

Convolution (1A)

-

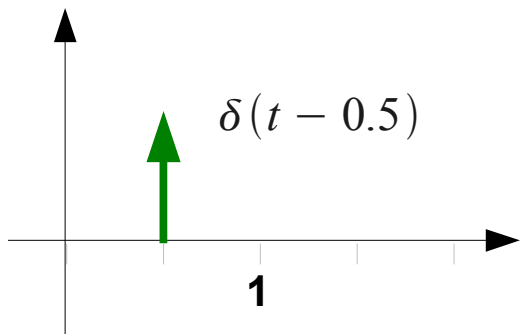
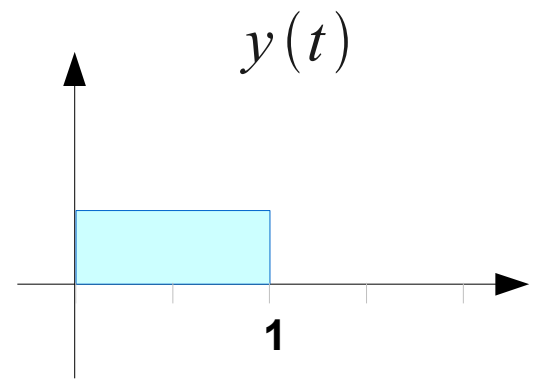
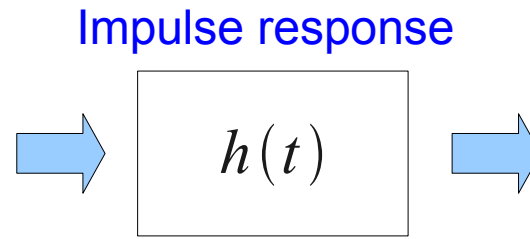
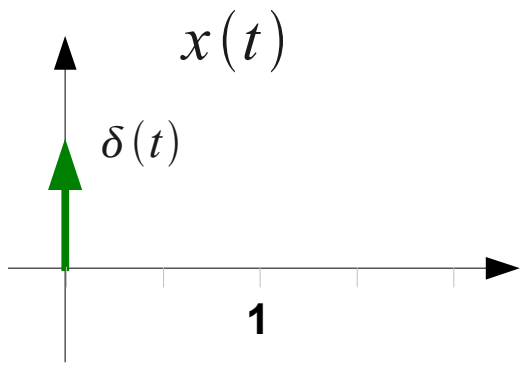
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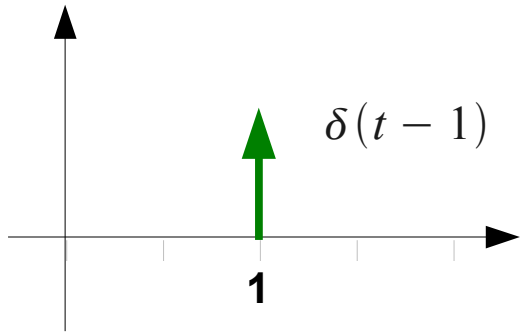
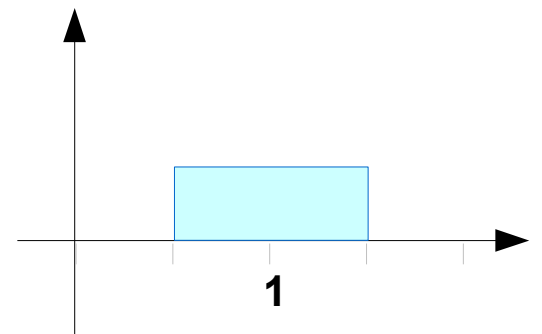
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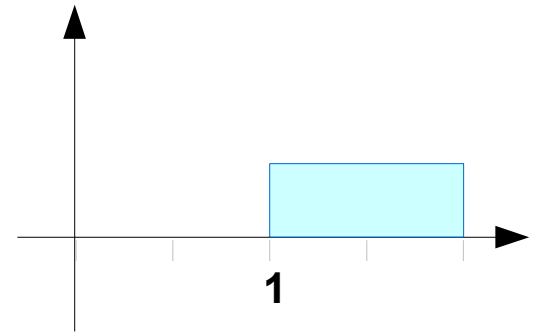
Impulse Response



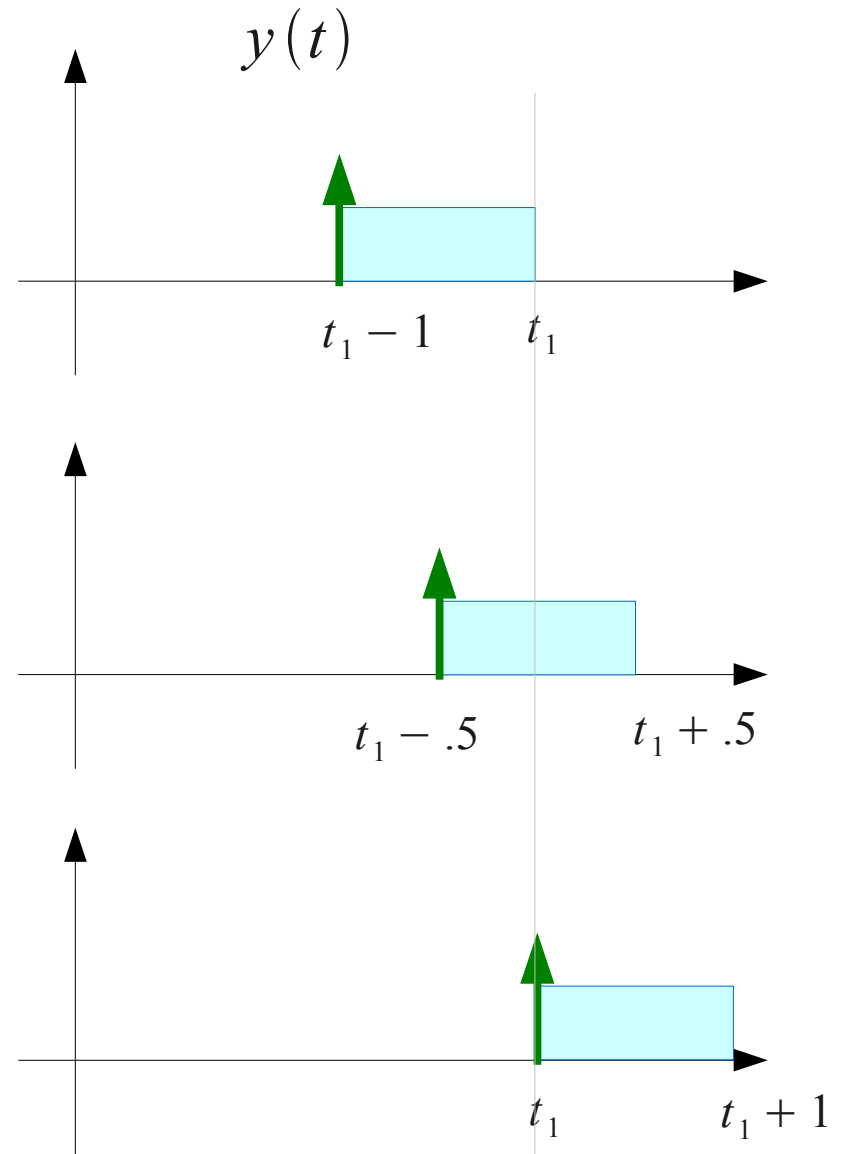
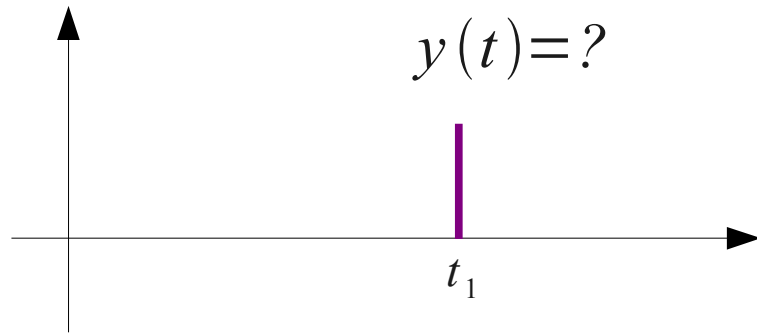
delayed response by 0.5



delayed response By 1



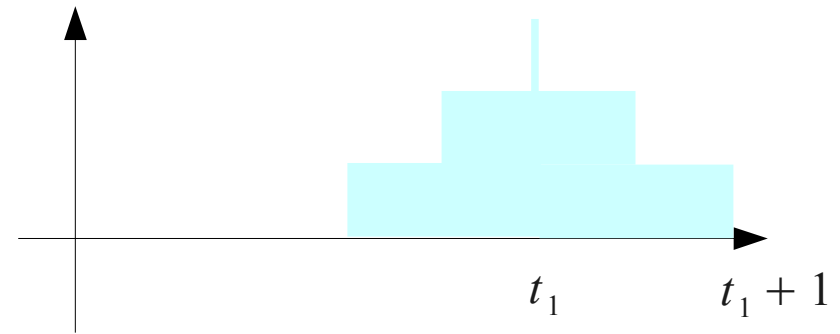
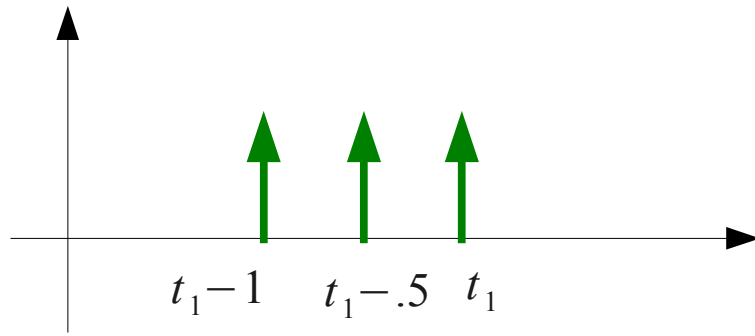
Output at t_1



