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In[1579]:= ClearAll["Global`*"]
           Raising[n_] =  $\sqrt{n+1}$  Ket[ $\psi_{n+1}$ ];
           Lowering[n_] = If[n > 0,  $\sqrt{n}$  Ket[ $\psi_{n-1}$ ], 0];
           doit[n_] = Lowering[n] + Raising[n];

In[1423]:= doit[0]
Out[1423]=  $|\psi_1\rangle$ 

In[1424]:= doit[1]
Out[1424]=  $|\psi_0\rangle + \sqrt{2} |\psi_2\rangle$ 

In[1425]:= FullSimplify[doit[0] +  $\sqrt{2}$  * doit[2]]
Out[1425]=  $3 |\psi_1\rangle + \sqrt{6} |\psi_3\rangle$ 

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## How to use:

These functions were written by Kelvin in order to make the raising ( $a^\dagger$ ) and lowering operators ( $a$ ) a little easier to use. You should learn how to use them mechanically by hand before using it in mathematica.

you can use the “doit[n]” function to a certain state but don’t forget to multiply it by the coefficient and use “FullSimplify[]” to get the correct final expression.

Good luck! :)