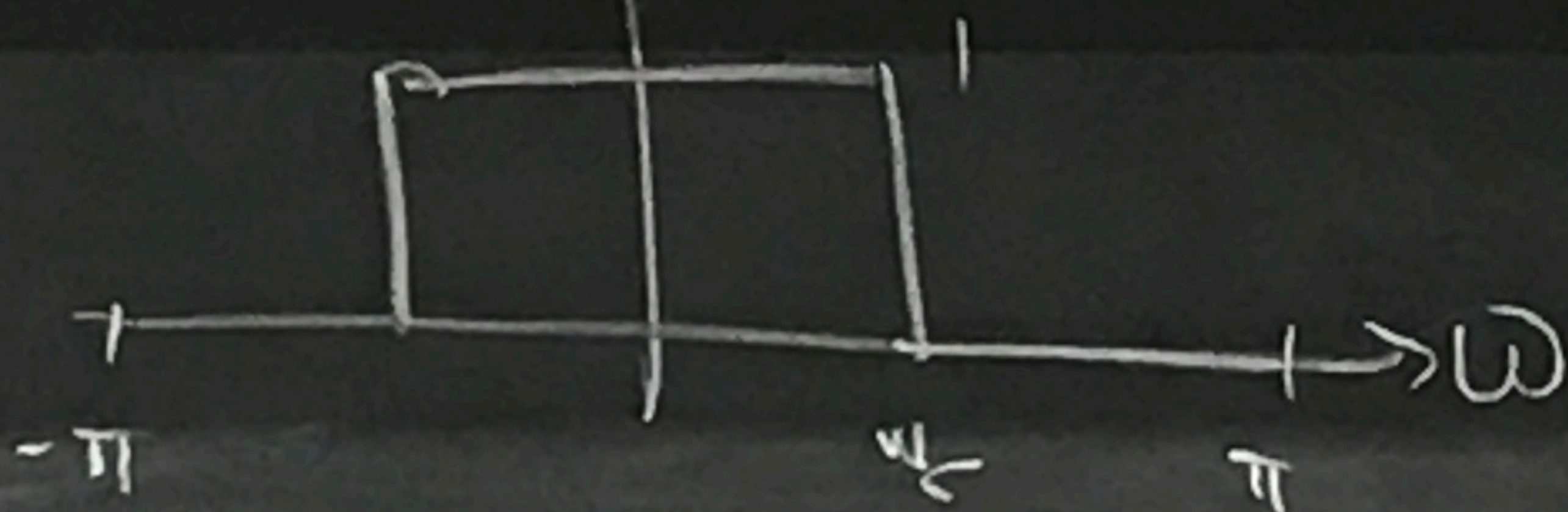
