

$$\begin{aligned}
\text{In}[115] := & \text{sigma}[x_]= \left((2 * (\text{muz} + g x) * \text{nu}) / (K * (\text{nu} + \text{muz} + g x)) \right) ^{0.5} \\
& f[x_]= - \left(T x / (2 * (\text{nu} + \text{muz} + g x)) \right) - \\
& T \left(\left((2 / (K * \text{nu})) ^{0.5} \right) * \left((\text{muz} + g x) ^{1.5} / (\text{muz} + \text{nu} + g x) ^{0.5} \right) * \right. \\
& \quad \left. \left((\sinh[x / \text{sigma}[x]]) / (\cosh[L / \text{sigma}[x]]) \right) \right) / (2 * (\text{muz} + \text{nu} + g x)) \\
& f'[x_]= \\
& f''[x_]=
\end{aligned}$$

$$\text{Out}[115]= 1.41421 \left(\frac{\text{nu} (\text{muz} + g x)}{K (\text{muz} + \text{nu} + g x)} \right)^{0.5}$$

$$\text{Out}[116]= - \frac{T x}{2 (\text{muz} + \text{nu} + g x)} - \frac{0.707107 \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x)^{1.5} \sinh \left[\frac{0.707107 x}{\left(\frac{\text{nu} (\text{muz} + g x)}{K (\text{muz} + \text{nu} + g x)} \right)^{0.5}} \right]}{(\text{muz} + \text{nu} + g x)^{1.5} \cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x)}{K (\text{muz} + \text{nu} + g x)} \right)^{0.5}} \right]}$$

$$\text{Out}[117]= \frac{g T x_}{2 (\text{muz} + \text{nu} + g x_)^2} - \frac{T}{2 (\text{muz} + \text{nu} + g x_)} + \frac{1.06066 g \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_)^{1.5} \sinh \left[\frac{0.707107 x}{\left(\frac{\text{nu} (\text{muz} + g x_)}{K (\text{muz} + \text{nu} + g x_)} \right)^{0.5}} \right]}{\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_)}{K (\text{muz} + \text{nu} + g x_)} \right)^{0.5}} \right] (\text{muz} + \text{nu} + g x_)^{2.5}}$$

$$\frac{1.06066 g \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_)^{0.5} \sinh \left[\frac{0.707107 x}{\left(\frac{\text{nu} (\text{muz} + g x_)}{K (\text{muz} + \text{nu} + g x_)} \right)^{0.5}} \right]}{\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_)}{K (\text{muz} + \text{nu} + g x_)} \right)^{0.5}} \right] (\text{muz} + \text{nu} + g x_)^{1.5}} -$$

$$\left(0.25 L \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_)^{1.5} \left(- \frac{g \text{nu} (\text{muz} + g x_)}{K (\text{muz} + \text{nu} + g x_)^2} + \frac{g \text{nu}}{K (\text{muz} + \text{nu} + g x_)} \right) \right)$$

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

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

$$\left(0.707107 \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_)^{1.5} \right)$$

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

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

$$\begin{aligned}
\text{Out}[118] = & - \frac{g^2 T x_-}{(\text{muz} + \text{nu} + g x_-)^3} + \frac{g T}{(\text{muz} + \text{nu} + g x_-)^2} - \frac{2.65165 g^2 \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]}{\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] (\text{muz} + \text{nu} + g x_-)^{3.5}} + \\
& \frac{3.18198 g^2 \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_-)^{0.5} \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]}{\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] (\text{muz} + \text{nu} + g x_-)^{2.5}} - \\
& \frac{0.53033 g^2 \left(\frac{1}{K \text{nu}} \right)^{0.5} T \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]}{\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] (\text{muz} + g x_-)^{0.5} (\text{muz} + \text{nu} + g x_-)^{1.5}} - \\
& \left(0.25 L \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \left(\frac{2 g^2 \text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)^3} - \frac{2 g^2 \text{nu}}{K (\text{muz} + \text{nu} + g x_-)^2} \right) \right. \\
& \left. \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \cosh' \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \right) / \\
& \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]^2 \left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{1.5} (\text{muz} + \text{nu} + g x_-)^{1.5} \right) + \\
& \left(0.75 g L \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \left(- \frac{g \text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)^2} + \frac{g \text{nu}}{K (\text{muz} + \text{nu} + g x_-)} \right) \right. \\
& \left. \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \cosh' \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \right) / \\
& \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]^2 \left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{1.5} (\text{muz} + \text{nu} + g x_-)^{2.5} \right) - \\
& \left(0.75 g L \left(\frac{1}{K \text{nu}} \right)^{0.5} T (\text{muz} + g x_-)^{0.5} \left(- \frac{g \text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)^2} + \frac{g \text{nu}}{K (\text{muz} + \text{nu} + g x_-)} \right) \right. \\
& \left. \sinh \left[\frac{0.707107 x_-}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \cosh' \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right] \right) / \\
& \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{0.5}} \right]^2 \left(\frac{\text{nu} (\text{muz} + g x_-)}{K (\text{muz} + \text{nu} + g x_-)} \right)^{1.5} (\text{muz} + \text{nu} + g x_-)^{1.5} \right) +
\end{aligned}$$

