4.18(1) 基本信号 $\delta(t) \leftrightarrow 1$

时移特性：$\delta(t-2) \leftrightarrow e^{-j2\omega}$

频移特性：$f(t) = e^{-jt}\delta(t-2) \leftrightarrow e^{-j2(\omega+1)}$

(5) $\varepsilon(t) \leftrightarrow \pi\delta(\omega) + \frac{1}{j\omega}$

时移特性：$\varepsilon(t-1) \leftrightarrow [\pi\delta(\omega) + \frac{1}{j\omega}]e^{-j\omega} = \pi\delta(\omega) \frac{e^{-j\omega}}{j\omega}$

尺度变换：$f(t) = \varepsilon(\frac{1}{2}t-1) \leftrightarrow 2[\pi\delta(2\omega) + \frac{1}{j2\omega}e^{-j2\omega}] = \pi\delta(\omega) + \frac{e^{-j2\omega}}{j\omega}$

4.20 (1) 由尺度变换得 $f(2t) \leftrightarrow \frac{1}{2}F(j\frac{\omega}{2})$

根据频域微分特性得 $(-jt)f(2t) \leftrightarrow \frac{1}{2}\frac{d}{d\omega}F(j\frac{\omega}{2})$

$\therefore t f(2t) \leftrightarrow j\frac{1}{2}\frac{d}{d\omega}F(j\frac{\omega}{2})$

(4) 根据傅里叶变换的时移性质可得 $f(1+t) \leftrightarrow F(j\omega)e^{j\omega}$

由反转特性可得 $\therefore f(1-t) \leftrightarrow F(-j\omega)e^{-j\omega}$

(5) 由微分性质得：$tf(t) \leftrightarrow j\frac{d}{d\omega}F(j\omega)$

由反转特性得：$tf(-t) \leftrightarrow -j\frac{d}{d\omega}F(-j\omega)$

由时移特性得 $(1-t)f(1-t) \leftrightarrow -je^{-j\omega}\frac{d}{d\omega}F(-j\omega)$

4.24 (1) $F(j\omega) = \int_{-\infty}^{+\infty} f(t)e^{-j\omega t}dt = \frac{\pi\cos\omega}{\frac{\pi^2}{4} - \omega^2}$

(2) $f'(t) = -\frac{\pi}{2}\sin(\frac{\pi}{2}t)g_2(t)$，则有

$f''(t) = \frac{\pi}{2}\delta(t+1) - \frac{\pi}{2}\delta(t-1) - (\frac{\pi}{2})^2 f(t)$

由时域微分性质可得 $(j\omega)^2 F(j\omega) = \frac{\pi}{2}e^{j\omega} - \frac{\pi}{2}e^{-j\omega} - (\frac{\pi}{2})^2 F(j\omega)$

$\therefore F(j\omega) = \frac{\pi\cos\omega}{(\frac{\pi}{2})^2 - \omega^2}$

(3) 由 $f(t)$ 的波形可知：$f(t) = \cos(\frac{\pi}{2}t)g_2(t)$

由 $g_2(t) \leftrightarrow 2Sa(\omega)$，$\cos(\frac{\pi}{2}t) \leftrightarrow \pi[\delta(\omega+\frac{\pi}{2}) + \delta(\omega-\frac{\pi}{2})]$

$\therefore F(j\omega) = Sa(\omega-\frac{\pi}{2}) + Sa(\omega+\frac{\pi}{2}) = \frac{\pi\cos\omega}{(\frac{\pi}{2})^2 - \omega^2}$