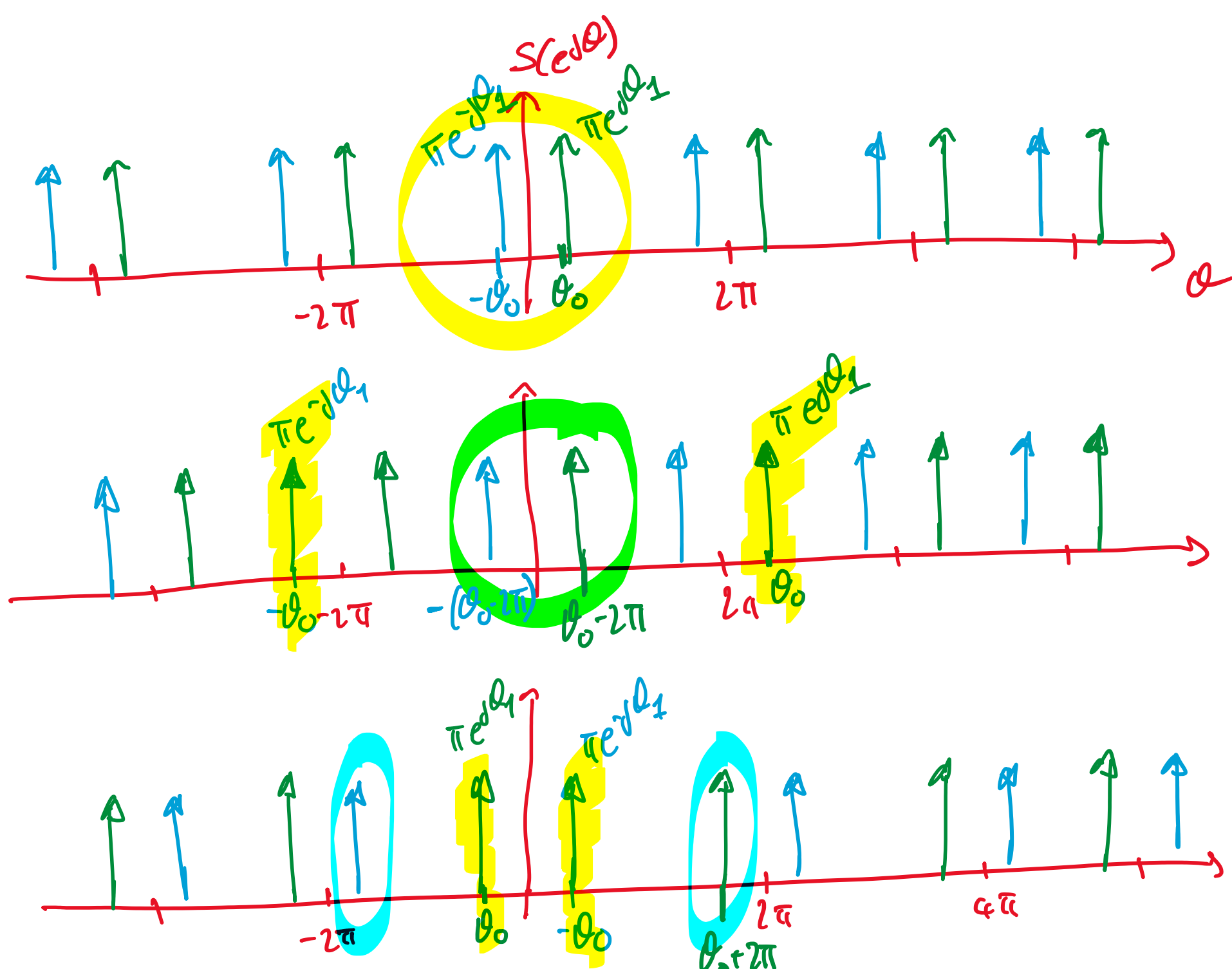


ES 1 TROVARE $S(e^{j\omega})$ PER $s(n) = \cos(\theta_0 n + \theta_1)$
 $= \cos((\theta_0 - 2\pi)n + \theta_1)$

$$s(n) = \frac{e^{j\theta_1}}{2} \cdot e^{j\theta_0 n} + \frac{e^{-j\theta_1}}{2} \cdot e^{-j\theta_0 n}$$

