8.3.

1. $V = V_+ e^{-j\beta z} + V_+ |\rho| e^{j(\theta_\rho + \beta z)}$

$= V_+ e^{-j\beta z} + V_+ |\rho| e^{j\theta_\rho/2} e^{j(\theta_\rho/2 + \beta z)}$

$= V_+ e^{-j\beta z} + V_+ |\rho| e^{j\theta_\rho/2} e^{j(\theta_\rho/2+\beta z)} + V_+ |\rho| e^{j\theta_\rho/2} e^{-j(\theta_\rho/2+\beta z)} - V_+ |\rho| e^{-j\beta z}$

$= V_+ |\rho| e^{j\theta_\rho/2} \left(e^{j(\theta_\rho/2 + \beta z)} + e^{-j(\theta_\rho/2 + \beta z)}\right) + (1-|\rho|) V_+ e^{-j\beta z}$

$= V_+ |\rho| e^{j\theta_\rho/2} (2\cosh(j(\theta_\rho/2 + \beta z))) + (1-|\rho|) V_+ e^{-j\beta z}$

$$= \underbrace{2 V_+ |\rho| e^{j\theta_\rho/2} \cos(\theta_\rho/2 + \beta z)}_{\text{Standing wave}} + \underbrace{(1-|\rho|) V_+ e^{-j\beta z}}_{\text{travelling wave}}$$

$V(z,t) = Re[V(z) e^{j\omega t}]$

$= Re[(2V_+|\rho| e^{j\theta_\rho/2} \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ e^{-j\beta z}) e^{j\omega t}]$

$= Re[2V_+ |\rho| e^{j(\theta_\rho/2 + \omega t)} \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ e^{j(\omega t - \beta z)}]$

$= Re[2V_+|\rho|(\cos(\theta_\rho/2 + \omega t) + j\sin(\theta_\rho/2 + \omega t)) \cos(\theta_\rho/2 + \beta z)$
$+ (1-|\rho|) V_+ (\cos(\omega t - \beta z) + j\sin(\omega t - \beta z))]$

$= 2V_+ |\rho| \cos(\theta/2 + \omega t) \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ \cos(\omega t - \beta z)$

$\omega t = \omega t_1 + \pi/4$

$\omega t_1 = -\theta_\rho/2 \rightarrow \omega t = \pi/4 - \theta_\rho/2$

$V(z,t) = 2V_+ |\rho| \cos(\theta/2 + \pi/4 - \theta_\rho/2) \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ \cos(\pi/4 - \theta_\rho/2 - \beta z)$

$= 2V_+ |\rho| \cos(\pi/4) \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ \cos(\pi/4 - \theta_\rho/2 - \beta z)$

$= \frac{2}{\sqrt{2}} V_+ |\rho| \cos(\theta_\rho/2 + \beta z) + (1-|\rho|) V_+ \cos(\pi/4 - \theta_\rho/2 - \beta z)$

$* \cos(\pi/4) - \theta_\rho/2 - \beta z) = \cos(\pi/4)\cos(-\theta_\rho/2 - \beta z) - \sin(\pi/4)\sin(-\theta_\rho/2 - \beta z)$

$= \frac{1}{\sqrt{2}} \cos(\theta_\rho/2 + \beta z) + \frac{1}{\sqrt{2}} \sin(\theta_\rho/2 + \beta z)$

$= \frac{1}{\sqrt{2}} V_+ (1+|\rho|) \cos(\theta_\rho/2 + \beta z) + \frac{1}{\sqrt{2}} (1-|\rho|) V_+ \sin(\theta_\rho/2 + \beta z)$

$|\rho| = \frac{1}{2}$

$$V(z,t) = \frac{1}{\sqrt{2}} V_+ \left(1 + \frac{1}{2}\right) \cos\left(\frac{\theta_\rho}{2} + \beta z\right) + \frac{1}{\sqrt{2}} \left(1 - \frac{1}{2}\right) V_+ \sin\left(\theta_\rho/2 + \beta z\right)$$

$$= \frac{3}{2\sqrt{2}} V_+ \cos\left(\frac{\theta_\rho}{2} + \beta z\right) + \frac{1}{2\sqrt{2}} V_+ \sin\left(\theta_\rho/2 + \beta z\right)$$

$$= \frac{3}{2\sqrt{2}} V_+ \left[\cos\left(\frac{\theta_\rho}{2} + \beta z\right) + \frac{1}{3} \sin\left(\frac{\theta_\rho}{2} + \beta z\right)\right]$$