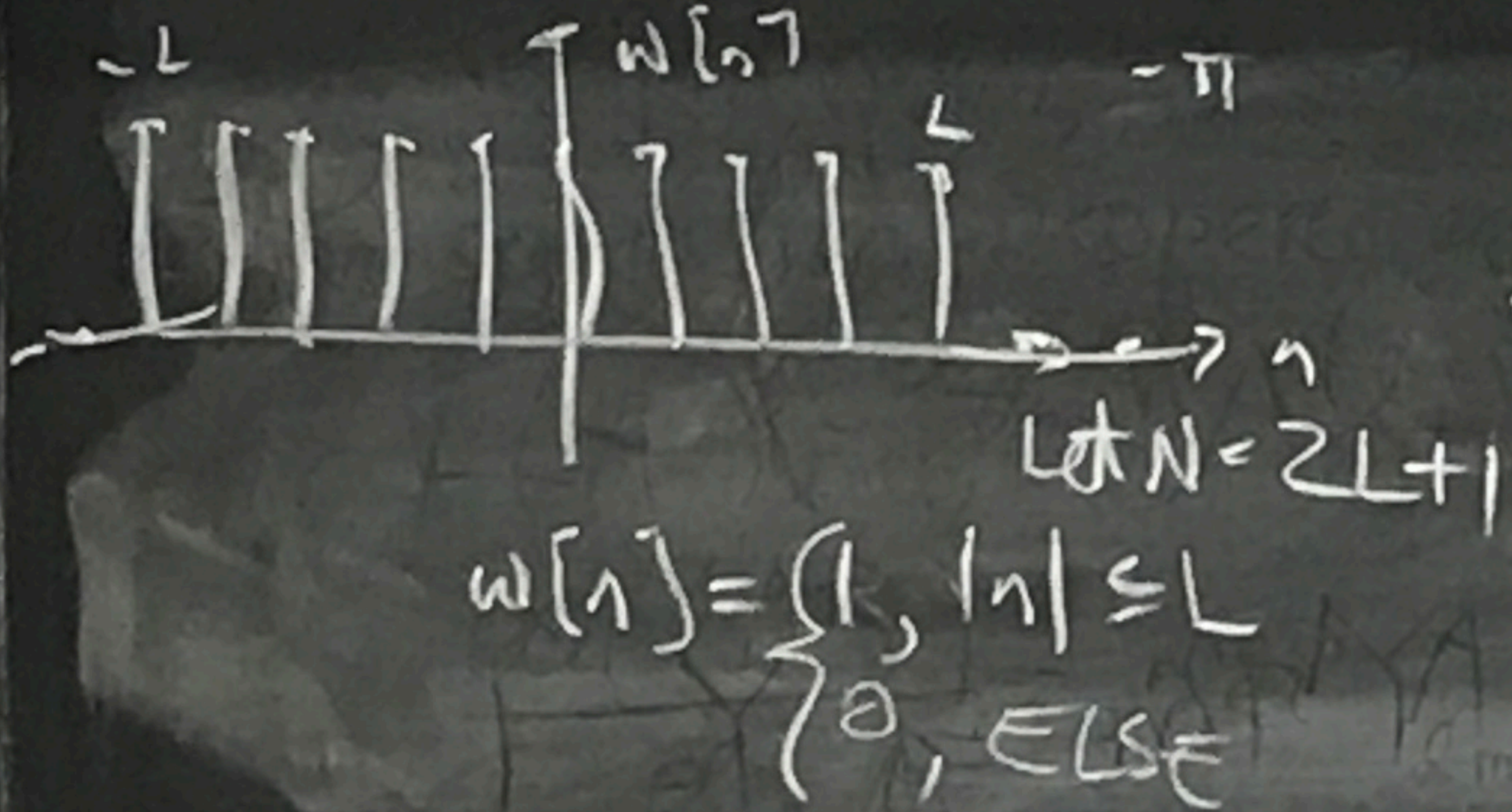