$$\begin{aligned}
& \left(0.375 L \left(\frac{1}{K \nu} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)^2 \right. \\
& \quad \left. \sinh \left[\frac{0.707107 x_-}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] \cosh' \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] \right) / \\
& \quad \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right]^2 \left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{2.5} (\text{muz} + \nu + g x_-)^{1.5} \right) - \\
& \quad \left(0.176777 L^2 \left(\frac{1}{K \nu} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)^2 \right. \\
& \quad \left. \sinh \left[\frac{0.707107 x_-}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] \cosh' \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right]^2 \right) / \\
& \quad \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right]^3 \left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{3.5} (\text{muz} + \nu + g x_-)^{1.5} \right) + \\
& \quad \left(2.12132 g \left(\frac{1}{K \nu} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \right. \\
& \quad \left(\frac{0.707107}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} - \frac{0.353553 x_- \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{1.5}} \right) \sinh' \left[\frac{0.707107 x_-}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] \right) / \\
& \quad \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] (\text{muz} + \nu + g x_-)^{2.5} \right) - \left(2.12132 g \left(\frac{1}{K \nu} \right)^{0.5} T (\text{muz} + g x_-)^{0.5} \right. \\
& \quad \left(\frac{0.707107}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} - \frac{0.353553 x_- \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{1.5}} \right) \sinh' \left[\frac{0.707107 x_-}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] \right) / \\
& \quad \left(\cosh \left[\frac{0.707107 L}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{0.5}} \right] (\text{muz} + \nu + g x_-)^{1.5} \right) - \\
& \quad \left(0.707107 \left(\frac{1}{K \nu} \right)^{0.5} T (\text{muz} + g x_-)^{1.5} \left(-\frac{0.353553 x_- \left(\frac{2 g^2 \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^3} - \frac{2 g^2 \nu}{K (\text{muz} + \nu + g x_-)^2} \right)}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{1.5}} - \right. \right. \\
& \quad \left. \frac{0.707107 \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{1.5}} + \frac{0.53033 x_- \left(-\frac{g \nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)^2} + \frac{g \nu}{K (\text{muz} + \nu + g x_-)} \right)^2}{\left(\frac{\nu (\text{muz} + g x_-)}{K (\text{muz} + \nu + g x_-)} \right)^{2.5}} \right)
\end{aligned}$$

$$\begin{aligned}
& \sinh' \left[\frac{0.707107 x_-}{\left(\frac{nu (muz+g x_-)}{K (muz+nu+g x_-)} \right)^{0.5}} \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_-)^{1.5} \right) - \\
& \left(0.5 L \left(\frac{1}{K nu} \right)^{0.5} T (muz + g x_-)^{1.5} \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) \\
& \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] \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)^{1.5} (muz + nu + g x_-)^{1.5} \right) + \\
& \left(0.0883883 L^2 \left(\frac{1}{K nu} \right)^{0.5} T (muz + g x_-)^{1.5} \left(-\frac{g nu (muz + g x_-)}{K (muz + nu + g x_-)^2} + \frac{g nu}{K (muz + nu + g x_-)} \right) \right)^2 \\
& \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] \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)^3 (muz + nu + g x_-)^{1.5} \right) - \\
& \left(0.707107 \left(\frac{1}{K nu} \right)^{0.5} T (muz + g x_-)^{1.5} \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)^2 \right) \\
& \sinh'' \left[\frac{0.707107 x_-}{\left(\frac{nu (muz+g x_-)}{K (muz+nu+g x_-)} \right)^{0.5}} \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_-)^{1.5} \right)
\end{aligned}$$