2.27. We define the area under a continuous-time signal $v(t)$ as $A_v = \int_{-\infty}^{+\infty} v(t)\,dt$.

Show that if $y(t) = x(t) * h(t)$ then $A_y = A_x A_h$

$$A_y = \int_{-\infty}^{+\infty} y(t)\,dt = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} x(\tau)h(t-\tau)\,d\tau\,dt = \int_{-\infty}^{+\infty} x(\tau)\left(\int_{-\infty}^{+\infty} h(t-\tau)\,dt\right)d\tau =$$

$$\begin{cases} u = t-\tau \\ v = \tau \end{cases} \Rightarrow \begin{cases} t = u+v \\ \tau = v \end{cases} \Rightarrow |J| = \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} = 1$$

$$A_y = \int_{-\infty}^{+\infty} x(v)\int_{-\infty}^{+\infty} h(u)\cdot 1\cdot du\,dv = \int_{-\infty}^{+\infty} x(v)\,dv \cdot \int_{-\infty}^{+\infty} h(u)\,du = A_x A_h$$