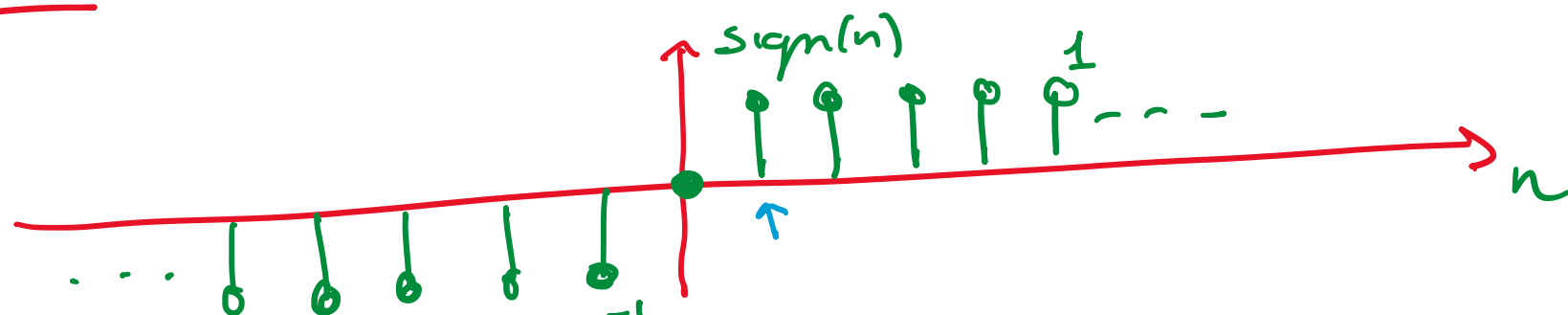
$$S(e^{j\omega}) = \frac{e^{j\theta_1}}{2} \cdot 2\pi \text{comb}_{2\pi}(\theta - \theta_0) + \frac{e^{-j\theta_1}}{2} \cdot 2\pi \text{comb}_{2\pi}(\theta + \theta_0)$$

$$= \pi e^{j\theta_1} \text{comb}_{2\pi}(\theta - \theta_0) + \pi e^{-j\theta_1} \text{comb}_{2\pi}(\theta + \theta_0)$$



- #1 FASE IN $(-\pi, \pi]$
 #2 FASE IN $[0, 2\pi)$

ES 2 TROVARE $S(e^{j\omega})$ PER $s(n) = \text{sign}(n)$



$$y(n) = s(n) - s(n-1) = \delta(n) + \delta(n-1)$$

$$Y(e^{j\omega}) = S(e^{j\omega})(1 - e^{-j\omega}) = 1 + e^{-j\omega}$$

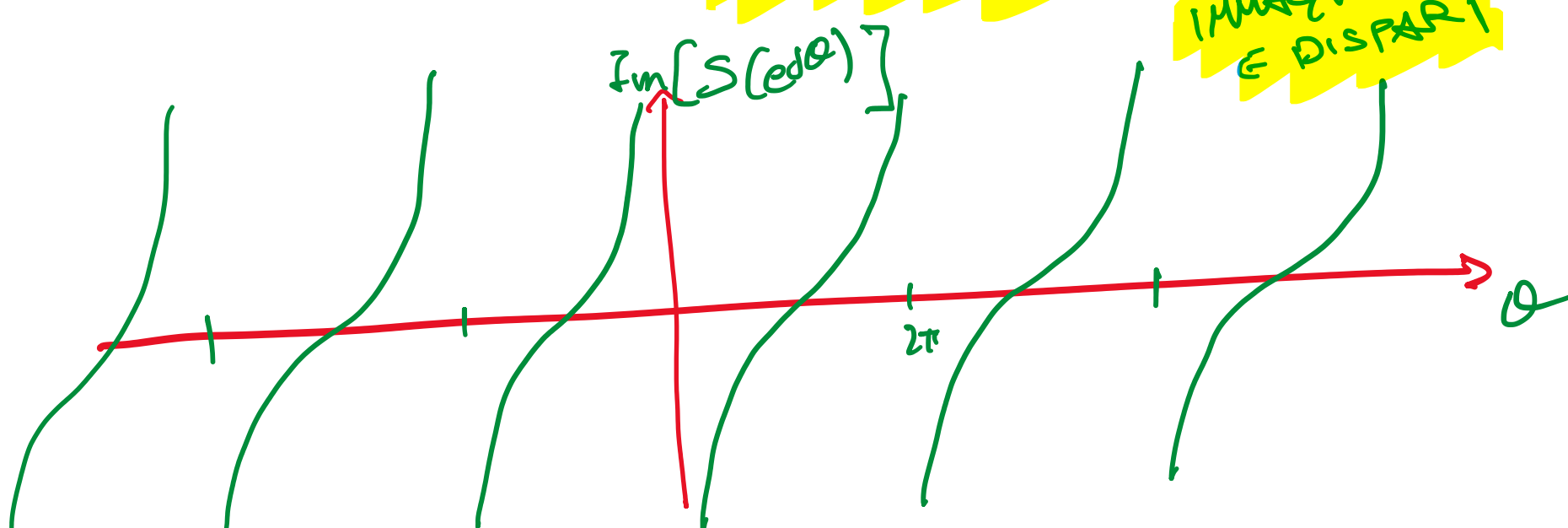
$$= \sum_{n=-\infty}^{+\infty} y(n) e^{-j\omega n}$$

$$S(e^{j\omega}) = \frac{1 + e^{-j\omega}}{1 - e^{-j\omega}} + \cancel{\pi \cdot 2\pi \text{comb}_{2\pi}(\omega)}$$

