9.4 B)

$$w(t) = \frac{dx(t)}{dt} + 3x(t) \qquad h(t)_{\text{overall}} = \delta(t)$$

$$h(t)_{\text{overall}} = \left[\frac{d\delta(t)}{dt} + 3\delta(t)\right] * h_2(t) = \delta(t)$$

$$\Rightarrow \frac{d\delta(t)}{dt} * h_2(t) + 3\delta(t) * h_2(t) = \delta(t)$$

now use these rules

$$\delta(t-\alpha) * x(t) = x(t-\alpha)$$

$$\frac{d\delta(t)}{dt} * x(t) = \frac{dx(t)}{dt}$$

$$\frac{dh_2(t)}{dt} + 3h_2(t) = \delta(t)$$

USE INTEGRATING FACTOR (diff. eq.)

$$e^{3t}\frac{dh_2(t)}{dt} + 3e^{3t}h_2(t) = \delta(t)e^{3t} = \delta(t)\cancel{\phi}^{\,1}$$

USE $\delta(t-\alpha)x(t) = \delta(t-\alpha)x(\alpha)$

$$\left[e^{3t}h_2(t)\right]' = \delta(t)$$

$$e^{3t}h_2(t) = \int \delta(t)\,dt = u(t)$$

$$\Rightarrow h_2(t) = e^{-3t}u(t)$$

$\underline{\text{Note:}}$ the problem statement implies that the form for $h_2(t)$ is $Ae^{-at}u(t)$