Steps in Computing Continuous-Time Convolution

$$y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\lambda)\, h(t-\lambda)\, d\lambda \quad (1)$$

$$= \int_{-\infty}^{\infty} x(t-\lambda)\, h(\lambda)\, d\lambda \quad (2)$$

You can use either (1) or (2), whichever is more convenient. The following steps are used for (1). If you use (2), then "flip and shift" x rather than h.

1. Plot $x(\lambda)$ and $h(\lambda)$.

2. Plot $h(-\lambda)$ [time-reverse] and $h(t-\lambda)$ [add t to all ordinates] versus λ.

3. **Do not skip this step:** Plot $x(\lambda)$ and $h(t-\lambda)$ on the same graph, versus λ.

   The location of $h(t-\lambda)$ on the λ-axis will be a function of t.
   (Note that these functions appear inside the integral in (1).)

4. Repeat the following steps for every value of $t \in (-\infty, \infty)$:

   (a) Form the product $x(\lambda) \cdot h(t-\lambda)$ at all λ values.

   (You may want to plot this product on a graph versus λ. This product will often "look different" when t takes on values in different intervals.)

   (b) Find the area under this product, i.e., evaluate $\int_{-\infty}^{\infty} x(\lambda)\, h(t-\lambda)\, d\lambda$.
   (In many problems, the integration limits will depend on t.)

   (c) The area you computed in step 4(b) is the value of $y(t)$ for a particular value of t (or, more often, the result is valid for an *interval* of t values.)

5. It is usually best to write the equation for $y(t)$ and to sketch a plot of $y(t)$ versus t.