

$$V_R = v \cdot \frac{R}{R + \frac{1}{j\omega C}} = v \frac{Rj\omega C}{1 + jR\omega C}$$

$$V_R = v \cdot (jR\omega C) \cdot \frac{1}{(1 + jR\omega C)}$$

$$\rightarrow |V_R| = |v| \cdot |R\omega C| \cdot \frac{1}{\sqrt{1 + R^2 C^2 \omega^2}}$$

$$\rightarrow \varphi(V_R) = \varphi(v) + \varphi(jR\omega C) + \varphi\left(\frac{1}{1 + jR\omega C}\right)$$

$$\varphi(v) = 30^\circ$$

$$\varphi(jR\omega C) = \text{Arctan}\left(\frac{R\omega C}{0}\right) = \text{Arctan}(\infty) = \pi/2$$

$$\begin{aligned} \varphi\left(\frac{1}{1 + jR\omega C}\right) &= \varphi(1) - \varphi(1 + jR\omega C) \\ &= \text{Arctan}\left(\frac{0}{1}\right) - \text{Arctan}\left(\frac{R\omega C}{1}\right) \\ &= 0 - \text{Arctan } R\omega C \end{aligned}$$