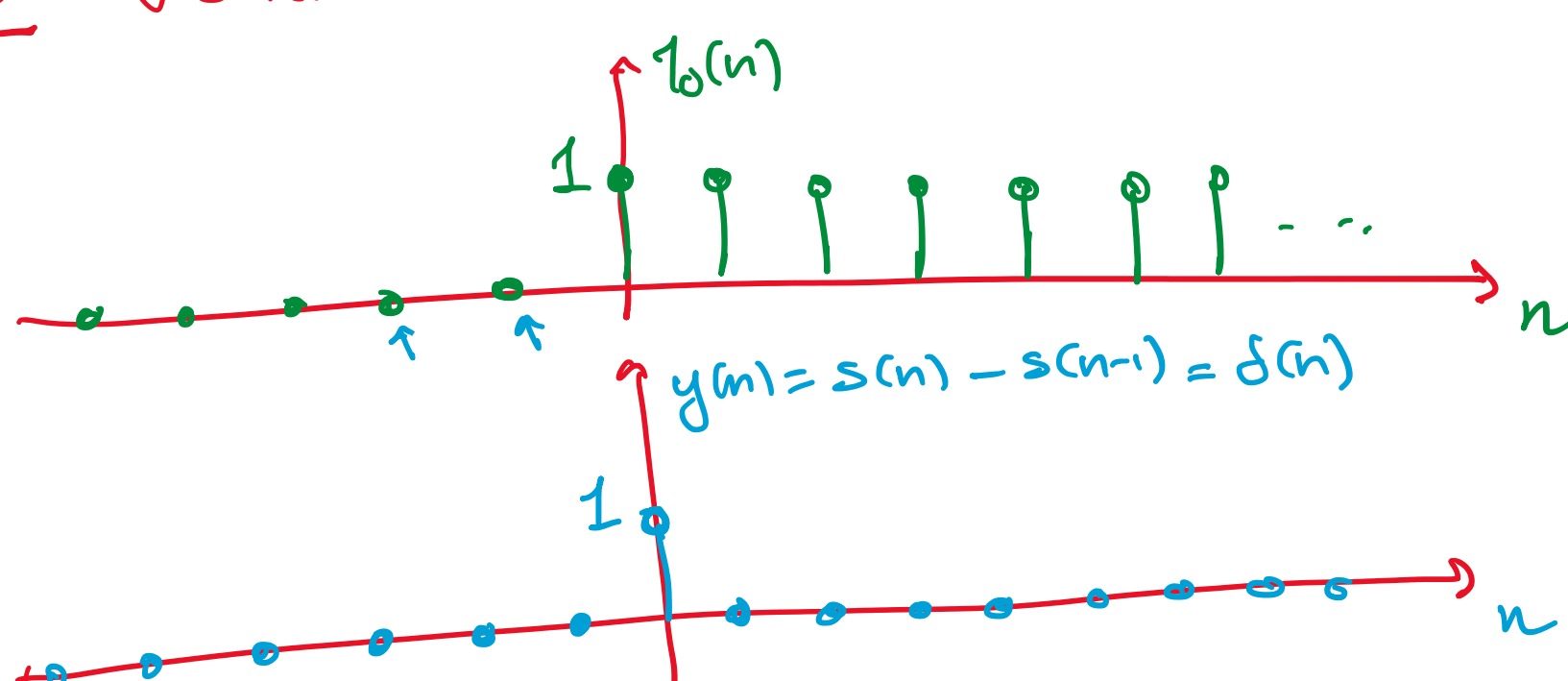
$$= \frac{1 + e^{-j\omega}}{1 - e^{-j\omega}} \cdot \frac{e^{j\omega/2}}{e^{j\omega/2}}$$

$$= \frac{e^{j\omega/2} + e^{-j\omega/2}}{e^{j\omega/2} - e^{-j\omega/2}} = \frac{2 \cos(\omega/2)}{2j \sin(\omega/2)} = \frac{-j}{\sin(\omega/2)}$$