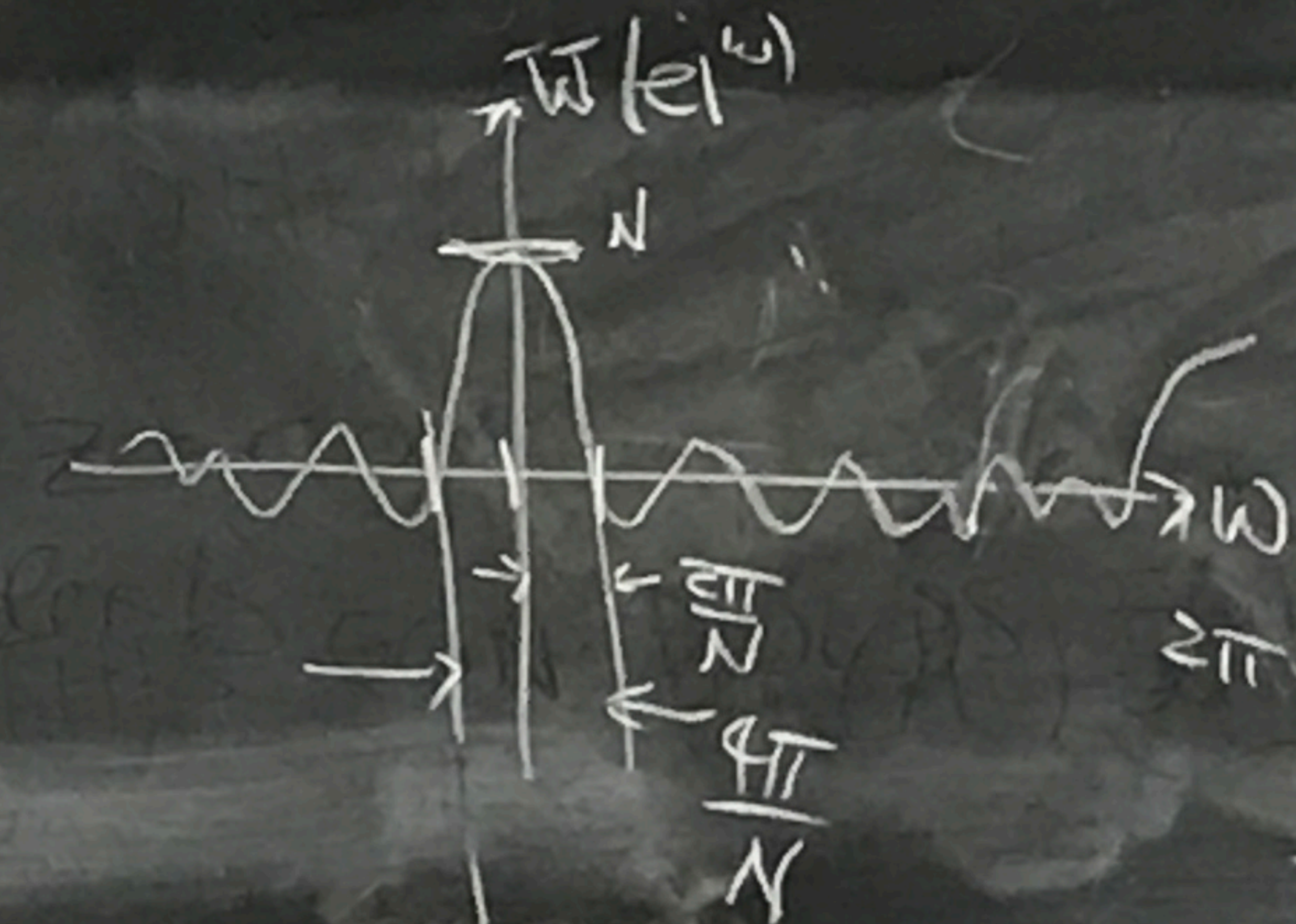


