(10) $\frac{df}{dx} = -af + \delta(x) \rightarrow -a\hat{f}(k) + 1 = \frac{-a}{a+ik} + 1 = \frac{ik}{a+ik}$

which agrees with $ik\hat{f}(k)$ ✓

(11) $u' + au = \delta(x-d)$, $ik\hat{u}(k) + a\hat{u}(k) = e^{-ikd}$

$$\hat{u}(k) = \frac{e^{-ikd}}{ik+a}$$

If $v(x) = u(x+d)$ then $\hat{v}(k) = e^{ikd}\hat{u}(k) = \frac{1}{a+ik}$

$$v(x) = \begin{cases} e^{-ax}, & x \geq 0 \\ 0, & x < 0 \end{cases} \quad \text{and } u(x) = \begin{cases} e^{-a(x-d)}, & x \geq d \\ 0, & x < d \end{cases}$$

(12) (integral of $u(x)$) $-$ (derivative of $u(x)$) $= \delta(x)$

$$\frac{\hat{u}(k)}{ik} - ik\hat{u}(k) = 1, \quad \hat{u}(k) = \frac{1}{\frac{1}{ik} - ik} = \frac{1+k^2}{ik}$$ transfer function

(23) $\delta * \delta = \delta$