Homework .

4.3 $g(\alpha) = i(e^{i\pi\alpha} - 2 + e^{-i\pi\alpha})/2\pi\alpha = 2i(\cos(\pi\alpha) - 1)/2\pi\alpha$
4.4 $g(\alpha) = (\sin(\alpha\pi) - \sin(\alpha\pi/2))/\alpha\pi$
4.6 $g(\alpha) = (\sin(\alpha) - \alpha\cos(\alpha))/\pi i\alpha^2$
4.7 $(e^{-i\alpha} - 1)/\pi\alpha^2$
4.11 $\cos(\pi\alpha/2)/\pi(1 - \alpha^2)$
4.12 $-i\alpha\cos(\pi\alpha/2)/\pi(1 - \alpha^2)$
4.17 $\sqrt{2/\pi}\int_0^\infty \sin(\alpha x)f(x)dx = \sqrt{2/\pi}(1 - \cos(\pi\alpha))/\alpha$
4.21 $g(\alpha) = \sigma e^{-\alpha^2\sigma^2/2}/\sqrt{2\pi}$
4.23 By the Fourier sin inversion formula applied to problem 4.17 we get $\int_0^\infty (1 - \cos(\pi\alpha))/\alpha \sin(\alpha x)d\alpha = (\pi/2)f(x)$ where $f(x)$ is 1 for $0 < x < \pi$, -1 for $-\pi < x < 0$, 0 for $|x| > \pi$, 1/2 for $x = \pi$ (as this is half the left and right limits). So for $x = 1$ (or anything else between 0 and π) we get $\pi/2$ and for $x = \pi$ we get $\pi/4$.
4.24 (c) $\sqrt{\pi/2}e^{-\alpha}$.