$$h[n] = \frac{\sin(\omega_c n)}{\pi n} \Leftrightarrow$$



$$\Leftrightarrow W(e^{j\omega}) = \frac{\sin\left(\frac{\omega N}{2}\right)}{\sin\left(\frac{\omega}{2}\right)}$$

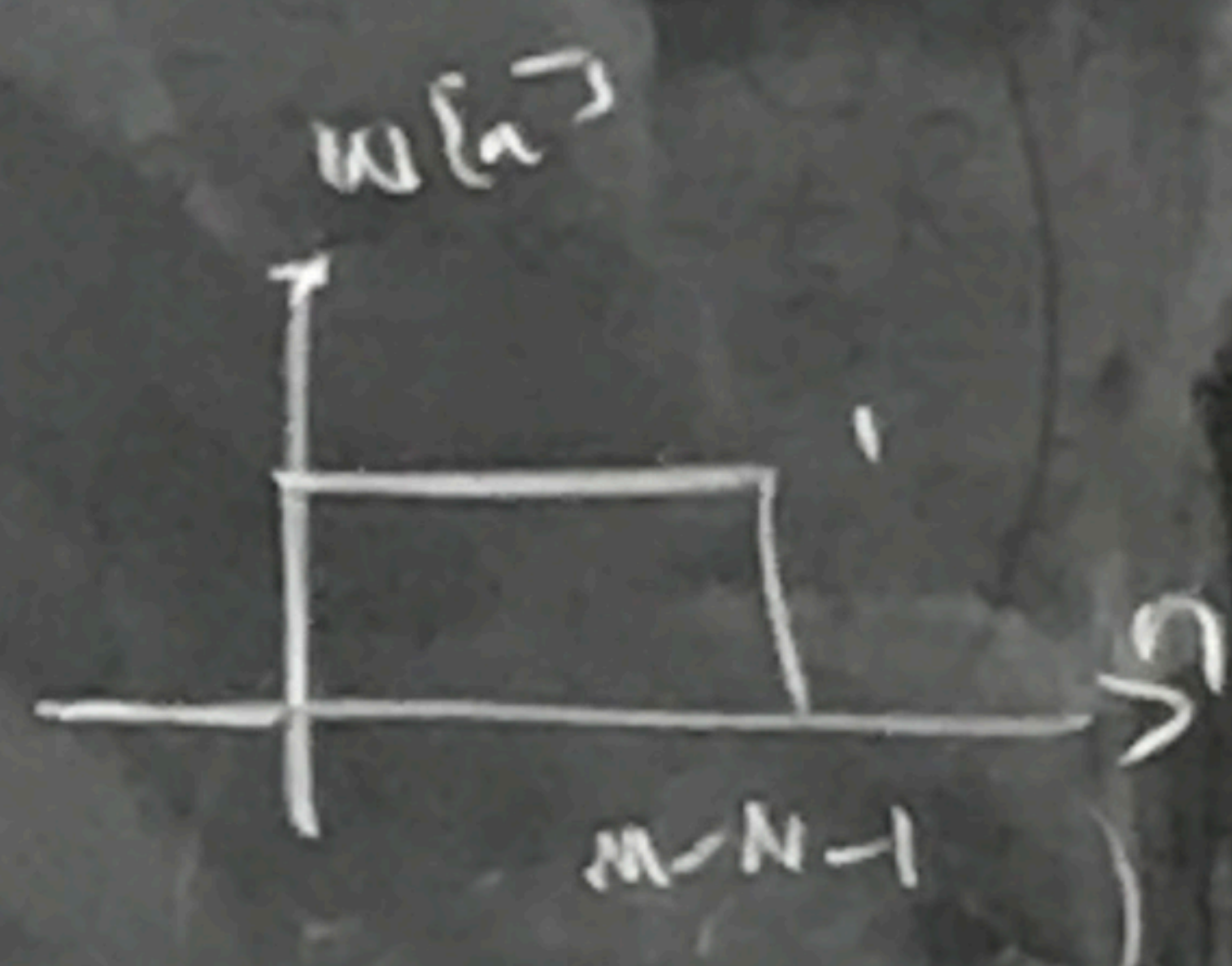