N=8 DFT

$$x(t) = \delta(t-t_1+1) + \delta(t-t_1+.5) + \delta(t-t_1)$$

$$y(t) = h(t-t_1+1) + h(t-t_1+.5) + h(t-t_1)$$



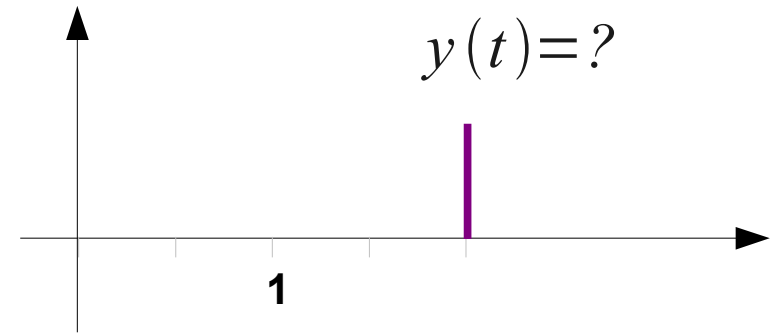
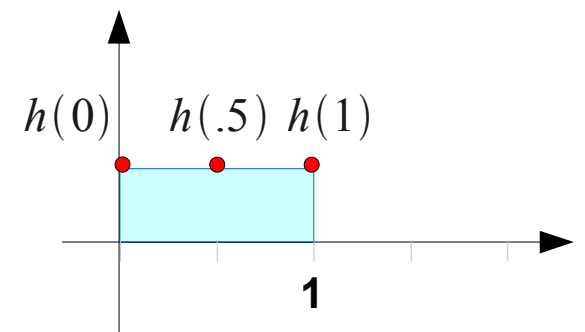
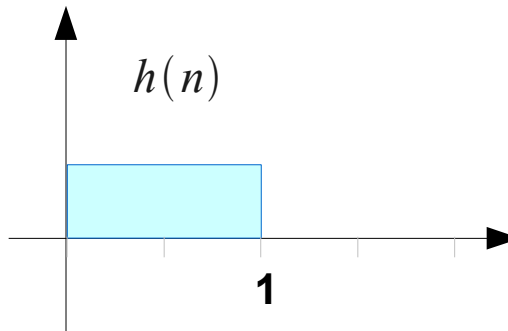
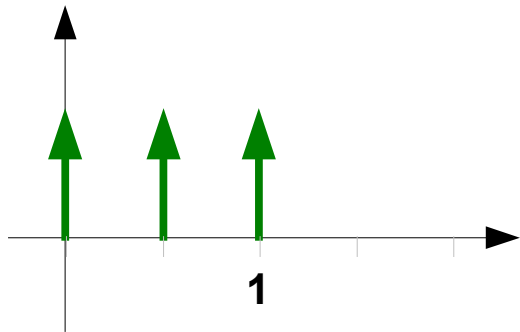
$$\begin{aligned} y(t) &= \int x(v)h(t-v) dv \\ &= \int \delta(v-t_1+1)h(t-v) dv && \rightarrow h(t-t_1+1) \\ &+ \int \delta(v-t_1+.5)h(t-v) dv && \rightarrow h(t-t_1+.5) \\ &+ \int \delta(v-t_1)h(t-v) dv && \rightarrow h(t-t_1) \end{aligned}$$

$$\begin{aligned} y(t_1) &= h(t_1-t_1+1) + h(t_1-t_1+.5) + h(t_1-t_1) \\ &= h(1) + h(.5) + h(0) \end{aligned}$$

N=8 DFT

$$x(t) = \delta(t-t_1+1) + \delta(t-t_1+.5) + \delta(t-t_1)$$

$$\delta(t) + \delta(t-.5) + \delta(t-1)$$



$$y(t) = h(t-t_1+1) + h(t-t_1+.5) + h(t-t_1)$$

$$y(t_1) = h(1) + h(.5) + h(0)$$

N=8 DFT

$$x(t) = \delta(t-t_1+1) + \delta(t-t_1+.5) + \delta(t-t_1)$$

$$x(v) = \delta(v-t_1+1) + \delta(v-t_1+.5) + \delta(v-t_1)$$

$$x(t-v) = \delta(t-v-t_1+1) + \delta(t-v-t_1+.5) + \delta(t-v-t_1)$$

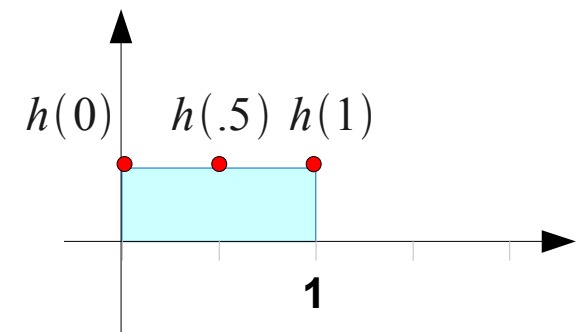
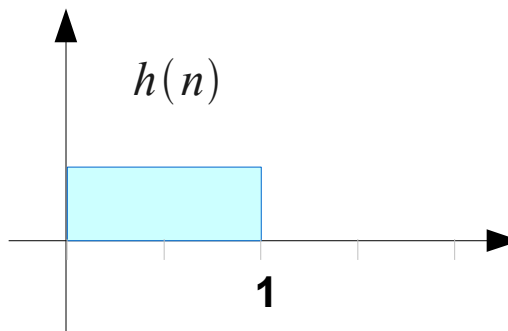
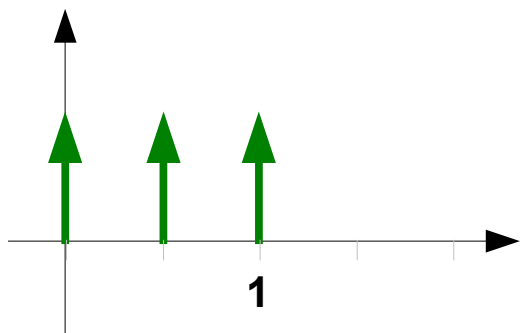
$$y(t) = \int x(t-v)h(v) dv$$

$$= \int \delta(t-v-t_1+1)h(v) dv \quad \rightarrow h(t-t_1+1)$$

$$+ \int \delta(t-v-t_1+.5)h(v) dv \quad \rightarrow h(t-t_1+.5)$$

$$+ \int \delta(t-v-t_1)h(v) dv \quad \rightarrow h(t-t_1)$$

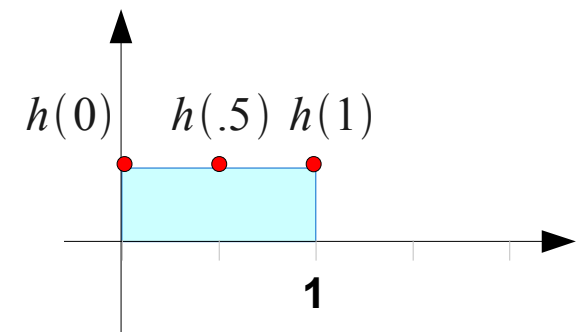
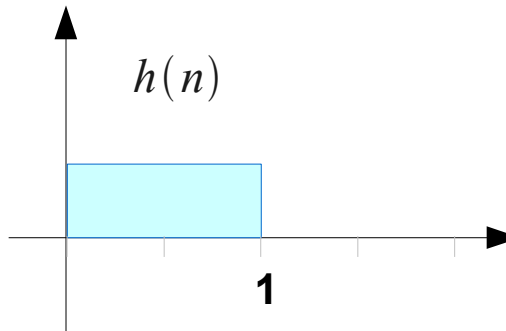
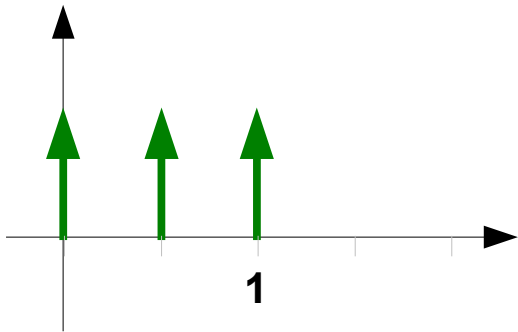
$$\delta(t) + \delta(t-.5) + \delta(t-1)$$



