$$\frac{1}{\pi\cdot\tau_2}\cdot\int_{-\infty}^{\infty}\frac{1}{\frac{1}{\tau_2^{\,2}}+(\omega-\omega_0)^2}\,d\omega\ \text{assume},\tau_2>0\ \rightarrow -\frac{\tau_2\cdot\operatorname{atan}\left[\tau_2\cdot(\omega_0-\infty)\right]-\tau_2\cdot\operatorname{atan}\left[\tau_2\cdot(\omega_0+\infty)\right]}{\pi\cdot\tau_2}$$

$$\lim_{b\to\infty}\left[\frac{1}{\pi\cdot\tau_2}\cdot\int_{-b}^{b}\frac{1}{\frac{1}{\tau_2^{\,2}}+(\omega-\omega_0)^2}\,d\omega\right]\ \left|\begin{array}{l}\text{assume},\tau_2>0\\ \text{simplify}\end{array}\right.\rightarrow$$

$$\frac{1}{\pi\cdot\tau_2}\cdot\int\frac{1}{\frac{1}{\tau_2^{\,2}}+(\omega-\omega_0)^2}\,d\omega\ \text{simplify}\ \rightarrow\frac{\operatorname{atan}\left(\frac{\omega-\omega_0}{\sqrt{\frac{1}{\tau_2^{\,2}}}}\right)}{\pi\cdot\tau_2\cdot\sqrt{\frac{1}{\tau_2^{\,2}}}}$$