$$\left(8\mu^2\left(\mu-\tfrac{\Delta v}{2\rho}\right)+6\mu\sqrt{\mu-\tfrac{\Delta v}{2\rho}}+1\right)\mu\left(\mu-\tfrac{\Delta v}{2\rho}\right)-\tfrac{\mu^2}{\sigma_x^2}\left(2\mu\sqrt{\mu+\Delta v/2\rho}+1\right)=4\left(\mu\sqrt{\mu+\tfrac{\Delta v}{2\rho}}+1\right)$$

$$8\mu^3\left(\mu-\tfrac{\Delta v}{2\rho}\right)^2+6\mu^2\left(\mu-\tfrac{\Delta v}{2\rho}\right)\sqrt{\mu-\Delta v/2\rho}+\mu\left(\mu-\tfrac{\Delta v}{2\rho}\right)-\tfrac{\mu^2}{\sigma_x^2}\left(2\mu\sqrt{\mu+\Delta v/2\rho}\right)-4\mu\sqrt{\mu+\tfrac{\Delta v}{2\rho}}^{-1}=4+\tfrac{\mu^2}{\sigma_x^2}$$

$$8\mu^3\left(\mu-\tfrac{\Delta v}{2\rho}\right)^2+6\mu^2\left(\mu-\tfrac{\Delta v}{2\rho}\right)\sqrt{\mu-\tfrac{\Delta v}{2\rho}}+\mu\left(\mu-\tfrac{\Delta v}{2\rho}\right)-2\mu\sqrt{\mu+\Delta v/2\rho}\left(\tfrac{1}{\sigma_x^2}+2\right)=4+\tfrac{\mu^2}{\sigma_x^2}$$

$$4\mu^2\left(\mu-\tfrac{\Delta v}{2\rho}\right)^{3/2}+3\mu\left(\mu-\tfrac{\Delta v}{2\rho}\right)+\tfrac{1}{2}\left(\mu-\tfrac{\Delta v}{2\rho}\right)^{1/2}-\left(\tfrac{1}{\sigma_x^2}+2\right)=\left(4+\tfrac{\mu^2}{\sigma_x^2}\right)\cdot\left(\mu-\tfrac{\Delta v}{2\rho}\right)^{-1/2}$$

$$\tfrac{1}{2}\left(\mu-\tfrac{\Delta v}{2\rho}\right)^{1/2}\left[8\mu^2\left(\mu-\tfrac{\Delta v}{2\rho}\right)^2+6\mu\left(\mu-\tfrac{\Delta v}{2\rho}\right)+1\right]-\left(\tfrac{1}{\sigma_x^2}+2\right)=\left(4+\tfrac{\mu^2}{\sigma_x^2}\right)\left(\mu-\tfrac{\Delta v}{2\rho}\right)^{-1/2}$$

QED

$$\sqrt{\mu-\Delta v/2\rho}-\frac{1}{\mu}=\pm\frac{1}{2\sigma_x}$$