[65]:=
```
f[eps_, T_, mu_] := 1 / (Exp[(eps - mu) / T] + 1)
```

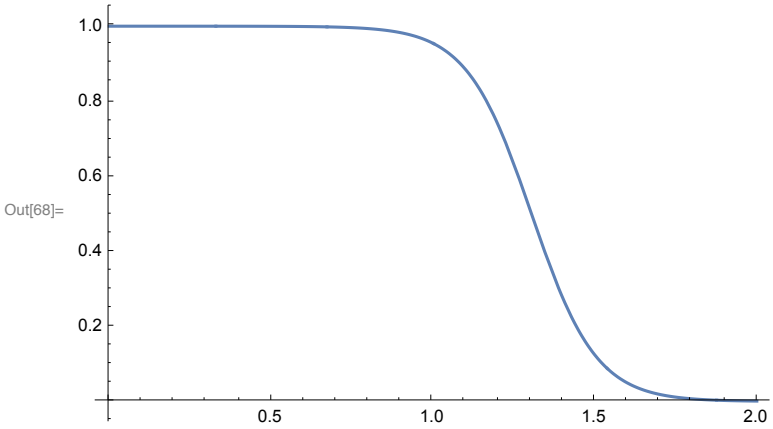
In[66]:=
```
fn[eps_, T_, n_] := f[eps, T, mu[n, T]]
```

In[67]:=
```
fn[1.0, 0.1, 1.]
```

Out[67]=
```
0.954365
```

In[68]:=
```
Plot[Re[fn[eps, 0.1, 1.]], {eps, 0, 2}]
```

Out[68]=



## Se grafica la funcion distribucion para distintas temperaturas

In[69]:=
```
Table[Plot[Re[fn[eps, T, 1.]], {eps, 0, 2}, AxesOrigin → {0, 0}],
 {T, {0.1, 0.5, 1.0, 5.0}}]
```

Out[69]=