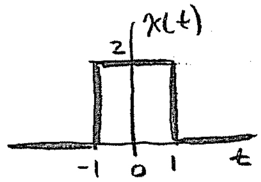
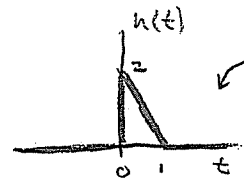
Let's compute $y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$

when $x(t)$ and $h(t)$ look like this:



and

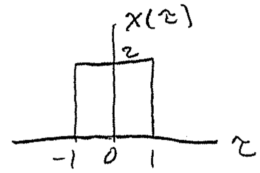


this is of the form $y = mx + b$, $m=-2, b=2$

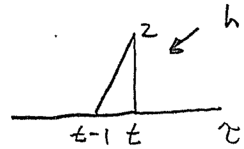
$$h(t) = \begin{cases} -2t+2, & 0 \le t \le 1 \\ 0, & \text{otherwise} \end{cases}$$

This time, we are going to do steps 0–4 five times in parallel, this will completley exhaust all values of t.

One of the hard parts is identifying which values of t correspond to which case. Let's start with the first case. We have our graph of $x(\tau)$, which is fixed:



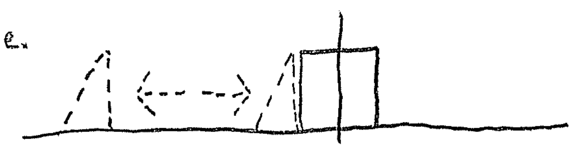
and we have our graph of $h(t-\tau)$ which is "floating" until we "lock it down" with a specific value of t:



$$h(t-\tau) = \begin{cases} 2\tau - 2t + 2, & t-1 < \tau < t \\ 0, & \text{otherwise} \end{cases}$$

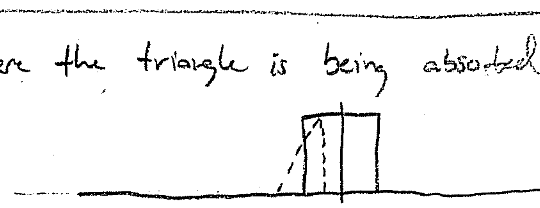
t is not specified at this time.

Our first case is where the triangle is completely to the left of the rectangle, i.e.



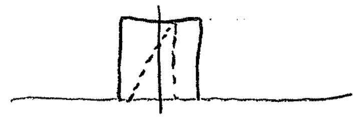
So we want to find where the right edge of the triangle (t) is Less than the left edge of the rectangle (-1): $\boxed{t < -1}$

Our second case is where the triangle is being absorbed into the rectangle



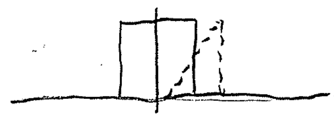
The right edge of the triangle (t) must be greater than the left edge of the rectangle (-1), and the left edge of the triangle $(t-1)$ must be less than the left edge of the rectangle (-1): $\boxed{-1 < t < 0}$

Our third case is when the triangle is completely inside the rectangle



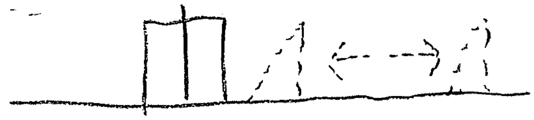
The right edge of the triangle (t) must be <u>less</u> <u>than</u> the right edge of the rectangle (1), <u>and</u> the left edge of the triangle ($t-1$) must be <u>greater</u> <u>than</u> the left edge of the rectangle (−1): $\boxed{0 < t < 1}$

Our fourth case is when the triangle is emerging from the rectangle:



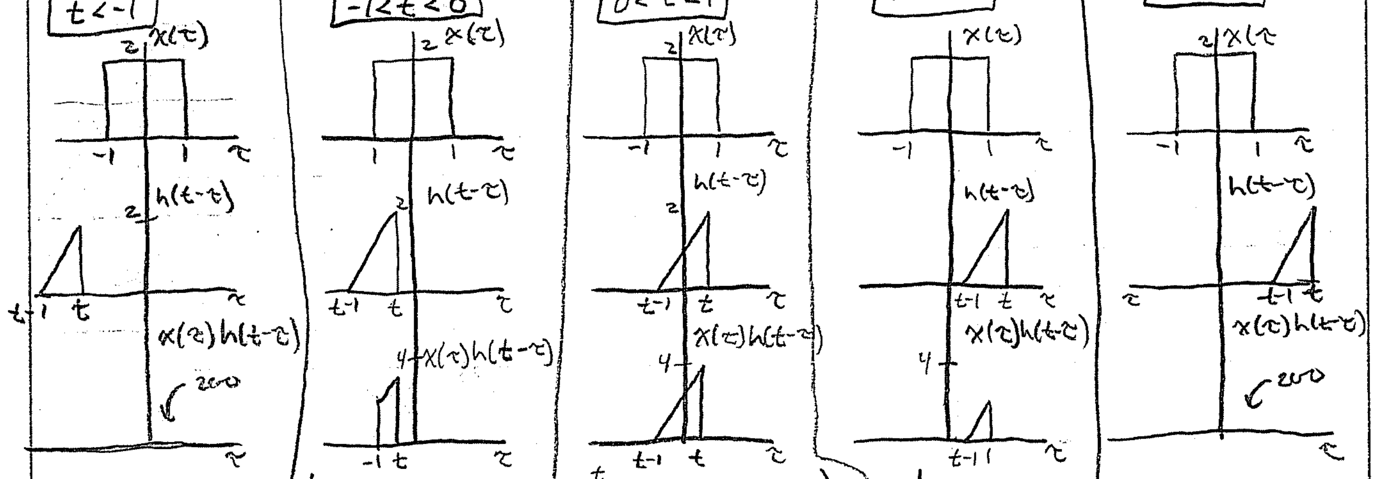
The right edge of the triangle (t) must be <u>greater</u> <u>than</u> the right edge of the rectangle (1), <u>and</u> the left edge of the triangle ($t-1$) must be <u>less</u> <u>than</u> the right edge of the rectangle (1): $1 < t < 2$

Our fifth and last case is when the triangle is completely to the right of the rectangle:



The left edge of the triangle ($t-1$) must be greater than the right edge of the rectangle (1): $t > 2$

Case 1 $t < -1$	Case 2 $-1 < t < 0$	Case 3 $0 < t < 1$	Case 4 $1 < t < 2$	Case 5 $t > 2$



Case 1: $\int (0) d\tau$ $\boxed{= 0}$

Case 2: $2\int_{-1}^{t} (2\tau - 2t + 2)\, d\tau$ $\boxed{= 2 - 2t^2}$

Case 3: $\int_{t-1}^{t}$ (Don't make this harder than it is, its the area of the entire triangle) dt $= \frac{1}{2}$ base $\times$ height $\boxed{= 2}$

Case 4: $2\int_{t-1}^{1} (2\tau - 2t + 2)\, d\tau$ $\boxed{= 2t^2 - 8t + 8}$

Case 5: $\int (0)\, d\tau$ $\boxed{= 0}$