Example 9-11: Convolve Impulses

When combined with the linearity property, we can work problems such as convolving the following two signals:

$$x(t) = \delta(t-5) + \delta(t+5)$$

and

$$h(t) = \delta(t-0.5) - 3\delta(t)$$

$$\begin{aligned}
&x(t) * h(t) \\
&\quad = (\delta(t-5) + \delta(t+5)) * (\delta(t-0.5) - 3\delta(t)) \\
&\quad = \delta(t-5) * \delta(t-0.5) - 3\delta(t-5) * \delta(t) \\
&\qquad + \delta(t+5) * \delta(t-0.5) - 3\delta(t+5) * \delta(t) \\
&\quad = \delta(t-5.5) - 3\delta(t-5) + \delta(t+4.5) - 3\delta(t+5)
\end{aligned}$$

So we end up with impulses at $t = 5.5, -4.5$ and ± 5. The area of the impulses at $t = \pm 5$ is -3. ■

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