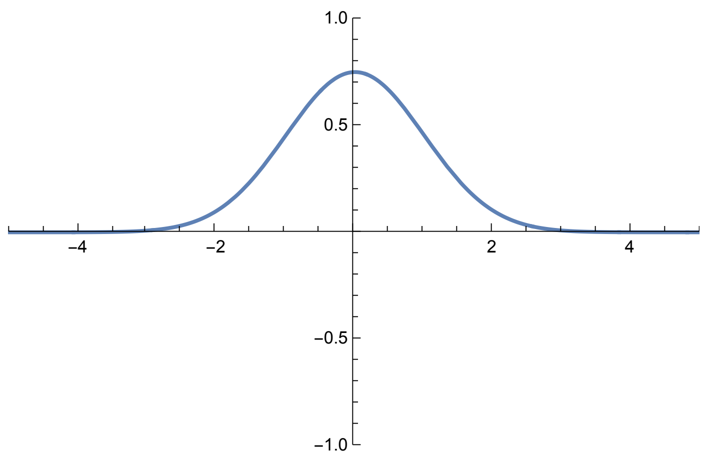
First we need to normalize the 0th and 1th wave functions by determining c_0 and c_1. These just come from doing normalization integrals.

Here is c_0 and $\psi_0(x)$:

In[31]:=
```
cnot = 1 / Pi^(1/4); psinot[x_] := cnot * Exp[-x^2 / 2]
```

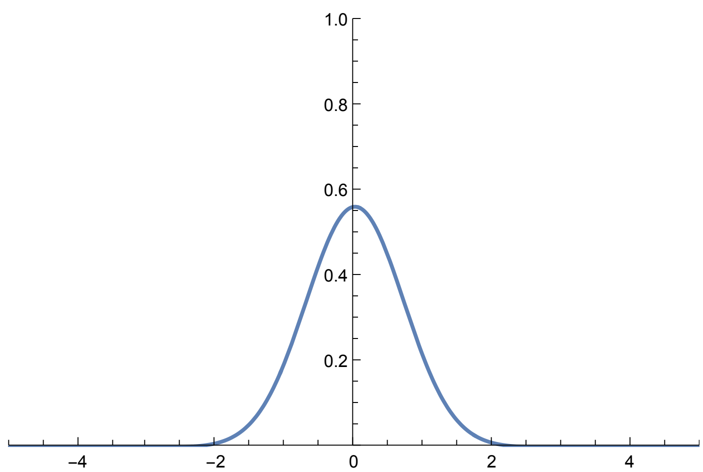
In[53]:=
```
Plot[psinot[x], {x, -5, 5}, PlotRange → {{-5, 5}, {-1, 1}}]
```

Out[53]=



In[32]:=
```
Plot[psinot[x]^2, {x, -5, 5}, PlotRange → {{-5, 5}, {0, 1}}]
```

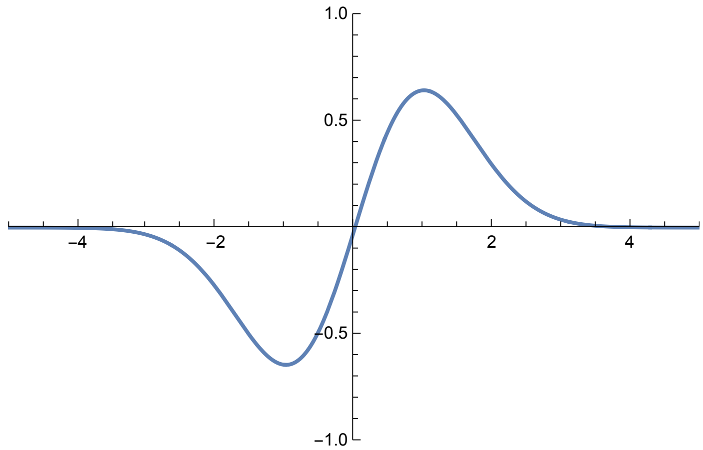
Out[32]=



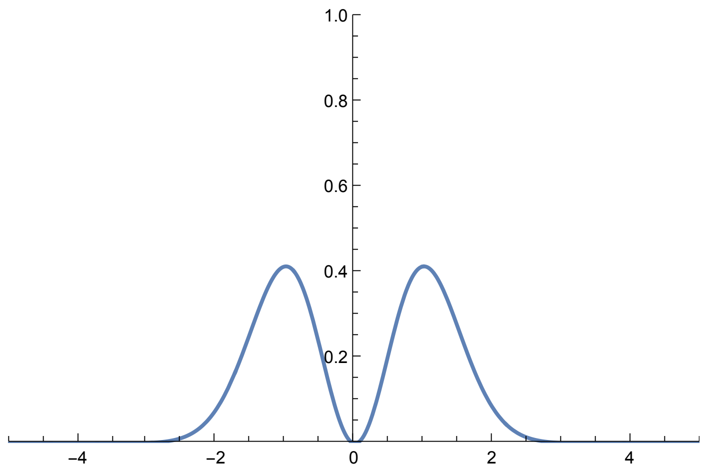
Here is c_1 and $\psi_1(x)$:

In[33]:=
```
cone = 2^(1/2) / Pi^(1/4); psione[x_] := cone * x * Exp[-x^2 / 2]
```

In[54]:=
```
Plot[psione[x], {x, -5, 5}, PlotRange → {{-5, 5}, {-1, 1}}]
```
Out[54]=



In[55]:=
```
Plot[psione[x]^2, {x, -5, 5}, PlotRange → {{-5, 5}, {0, 1}}]
```
Out[55]=



What are we going to do next?

We have $\psi_0(x)$ and $\psi_1(x)$ and now we need to make the combination

$$\psi(x, t) = \frac{e^{-i E_0 t/\hbar}\,\psi_0(x) + e^{-i E_1 t/\hbar}\,\psi_1(x)}{\sqrt{2}}$$

But that is a probability amplitude. To understand the probability, we also have to take absolute-value sqared of this thing, which means we first have to turn

$$e^{-i E_0 t/\hbar} = \cos\frac{E_0 t}{\hbar} - i \sin\frac{E_0 t}{\hbar}$$

$$e^{-i E_1 t/\hbar} = \cos\frac{E_1 t}{\hbar} - i \sin\frac{E_1 t}{\hbar}$$

and then take the real and imaginary parts of the combinations and square them.

The upshot is

$$|\psi(x,t)|^2 = \left[\cos\frac{E_0 t}{\hbar}\,\psi_0(x) + \cos\frac{E_1 t}{\hbar}\,\psi_1(x)\right]^2 + \left[\sin\frac{E_0 t}{\hbar}\,\psi_0(x) + \sin\frac{E_1 t}{\hbar}\,\psi_1(x)\right]^2$$

```
enot = 1 / 2; eone = 3 / 2;
```

```
In[44]:= timeDependentProbability[x_, t_] :=
  ((Cos[enot * t] * psinot[x] + Cos[eone * t] * psione[x])^2 +
     (Sin[enot * t] * psinot[x] + Sin[eone * t] * psione[x])^2) / 2
```

```
In[45]:= Plot[timeDependentProbability[x, 0], {x, -5, 5}, PlotRange → {{-5, 5}, {0, 1}}]
```

In[52]:=
```
Animate[Plot[timeDependentProbability[x, t],
   {x, -5, 5}, PlotRange → {{-5, 5}, {0, 1}}], {t, 0, 4 * Pi}]
```

Out[52]=