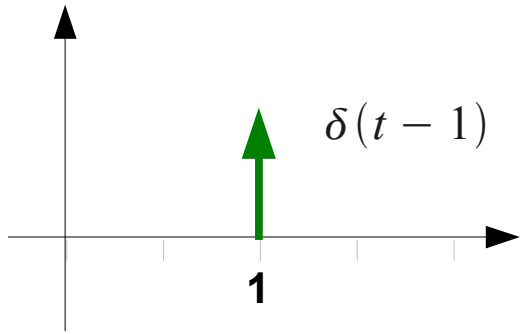
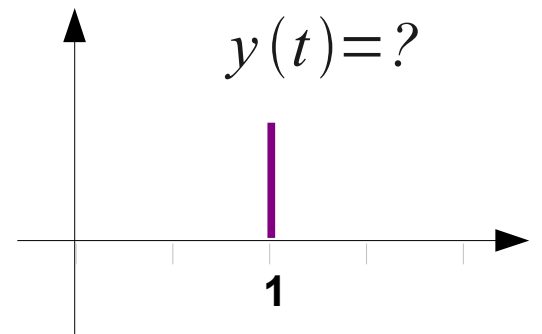
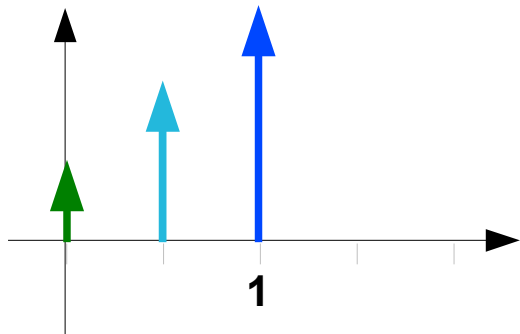
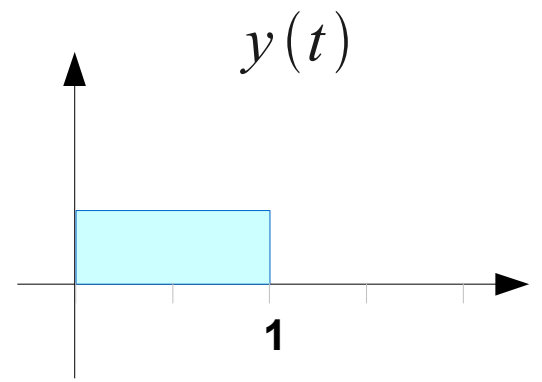
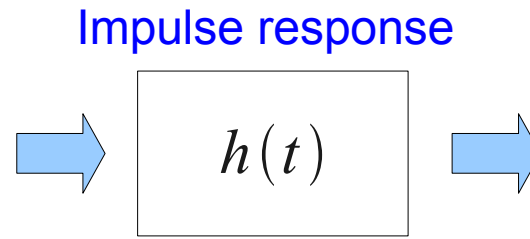
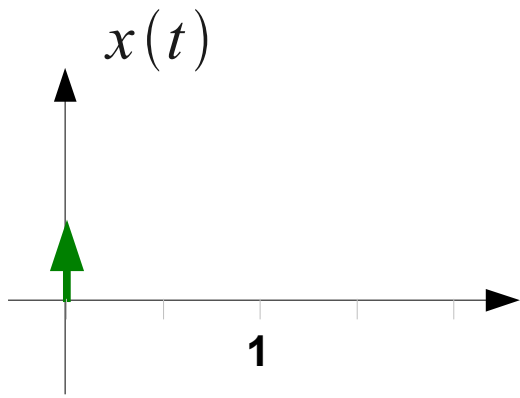
N=8 DFT

$$\begin{aligned}
 y(t) &= \int x(v)h(t-v) dv \\
 &= \int \delta(v-t_1+1)h(t-v) dv && \rightarrow h(t-t_1+1) \\
 &+ \int \delta(v-t_1+.5)h(t-v) dv && \rightarrow h(t-t_1+.5) \\
 &+ \int \delta(v-t_1)h(t-v) dv && \rightarrow h(t-t_1)
 \end{aligned}$$

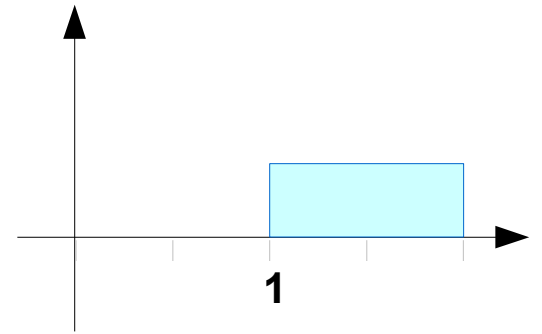
$$\begin{aligned}
 y(t) &= \int x(t-v)h(v) dv \\
 &= \int \delta(t-v-t_1+1)h(v) dv && \rightarrow h(t-t_1+1) \\
 &+ \int \delta(t-v-t_1+.5)h(v) dv && \rightarrow h(t-t_1+.5) \\
 &+ \int \delta(t-v-t_1)h(v) dv && \rightarrow h(t-t_1)
 \end{aligned}$$



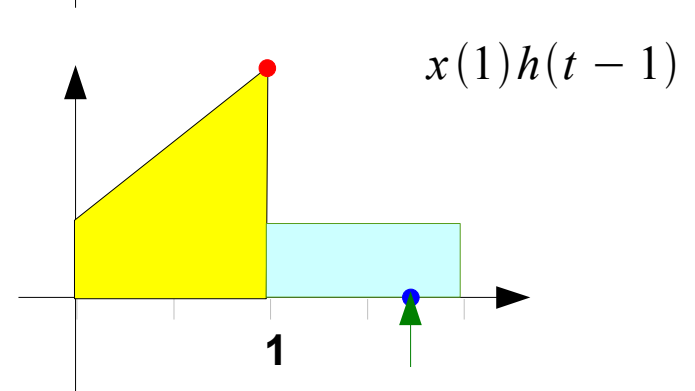
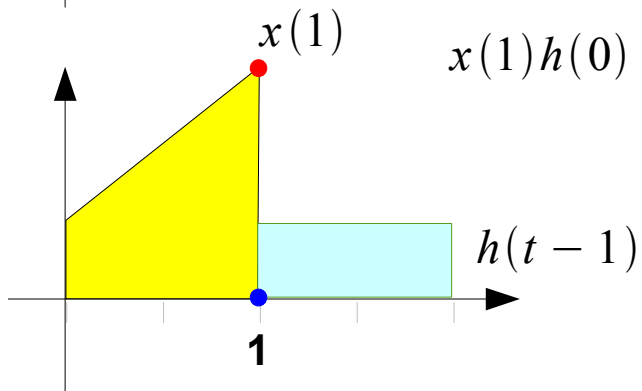
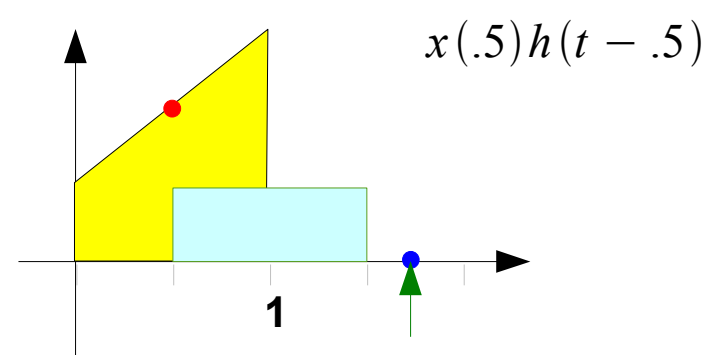
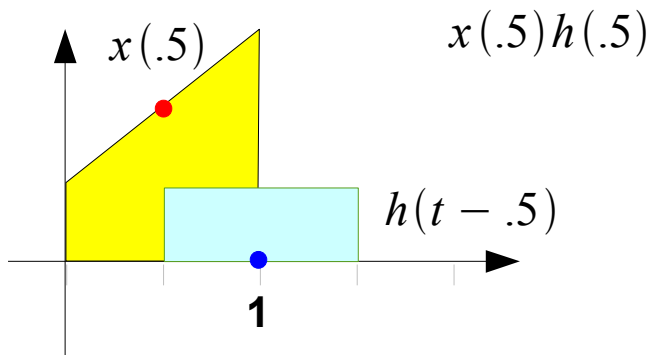
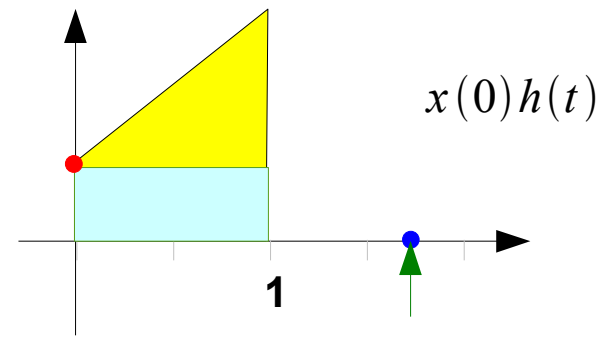
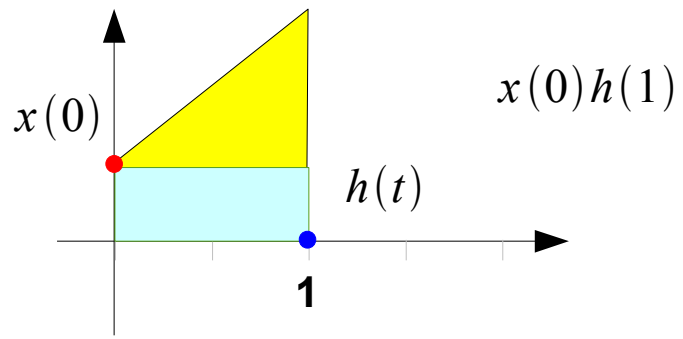
Impulse Response



