$$f(t) = b e^{-bt}$$

$$\downarrow$$

$$\int_0^\infty f(t) e^{-jwt} \, dt = \int_0^\infty b e^{-bt} e^{-jwt} \, dt$$

$$= b \int_0^\infty e^{-(b+jw)t} \, dt$$

$$u = b + jw$$

$$\Rightarrow F(w) = b \int_0^\infty e^{-ut} \, dt = \frac{-b}{u} \left[e^{-ut} \right]_0^\infty$$

$$= \frac{b}{u} \left[e^{-ut} \right]_\infty^0$$

$$= \frac{b}{u} \left[e^{-0} - e^{-\infty} \right]$$

$$= \frac{b}{u} \left[1 - 0 \right] = b/u$$

$$\Rightarrow F(w) = \frac{b}{b + jw} = \frac{1}{1 + j(w/b)}$$

$$F(w) = \frac{1}{1 + jw\tau}$$

$$|F(w)|^2 = \frac{1}{1+jwt} \frac{1}{1-jw\tau}$$

$$|F| = \sqrt{\frac{1}{1+(w\tau)^2}}$$

$$f(t) = \frac{A_0}{2} + \sum_{n=1}^{\infty} A_n \cos(nt) + B_n \sin(nt)$$

$$f(t_0) = a\int_{-\infty}^{\infty} \delta(t)\, \delta(t-t_0)\, dt$$

$$F(w) = a\int_{-\infty}^{\infty} \delta(t-t_0)\, e^{-jwt}\, dt$$

$$F(w) = a\, e^{-jwt_0}$$

$$|F|^2 = a\, e^{-jwt_0}\, a\, e^{+jwt_0} = a^2$$

$$\phi(w) = -wt_0 \qquad z = re^{j\theta}$$

$$\frac{-d\theta}{dw} = t_0$$