$$= -j \cot(\omega/2)$$



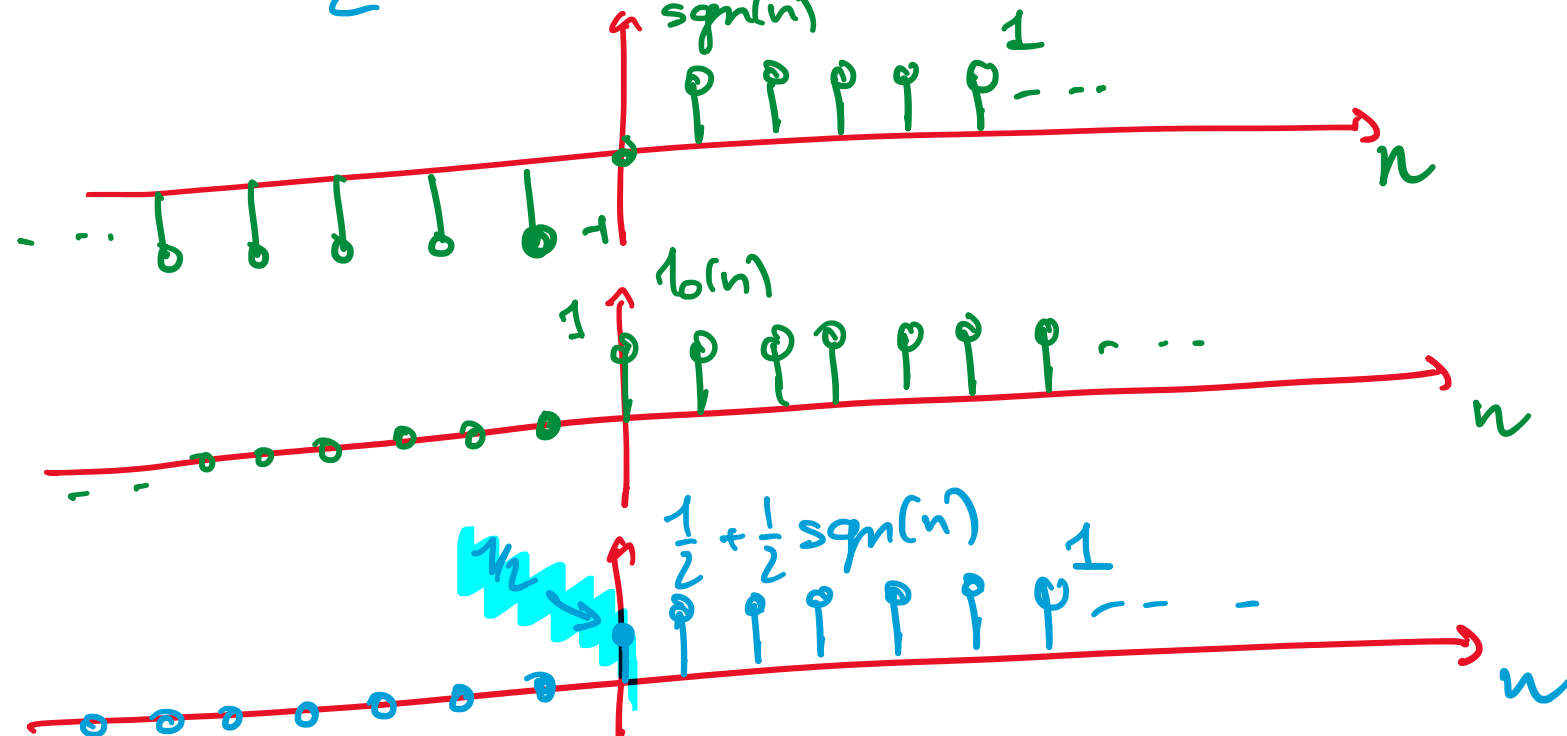
ES 3 TROVARE $S(e^{j\omega})$ PER $s(n) = 1_0(n)$



$$Y(e^{j\omega}) = S(e^{j\omega})(1 - e^{-j\omega}) = 1$$

$$S(e^{j\omega}) = \frac{1}{1 - e^{-j\omega}} + \cancel{\pi \cdot \pi \text{comb}_{2\pi}(\omega)}$$

$$s(n) = 1_0(n) = \frac{1}{2} \text{sgn}(n) + \frac{1}{2} + \frac{1}{2} \delta(n)$$



$$s(n) = \frac{1}{2} \text{sgn}(n) + \frac{1}{2} + \frac{1}{2} \delta(n)$$

$$S(e^{j\omega}) = -\frac{j}{2} \cot(\omega/2) + \frac{1}{2} \cdot 2\pi \text{comb}_{2\pi}(\omega) + \frac{1}{2}$$

$$\frac{1}{2} \frac{1 + e^{-j\omega}}{1 - e^{-j\omega}} + \frac{1}{2} = \frac{1 + e^{-j\omega} + 1 - e^{-j\omega}}{2(1 - e^{-j\omega})} = \frac{1}{1 - e^{-j\omega}}$$