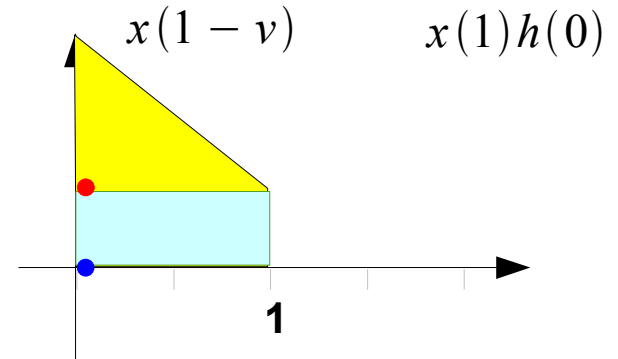
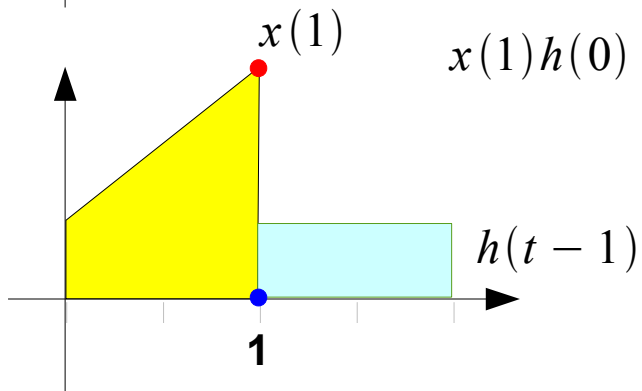
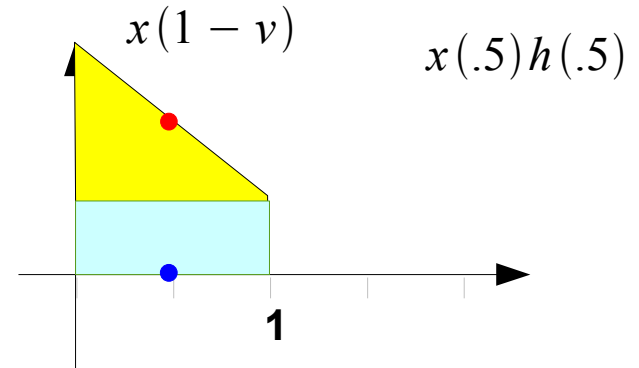
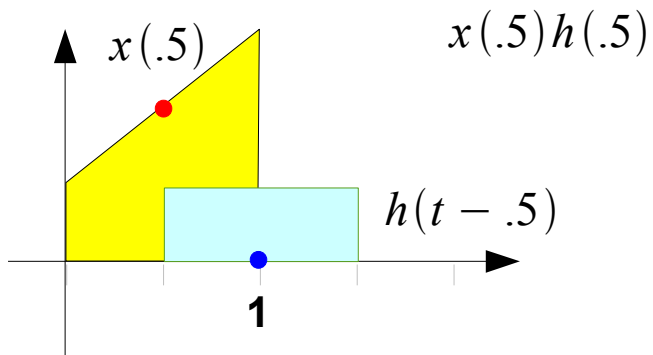
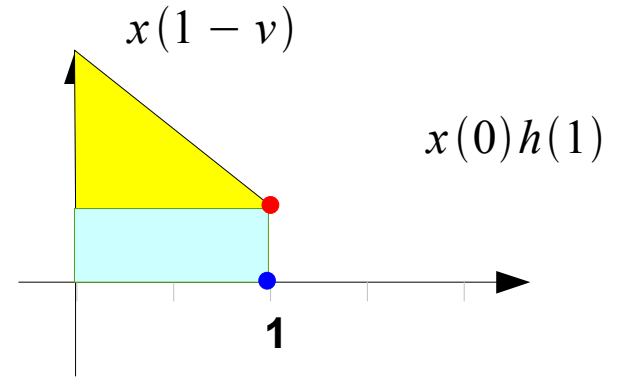
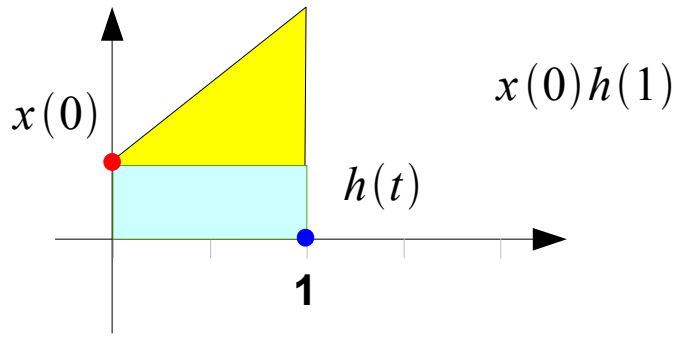
delayed response
By 1



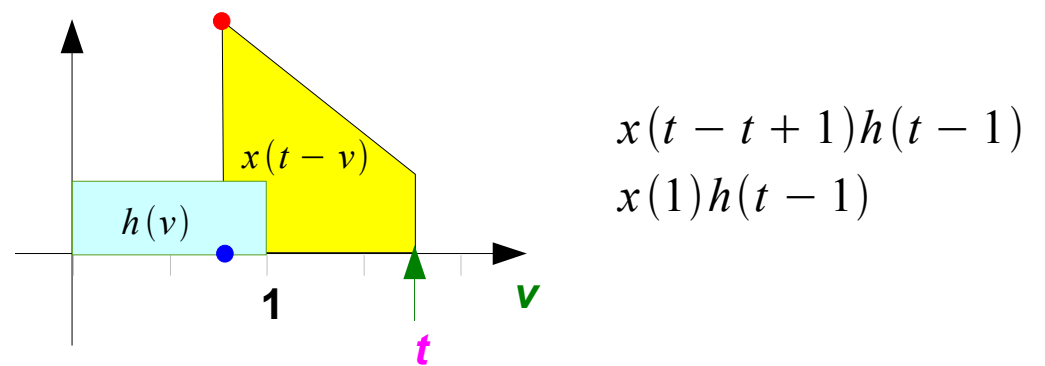
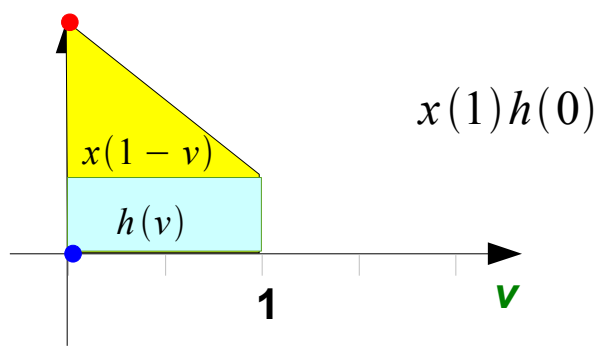
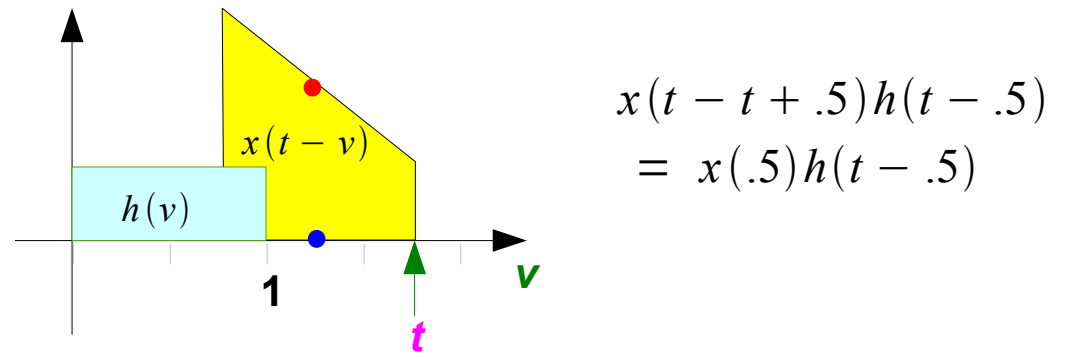
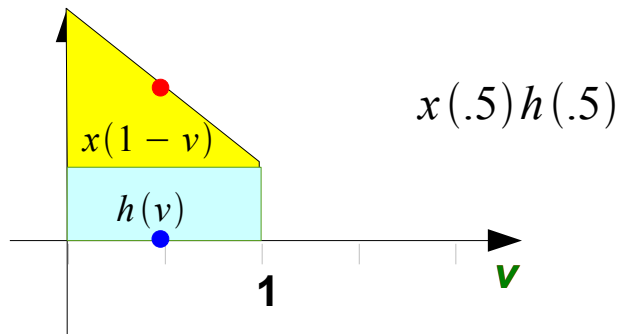
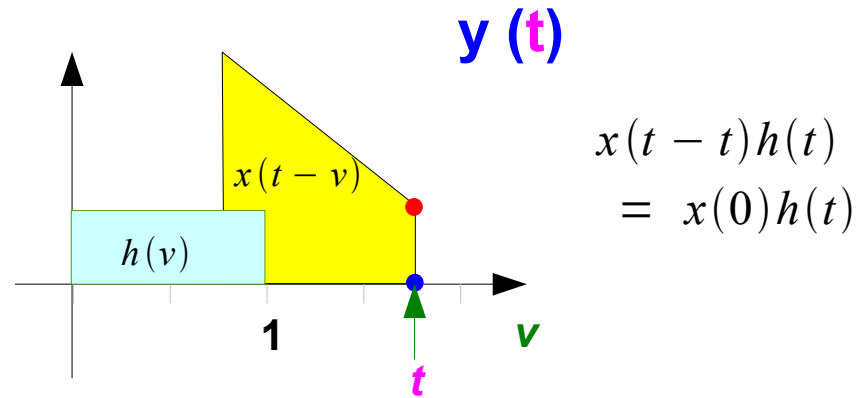
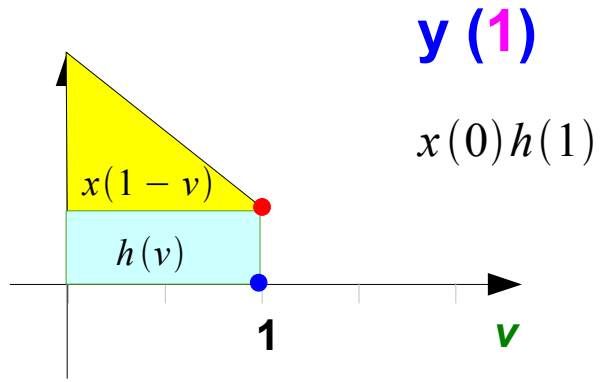
Impulse Response



