```
(*Self-adjoint Wheeler-deWitt equation for the first ordering:*)
(*-y''[Q]-(3/(16Q^2)+(8πρQ)/3)y[Q]==-k y[Q]*)
(*For negative Q, ρ=0, for k=0 this becomes:*)
```

In[∘]:=
```
DSolve[-y''[Q] - (3 / (16 Q^2)) y[Q] == 0, y[Q], Q]
```

Out[∘]=

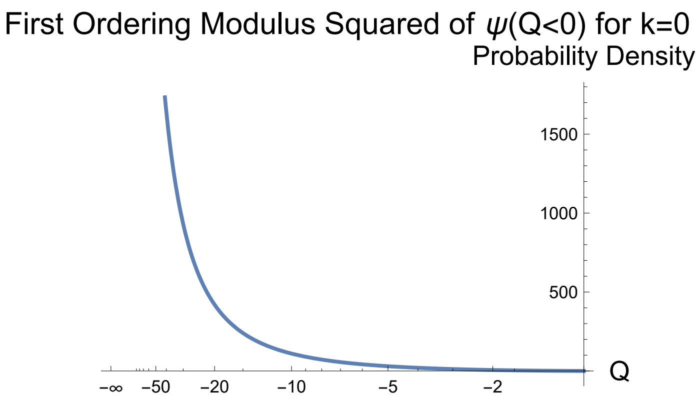
$$\left\{\left\{y[Q] \to Q^{1/4}\, \mathbb{c}_1 + Q^{3/4}\, \mathbb{c}_2\right\}\right\}$$

In[∘]:=
```
(*Which then has to be multiplied by Q^(1/4) to become the WdW solution:*)
wdwsolutionzerokneg1[Q_, α_, β_] :=
 Q^(1/2) α + Q β
```

In[∘]:=
```
(*This goes to -Infinity regardless of α/β choices*)
(*Now let's look at positive Q:*)

Plot[Abs[wdwsolutionzerokneg1[Q, 1, 1]]^2, {Q, -Infinity, 0},
 AxesLabel → {Style["Q", Black, 14], Style["Probability Density", Black, 14]},
 PlotLabel → Style["First Ordering Modulus Squared of ψ(Q<0) for k=0", Black, 16],
 AxesStyle → Directive[Black, Thickness[0.0009]]]
```

Out[∘]=




```
(*Self-adjoint Wheeler-deWitt equation for ordering 1:*)
(*-y''[Q]-(3/(16Q^2)+(8πρQ)/3)y[Q]==-k y[Q]*)
(*For k=0 this becomes:*)
```

In[∘]:=
```
DSolve[-y''[Q] - (3 / (16 Q^2) + (8 π × A) / (3 Q)) y[Q] == 0, y[Q], Q]
```

Out[∘]=

$$\left\{\left\{y[Q] \to e^{4\, i\, \sqrt{A}\, \sqrt{\frac{2\pi}{3}}\, \sqrt{Q}}\, Q^{1/4}\, \mathbb{c}_1 + \frac{i\, e^{-4\, i\, \sqrt{A}\, \sqrt{\frac{2\pi}{3}}\, \sqrt{Q}}\, \sqrt{\frac{3}{2\pi}}\, Q^{1/4}\, \mathbb{c}_2}{4\, \sqrt{A}}\right\}\right\}$$

In[ ]:=
```
(*Which then has to be multiplied by Q^(1/4) to become the WdW solution:*)
wdwsolutionzerokpos1[Q_, α_, β_] :=
```

$$e^{4 i \sqrt{A} \sqrt{\frac{2\pi}{3}} \sqrt{Q}} Q^{1/2} \alpha + \frac{i e^{-4 i \sqrt{A} \sqrt{\frac{2\pi}{3}} \sqrt{Q}} \sqrt{\frac{3}{2\pi}} Q^{1/2} \beta}{4 \sqrt{A}}$$

```
(*Since both terms have a complex exponent,
the limit to infinity will not go to 0, the fubction remains cyclic.*)
(*As a conclusion, this wavefunction cannot be normalised.*)
```

In[ ]:=
```
Limit[wdwsolutionzerokpos1[Q, 1, 1] /. A → 1, Q → Infinity]
```

Out[ ]=
```
Indeterminate
```

In[ ]:=
```
Plot[Abs[wdwsolutionzerokpos1[Q, 1, 1]]^2 /. A → 1, {Q, 0, Infinity},
 AxesLabel → {Style["Q", Black, 14], Style["Probability Density", Black, 14]},
 PlotLabel → Style["First Ordering Modulus Squared of ψ(Q>0) for k=0", Black, 16],
 AxesStyle → Directive[Black, Thickness[0.0009]]]
```

Out[ ]=