$$w[n] = \begin{cases} 1, & |n| \leq L \\ 0, & \text{ELSE} \end{cases}$$

M "CLASSIC" WINDOWS

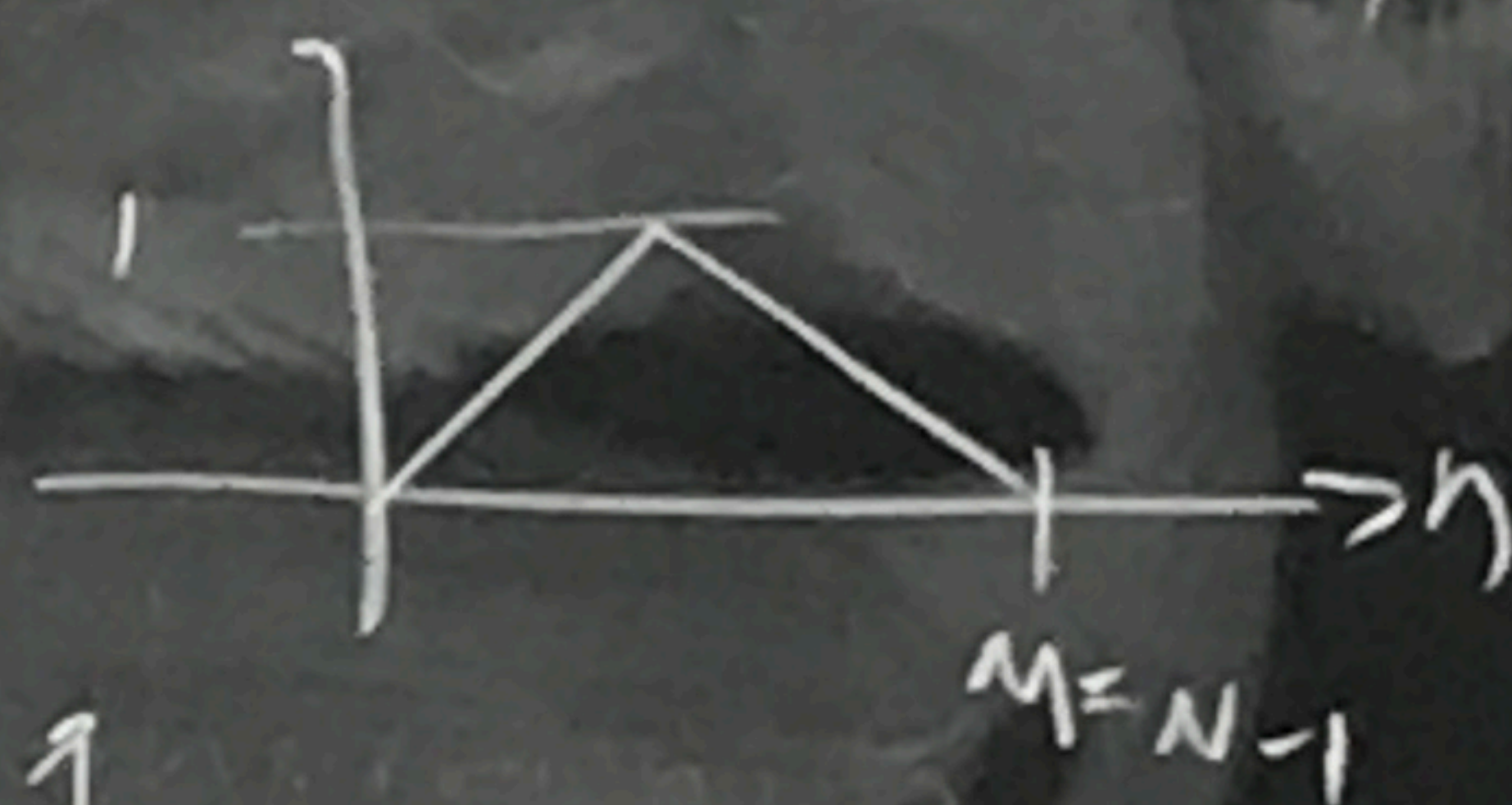
RECTANGULAR WINDOW

$$w[n] = 1, 0 \leq n \leq M = N-1$$



