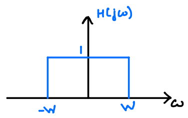
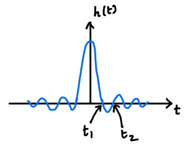
In general, a rectangular function in one domain will have a sinc function in the other domain.
A "box" or ideal LPF in frequency domain corresponds to a "sinc" function in the time or spatial domains

$x(t) \rightarrow \boxed{\text{LTI}} \rightarrow y(t)$

An ideal lowpass filter has frequency response of $H(j\omega)$ and inverse transform $h(t) = \frac{\sin Wt}{\pi t}$





(a) Zero Crossings:

sinc function $= 0$

$$\frac{\sin Wt}{\pi t} = 0$$

$$\sin Wt = 0$$

Think about times when sin is 0.

$0, \pi, 2\pi \ldots.$

So, for t_1, $Wt_1 = \pi$

$$\boxed{t_1 = \frac{\pi}{W}}$$

for t_2, $Wt_2 = 2\pi$

$$\boxed{t_2 = \frac{2\pi}{W}}$$

(b) $h(t)$ as sinc form $\quad \operatorname{sinc}\theta = \frac{\sin \pi\theta}{\pi\theta}$

$$\frac{\sin Wt}{\pi t} = \frac{\sin \pi \underbrace{\boxed{\frac{Wt}{\pi}}}_{\theta}}{\pi \underbrace{\boxed{\frac{Wt}{\pi}}}_{\theta}} \cdot \frac{W}{\pi} = \boxed{\frac{W}{\pi} \operatorname{sinc}\left(\frac{Wt}{\pi}\right)}$$

(c) amplitude of $h(t)$ for $t=0$:

$$h(t) = \frac{\sin Wt}{\pi t}$$

$t=0$:

$$h(0) = \frac{\sin 0}{0} \leftarrow \text{oh no!}$$

So, we do $t \to 0$

L'Hopital's rule is used.

$$\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$$

$$h(0) = \lim_{t \to 0} \frac{\sin Wt}{\pi t} = \lim_{t \to 0} \frac{W \cos Wt}{\pi} = \frac{W}{\pi}$$

$$\boxed{h(0) = \frac{W}{\pi}}$$