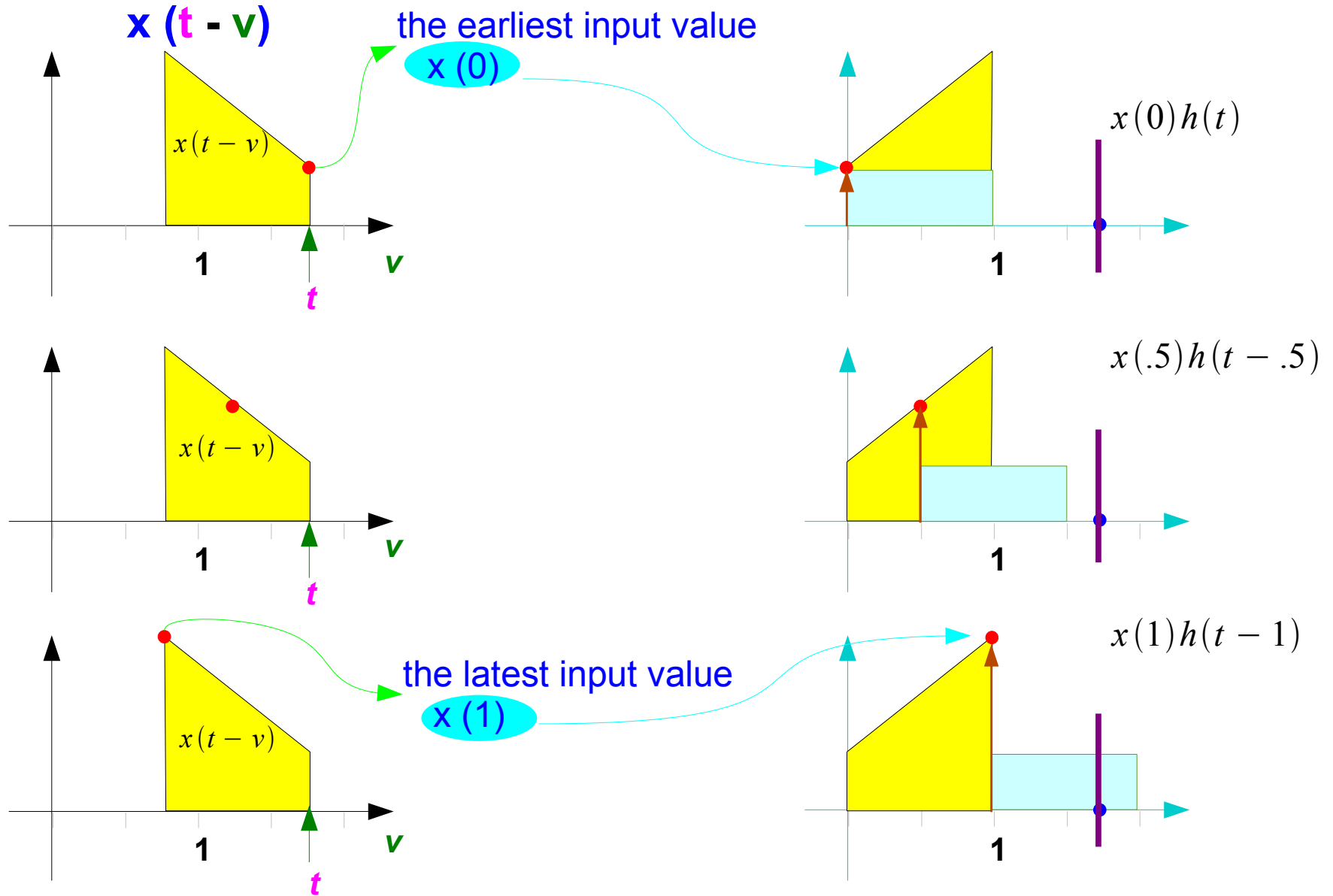
Impulse Response



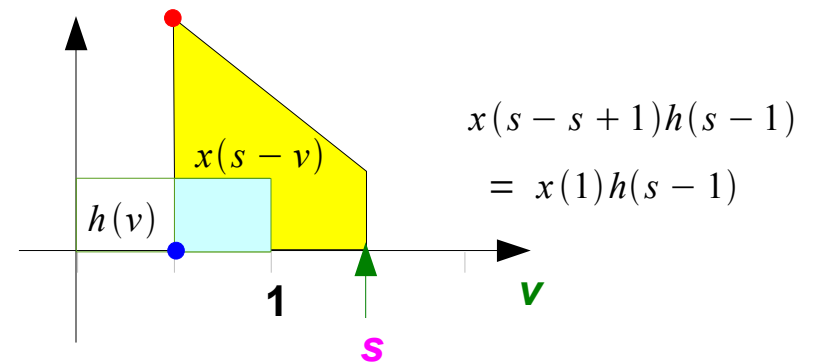
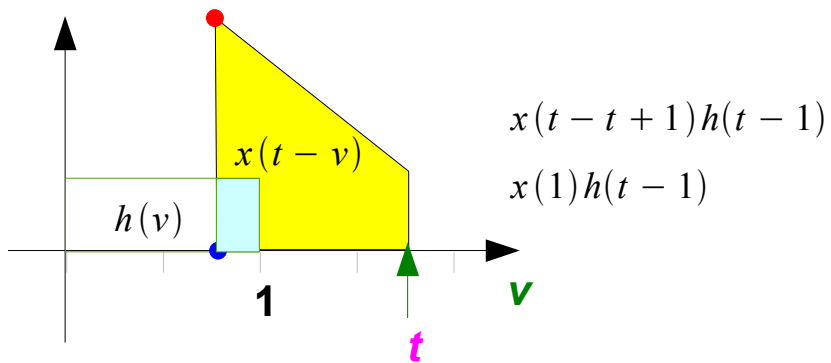
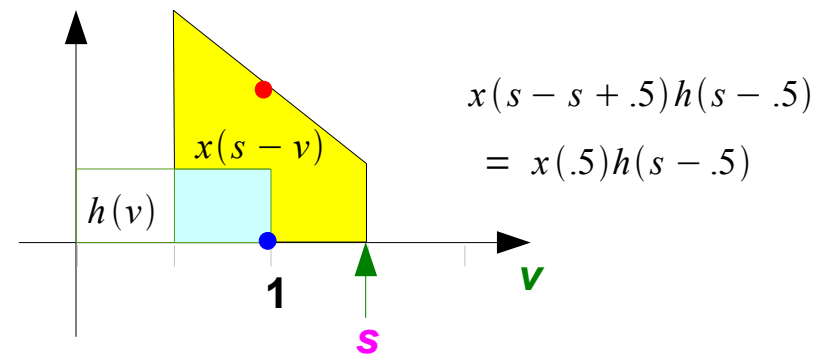
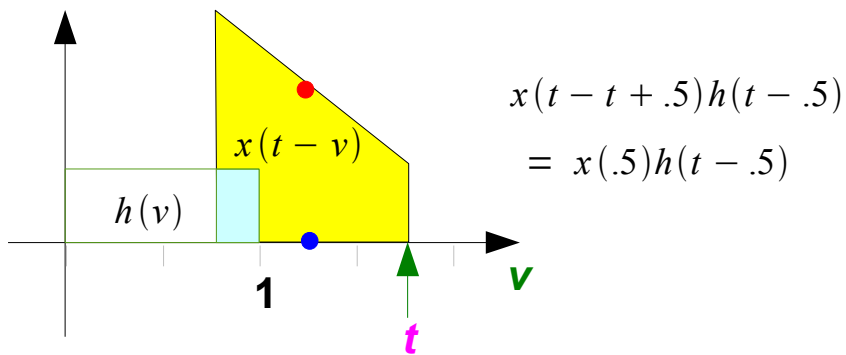
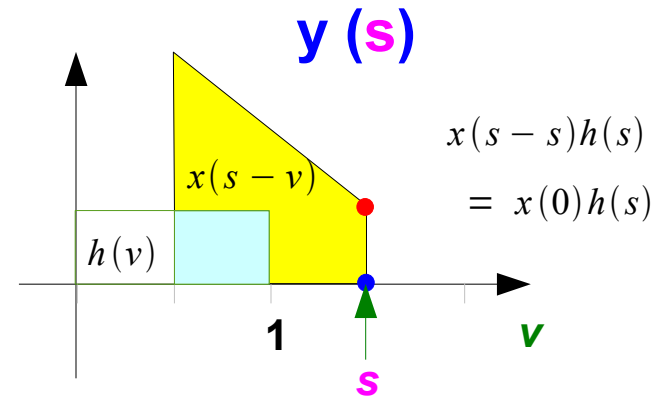
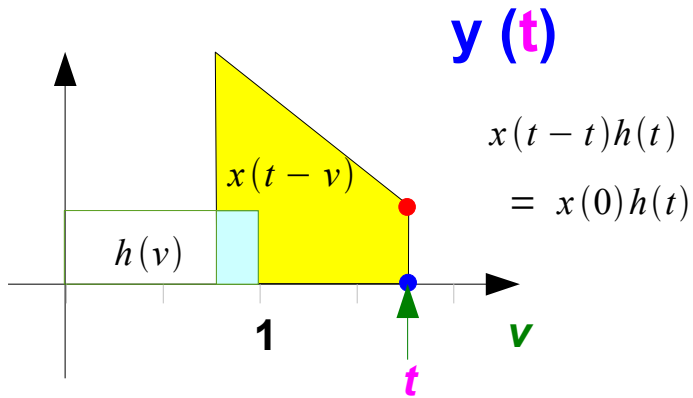
Impulse Response



