

## Proposed solutions FWA December '06

1.  $D(g\delta)(\varphi) = -g\delta(D\varphi) = -g(0)D\varphi(0)$ .
2.  $i \operatorname{sign} \left[ (2i)^{-1}(\delta_{1/(2\pi)} - \delta_{-1/(2\pi)}) + (2)^{-1}(\delta_{1/(2\pi)} + \delta_{-1/(2\pi)}) \right]$   
 $= (2)^{-1}(\delta_{1/(2\pi)} + \delta_{-1/(2\pi)}) - (2i)^{-1}(\delta_{1/(2\pi)} - \delta_{-1/(2\pi)})$ ;  
 $\Re((1-i)e^{ix}) = f$ .
3.  $H(\omega) = H(-\omega)^*$ ,  $|H(\omega)|^2 + |H(\omega + \pi)|^2 = 1$ , and  $H$  has period  $2\pi$ .
4.  $\sum_k | \langle f, \psi_{0k} \rangle |^2 = \sum_k \left| (2\pi)^{-1} \int_a^b \hat{\psi}(\omega)^* e^{i\omega k} d\omega \right|^2 = (2\pi)^{-1} \int_a^b |\hat{\psi}(\omega)|^2 d\omega$ .