Concept Question 2-9: What is the area property of convolution?

The area of the convolution of two signals is the product of the areas of the two signals.

$$\begin{aligned}
\text{Area of } y(t) &= \int_{-\infty}^{\infty} y(t)\, dt \\
&= \int_{-\infty}^{\infty} \left[\int_{-\infty}^{\infty} h(\tau)\, x(t-\tau)\, d\tau \right] dt \\
&= \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} h(\tau)\, x(t-\tau)\, dt\, d\tau \\
&= \int_{-\infty}^{\infty} h(\tau) \left[\int_{-\infty}^{\infty} x(t-\tau)\, dt \right] d\tau \\
&= \left[\int_{-\infty}^{\infty} h(\tau)\, d\tau \right] \left[\int_{-\infty}^{\infty} x(t-\tau)\, dt \right] \\
&= \text{area of } h(t) \times \text{area of } x(t). \qquad (2.76)
\end{aligned}$$