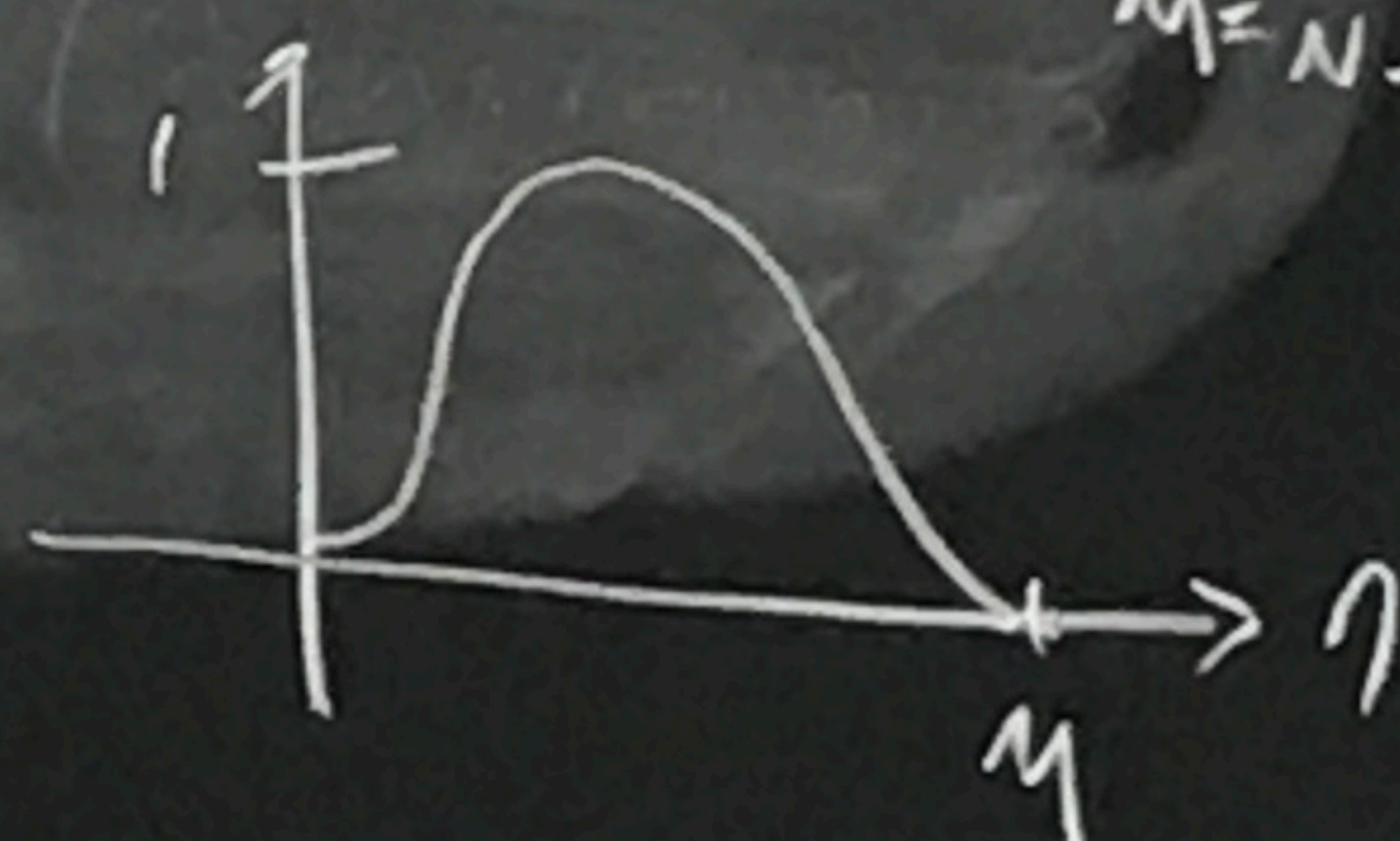
BARTLETT

$$w[n] = \begin{cases} \frac{2n}{M}, & 0 \leq n \leq \frac{M}{2} \\ 2\left(1 - \frac{n}{M}\right), & \frac{M}{2} \leq n \leq M \end{cases}$$