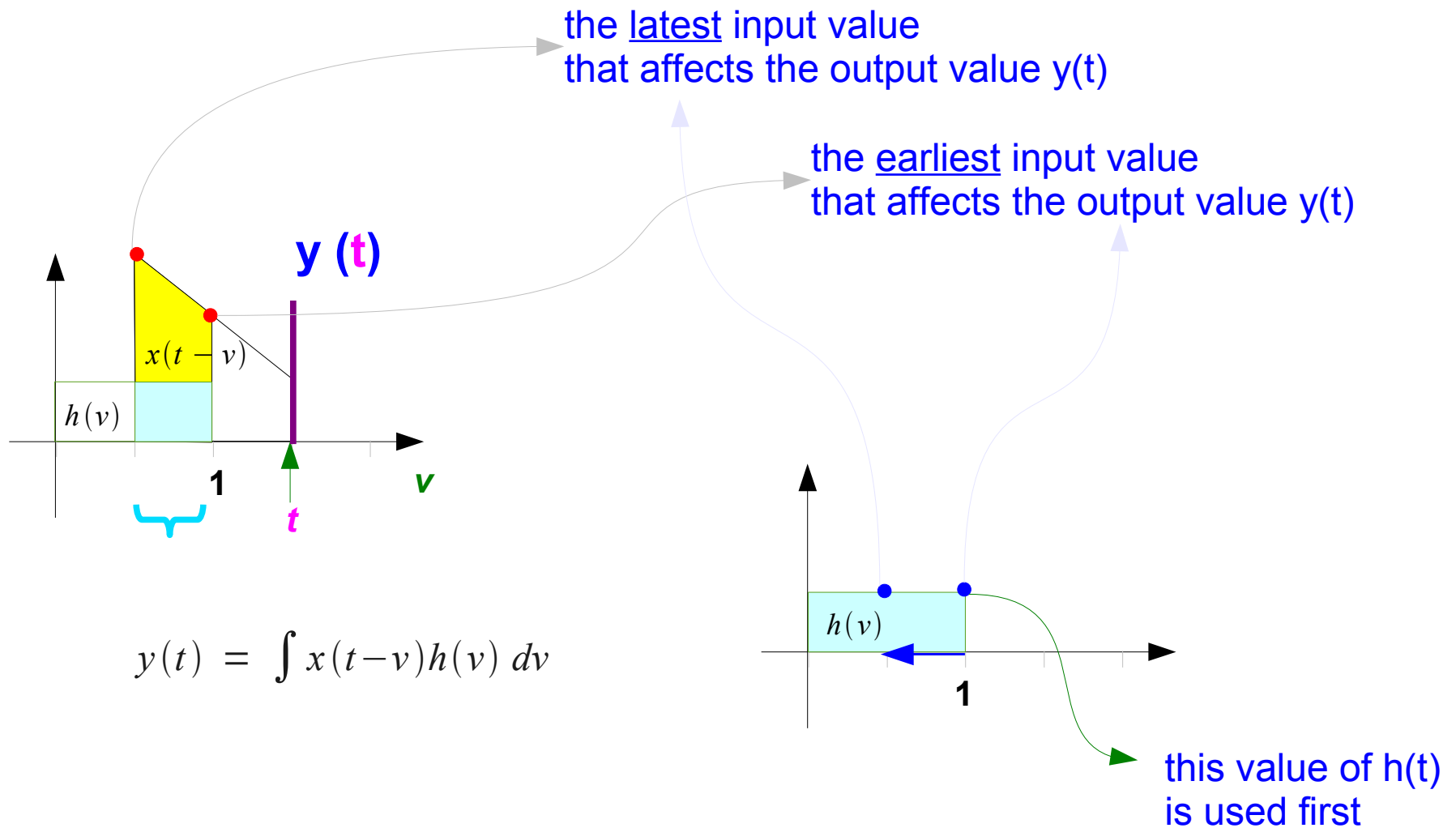
Impulse Response



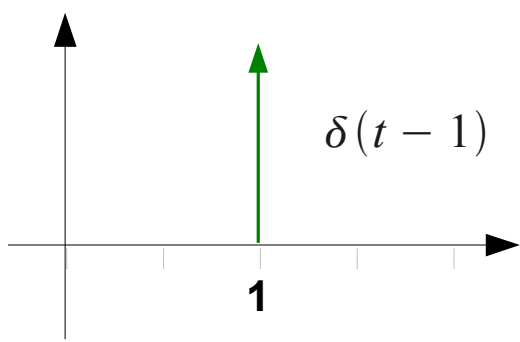
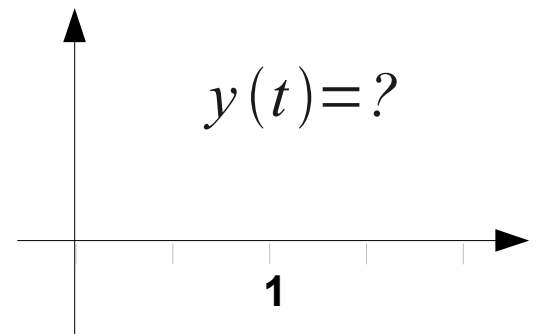
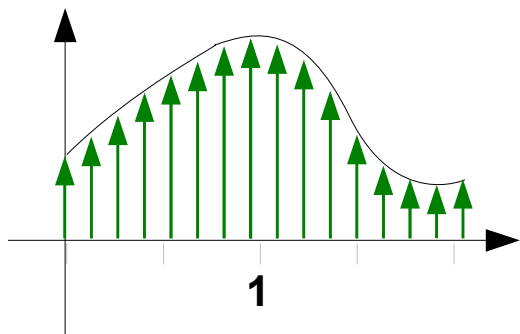
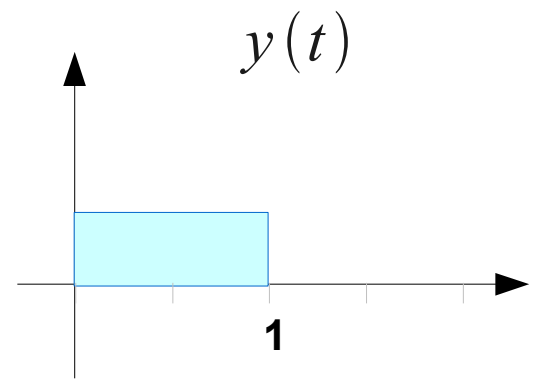
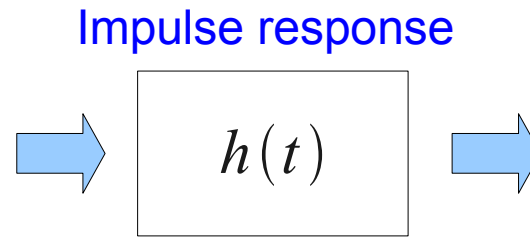
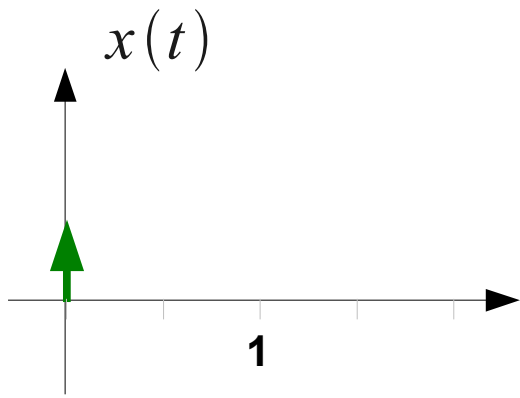
Impulse Response



