c) $T_{HP}(s) = \dfrac{s^2}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2} \Rightarrow T(z) = T(s)\Big|_{s \to k\frac{z-1}{z+1}}$

$$T_{HP}(z) = \frac{K^2\left(\frac{z-1}{z+1}\right)^2}{K^2\frac{(z-1)^2}{(z+1)^2} + \frac{\omega_0 K}{Q}\cdot\frac{z-1}{z+1} + \omega_0^2} = \frac{K^2(z-1)^2}{K^2\left[(z-1)^2 + \frac{\omega_0}{QK}(z-1)(z+1) + \frac{\omega_0^2}{K^2}(z+1)^2\right]}$$

$$T_{HP}(z) = \frac{(z-1)^2}{z^2\left[1 + \frac{\omega_0}{QK} + \frac{\omega_0^2}{K^2}\right] + z\cdot\left[2\frac{\omega_0}{K^2} - 2\right] + \left[1 + \frac{\omega_0^2}{K^2} - \frac{\omega_0}{QK}\right]}$$