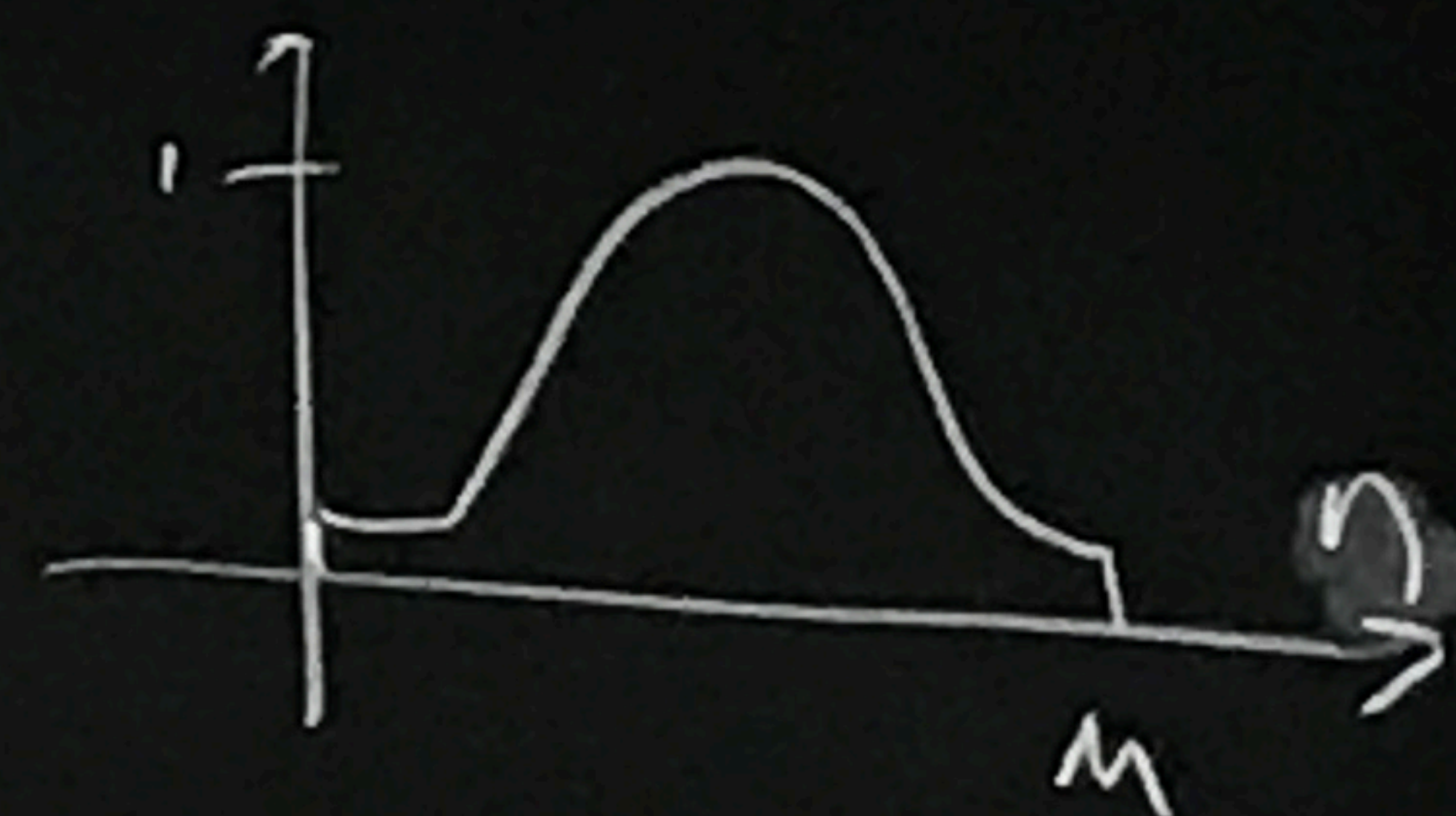
VON HANN ("HANNING")

$$w[n] = \frac{1}{2} \left[1 - \cos\left(\frac{2\pi n}{M}\right) \right] \begin{cases} 0 \leq n \leq M \\ 0, \text{ ELSE} \end{cases}$$



HAMMING

$$w[n] = \begin{cases} .54 - .46 \cos\left(\frac{2\pi n}{M}\right), & 0 \leq n \leq M \\ 0, \text{ ELSE} \end{cases}$$



BLACKMAN

$$w[n] = \begin{cases} .42 - .5 \cos\left(\frac{2\pi n}{M}\right) + .18 \cos\left(\frac{4\pi n}{M}\right), & 0 \leq n \leq M \\ 0, \text{ ELSE} \end{cases}$$