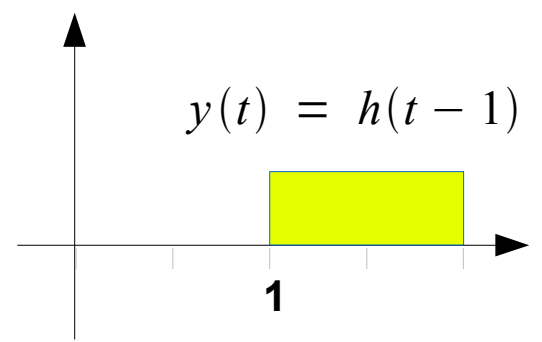
Impulse Response



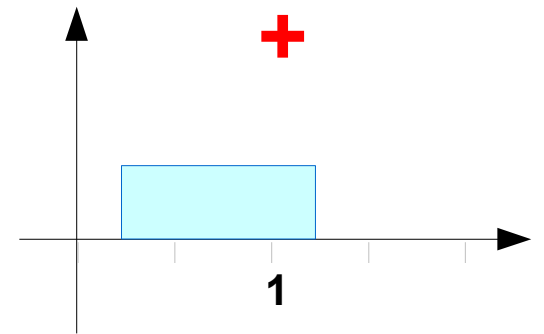
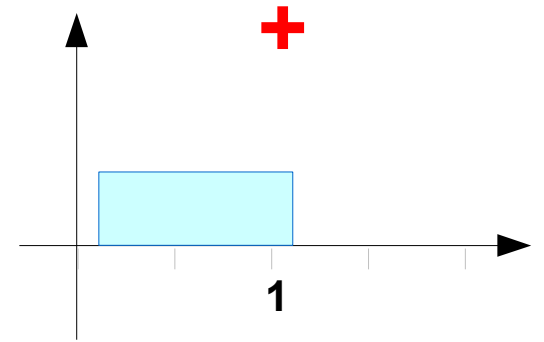
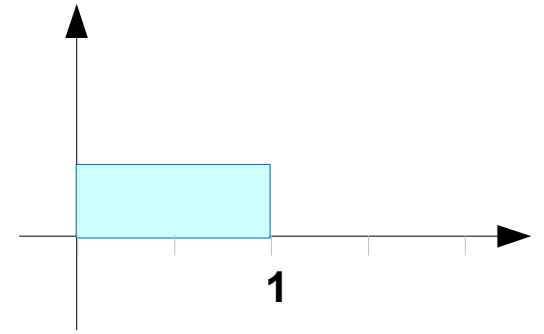
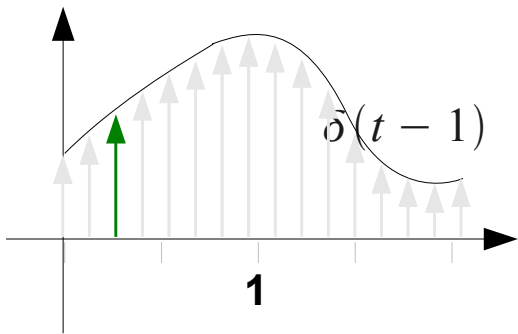
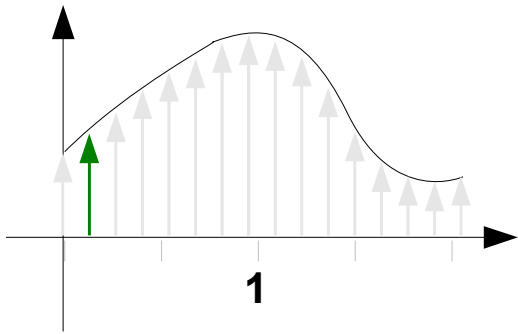
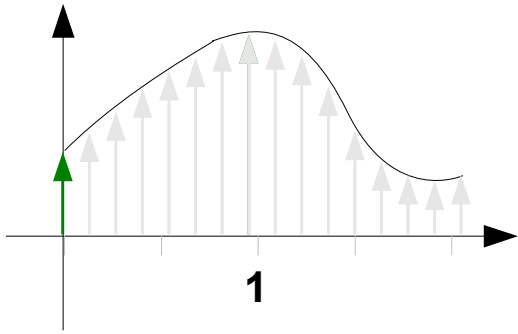
Impulse Response



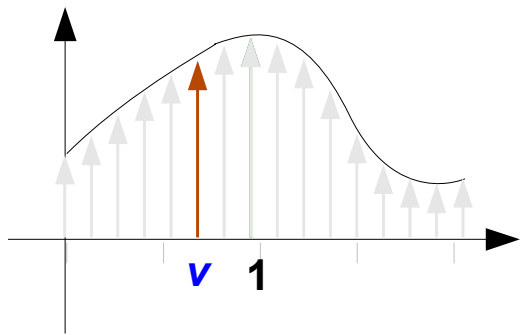
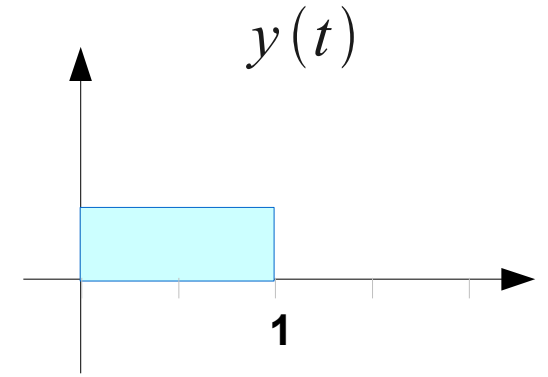
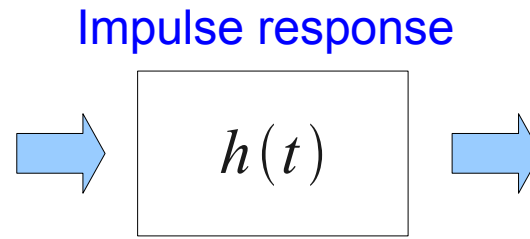
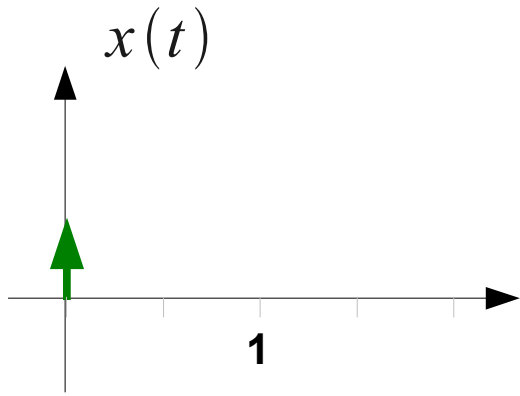
delayed response
By 1



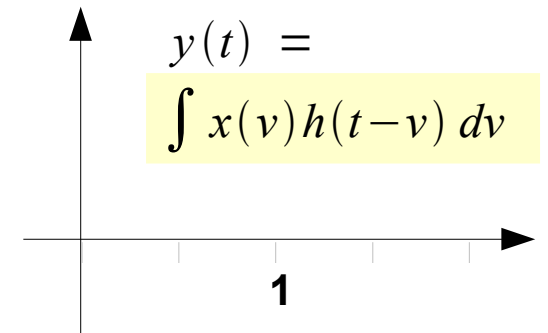
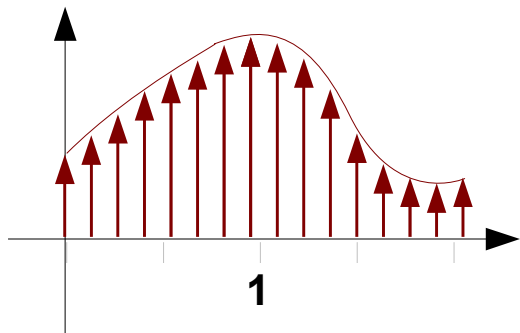
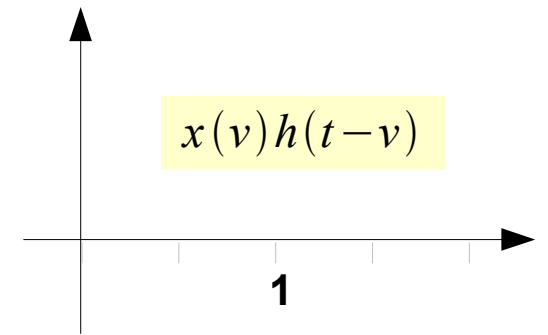
Impulse Response



