In[111]:=
```
sigma[x_] = ((2 * (muz + g x) * nu) / (K * (nu + muz + g x)))^0.5
g[x_] = -(T x / (2 * (nu + muz + g x))) +
  T (((2 * nu / (K))^0.5) * ((muz + g x)^0.5 / (muz + nu + g x)^0.5) *
      ((sinh[x / sigma[x]]) / (cosh[L / sigma[x]])))) / (2 * (muz + nu + g x))

g'[x_]
g''[x_]
```

Out[111]=
$$1.41421 \left(\frac{nu\ (muz + g\ x)}{K\ (muz + nu + g\ x)}\right)^{0.5}$$

Out[112]=
$$-\frac{T\ x}{2\ (muz + nu + g\ x)} + \frac{0.707107 \left(\frac{nu}{K}\right)^{0.5} T\ (muz + g\ x)^{0.5} \sinh\left[\frac{0.707107\ x}{\left(\frac{nu\ (muz+g\ x)}{K\ (muz+nu+g\ x)}\right)^{0.5}}\right]}{(muz + nu + g\ x)^{1.5} \cosh\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x)}{K\ (muz+nu+g\ x)}\right)^{0.5}}\right]}$$

Out[113]=
$$\frac{g\ T\ x\_}{2\ (muz + nu + g\ x\_)^2} - \frac{T}{2\ (muz + nu + g\ x\_)} - \frac{1.06066\ g \left(\frac{nu}{K}\right)^{0.5} T\ (muz + g\ x\_)^{0.5} \sinh\left[\frac{0.707107\ x\_}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]}{\cosh\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]\ (muz + nu + g\ x\_)^{2.5}} +$$

$$\frac{0.353553\ g \left(\frac{nu}{K}\right)^{0.5} T \sinh\left[\frac{0.707107\ x\_}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]}{\cosh\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]\ (muz + g\ x\_)^{0.5}\ (muz + nu + g\ x\_)^{1.5}} +$$

$$\left(0.25\ L \left(\frac{nu}{K}\right)^{0.5} T\ (muz + g\ x\_)^{0.5} \left(-\frac{g\ nu\ (muz + g\ x\_)}{K\ (muz + nu + g\ x\_)^2} + \frac{g\ nu}{K\ (muz + nu + g\ x\_)}\right)\right.$$

$$\left.\sinh\left[\frac{0.707107\ x\_}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right] \cosh'\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]\right) /$$

$$\left(\cosh\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]^2 \left(\frac{nu\ (muz + g\ x\_)}{K\ (muz + nu + g\ x\_)}\right)^{1.5} (muz + nu + g\ x\_)^{1.5}\right) +$$

$$\left(0.707107 \left(\frac{nu}{K}\right)^{0.5} T\ (muz + g\ x\_)^{0.5}\right.$$

$$\left.\left(\frac{0.707107}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}} - \frac{0.353553\ x\_ \left(-\frac{g\ nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)^2} + \frac{g\ nu}{K\ (muz+nu+g\ x\_)}\right)}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{1.5}}\right) \sinh'\left[\frac{0.707107\ x\_}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]\right) /$$

$$\left(\cosh\left[\frac{0.707107\ L}{\left(\frac{nu\ (muz+g\ x\_)}{K\ (muz+nu+g\ x\_)}\right)^{0.5}}\right]\ (muz + nu + g\ x\_)^{1.5}\right)$$

Out[114]=

$$-\frac{g^2\,T\,x\_}{(muz+nu+g\,x\_)^3}+\frac{g\,T}{(muz+nu+g\,x\_)^2}+\frac{2.65165\,g^2\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]}{\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right](muz+nu+g\,x\_)^{3.5}}-$$

$$\frac{1.06066\,g^2\left(\frac{nu}{K}\right)^{0.5}T\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]}{\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right](muz+g\,x\_)^{0.5}(muz+nu+g\,x\_)^{2.5}}-$$

$$\frac{0.176777\,g^2\left(\frac{nu}{K}\right)^{0.5}T\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]}{\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right](muz+g\,x\_)^{1.5}(muz+nu+g\,x\_)^{1.5}}+$$

$$\left(0.25\,L\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(\frac{2\,g^2\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^3}-\frac{2\,g^2\,nu}{K\,(muz+nu+g\,x\_)^2}\right)\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^2\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}(muz+nu+g\,x\_)^{1.5}\right)-$$

$$\left(0.75\,g\,L\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^2\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}(muz+nu+g\,x\_)^{2.5}\right)+$$

$$\left(0.25\,g\,L\left(\frac{nu}{K}\right)^{0.5}T\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^2(muz+g\,x\_)^{0.5}\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}(muz+nu+g\,x\_)^{1.5}\right)-$$

$$\left(0.375\,L\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)^{2}\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Bigg/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^{2}\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{2.5}(muz+nu+g\,x\_)^{1.5}\right)+$$

$$\left(0.176777\,L^{2}\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)^{2}\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^{2}\right)\Bigg/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^{3}\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{3.}(muz+nu+g\,x\_)^{1.5}\right)-$$

$$\left(2.12132\,g\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\right.$$

$$\left.\left(\frac{0.707107}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}-\frac{0.353553\,x\_\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}\right)\sinh'\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Bigg/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right](muz+nu+g\,x\_)^{2.5}\right)+$$

$$\left(0.707107\,g\left(\frac{nu}{K}\right)^{0.5}T\left(\frac{0.707107}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}-\frac{0.353553\,x\_\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}\right)\right.$$

$$\left.\sinh'\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Bigg/\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right](muz+g\,x\_)^{0.5}(muz+nu+g\,x\_)^{1.5}\right)+$$

$$\left(0.707107\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{0.353553\,x\_\left(\frac{2\,g^{2}\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{3}}-\frac{2\,g^{2}\,nu}{K\,(muz+nu+g\,x\_)^{2}}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}-\right.\right.$$

$$\left.\left.\frac{0.707107\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}+\frac{0.53033\,x\_\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^{2}}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)^{2}}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{2.5}}\right)$$

$$\sinh'\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\Big/\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\,(muz+nu+g\,x\_)^{1.5}\right)+$$

$$\left(0.5\,L\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)\right.$$

$$\left.\left(\frac{0.707107}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}-\frac{0.353553\,x\_\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}\right)\right.$$

$$\left.\cosh'\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\sinh'\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^2\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}(muz+nu+g\,x\_)^{1.5}\right)-$$

$$\left(0.0883883\,L^2\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)^2\right.$$

$$\left.\sinh\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\cosh''\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/$$

$$\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]^2\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{3.}(muz+nu+g\,x\_)^{1.5}\right)+\left(0.707107\right.$$

$$\left.\left(\frac{nu}{K}\right)^{0.5}T\,(muz+g\,x\_)^{0.5}\left(\frac{0.707107}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}-\frac{0.353553\,x\_\left(-\frac{g\,nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)^2}+\frac{g\,nu}{K\,(muz+nu+g\,x\_)}\right)}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{1.5}}\right)^2\right.$$

$$\left.\sinh''\left[\frac{0.707107\,x\_}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\right)\Big/\left(\cosh\left[\frac{0.707107\,L}{\left(\frac{nu\,(muz+g\,x\_)}{K\,(muz+nu+g\,x\_)}\right)^{0.5}}\right]\,(muz+nu+g\,x\_)^{1.5}\right)$$