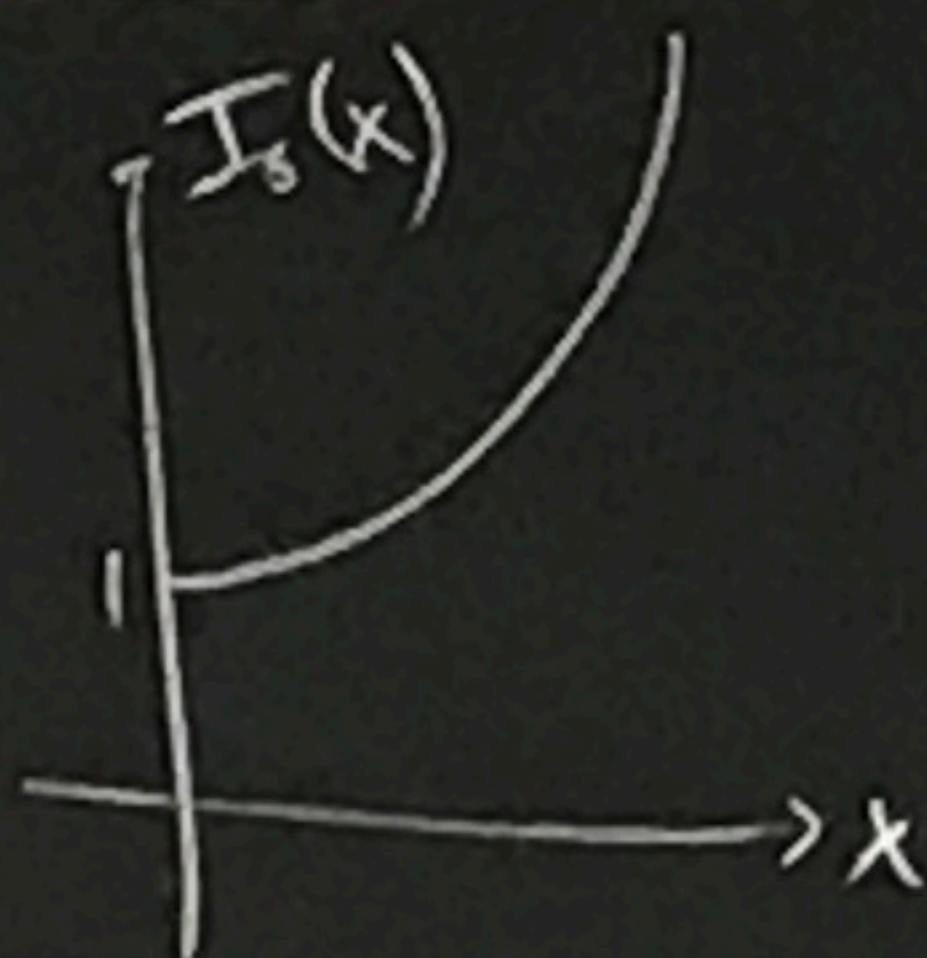
Kaiser windows

$$w[n] = \frac{I_0 \left[\beta \left(1 - \left(\frac{n - \frac{M}{2}}{\alpha} \right)^2 \right)^{1/2} \right]}{I_0(\beta)}, \quad 0 \leq n \leq M \quad (0.54\pi \text{ 7.5-7.6})$$

0, ELSE

$$\alpha = M/2$$

$I_0(x)$



$$\Delta\omega = \omega_s - \omega_p = 0.1\pi$$

$$A = -20 \log_{10} \delta_2 = 60$$

$$\beta = 1.1102 (51.3) = 5.6533$$

$$\beta = \begin{cases} 1.1102 (A - 8.7) & A > 50 \\ 0.5842 (A - 21)^4 + 0.7886 (A - 21) & 21 \leq A \leq 50 \\ 0, & A < 21 \end{cases}$$

$$M = \frac{A - 8}{2.285 \Delta\omega} = \frac{52}{(2.285)(0.1)(\pi)} = 73$$

TABLE 7.2 COMPARISON OF COMMONLY USED WINDOWS

Type of Window	Peak Side-Lobe Amplitude (Relative)	Approximate Width of Main Lobe	Peak Approximation Error, $20 \log_{10} \delta$ (dB)	Equivalent Kaiser Window, β	Transition Width of Equivalent Kaiser Window
Rectangular	-13	$4\pi/(M+1)$	-21	0	$1.81\pi/M$
Bartlett	-25	$8\pi/M$	-25	1.33	$2.37\pi/M$
Hann	-31	$8\pi/M$	-44	3.86	$5.01\pi/M$
Hamming	-41	$8\pi/M$	-53	4.86	$6.27\pi/M$
Blackman	-57	$12\pi/M$	-74	7.04	$9.19\pi/M$

5.6533

>> 52/(2.285+.1*pi)

ans =

72.4381

I copied Richard on this in case you need help.

Confirm receipt.

Thanks,

Rich Kitay

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