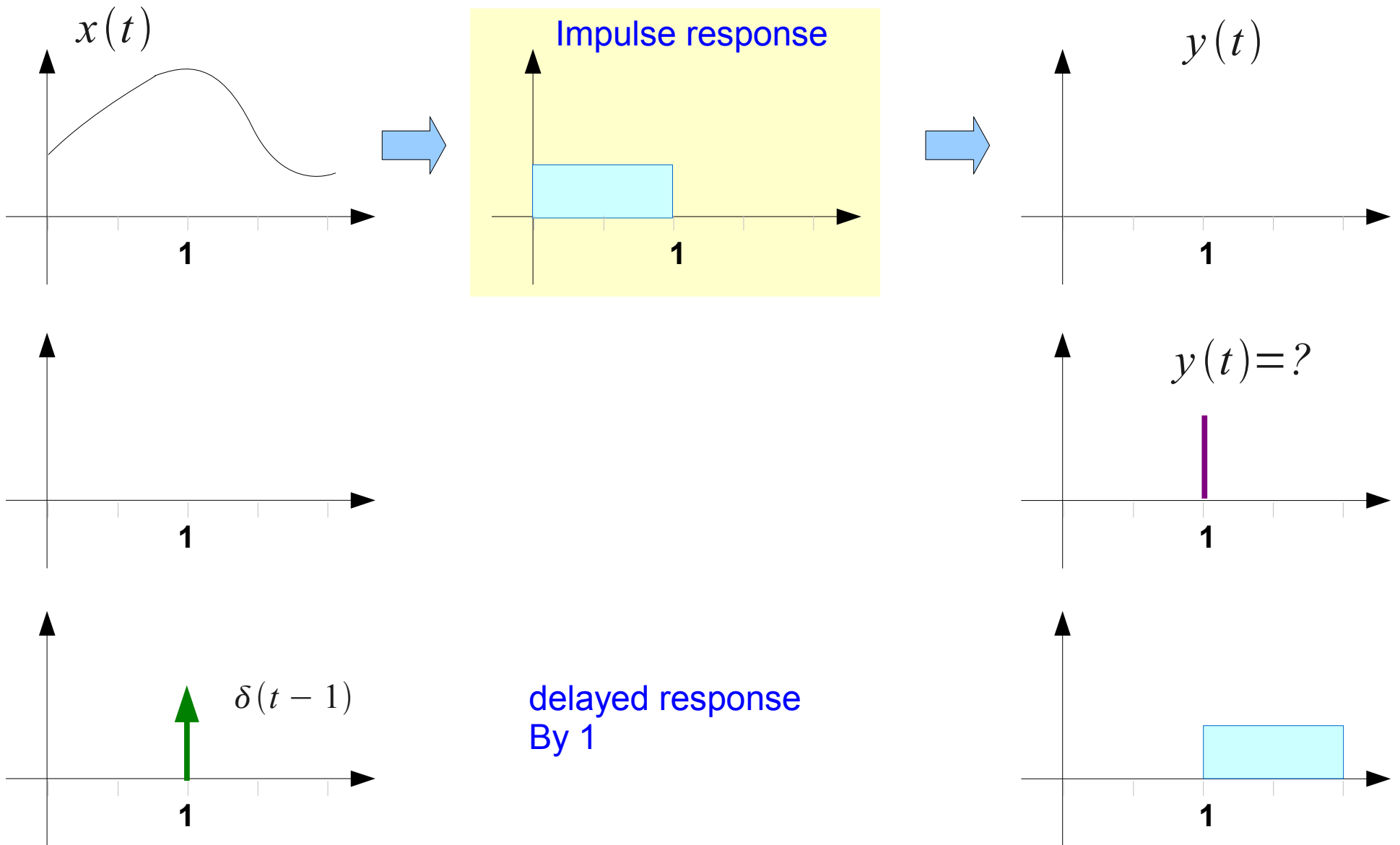
Impulse Response



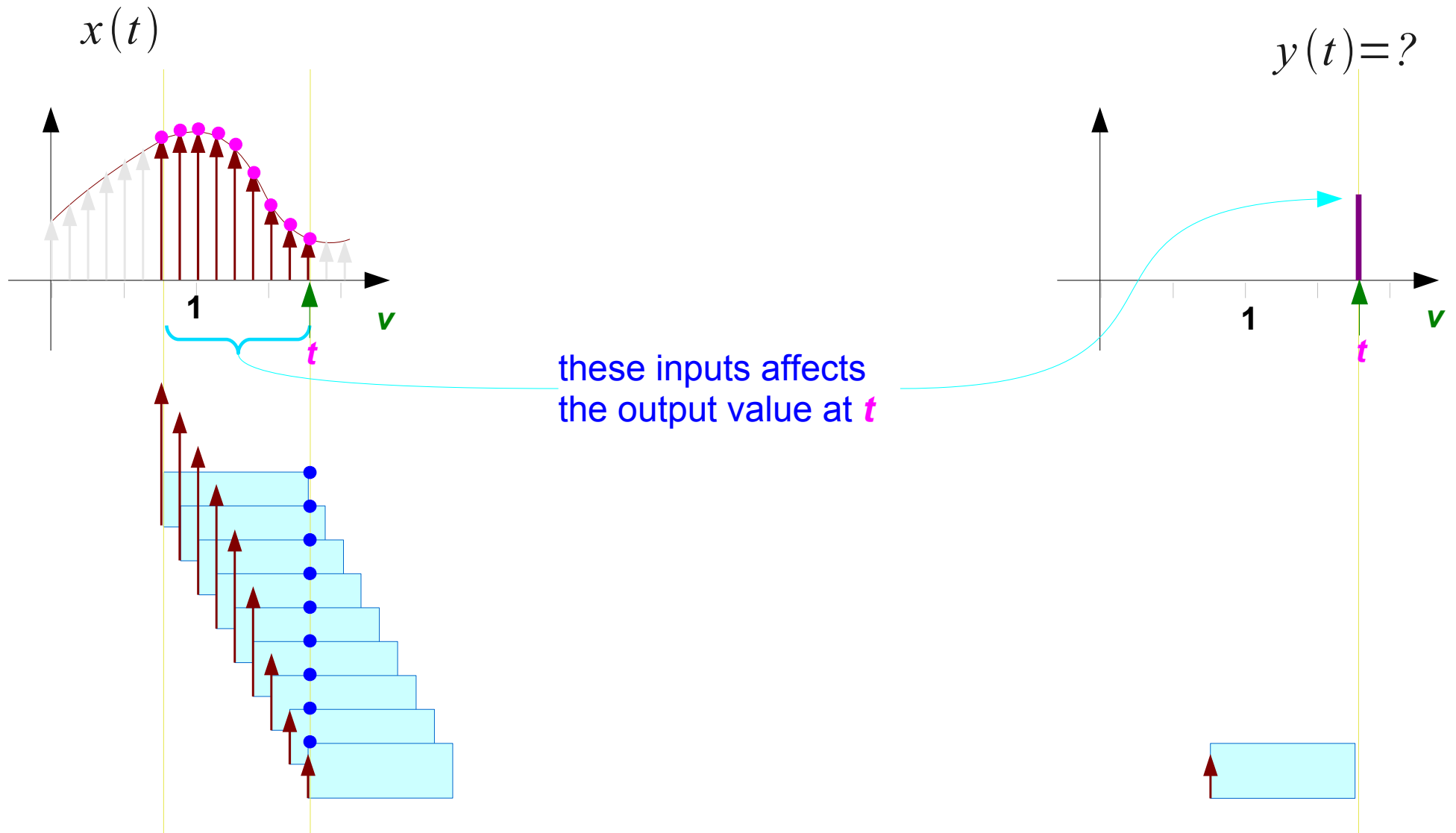
input value at time v
 $\rightarrow x(v)$
 delayed impulse response
 $\rightarrow h(t-v)$



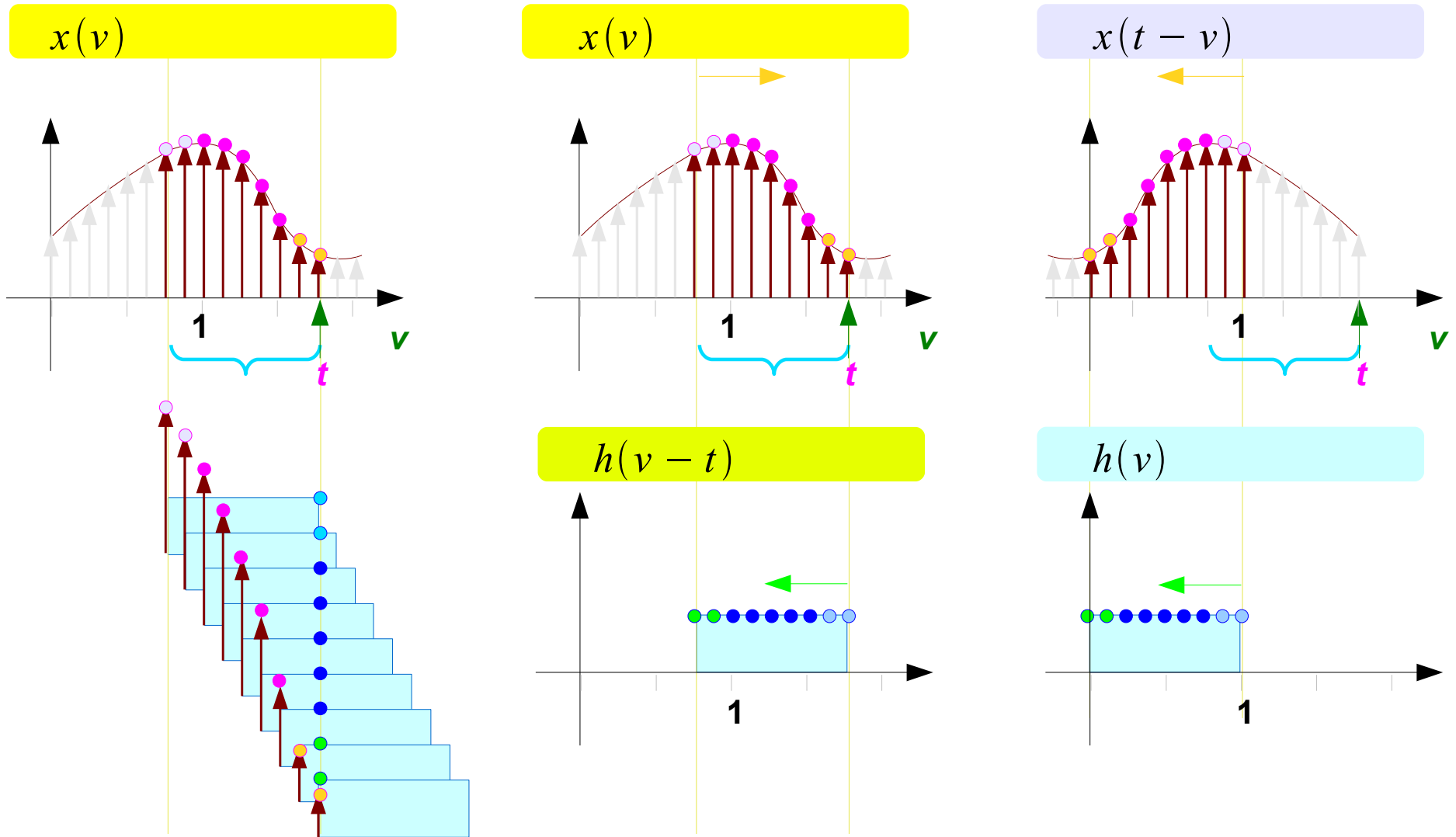
Impulse Response



Impulse Response



Impulse Response



References

[1] <http://en.wikipedia.org/>

[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003