

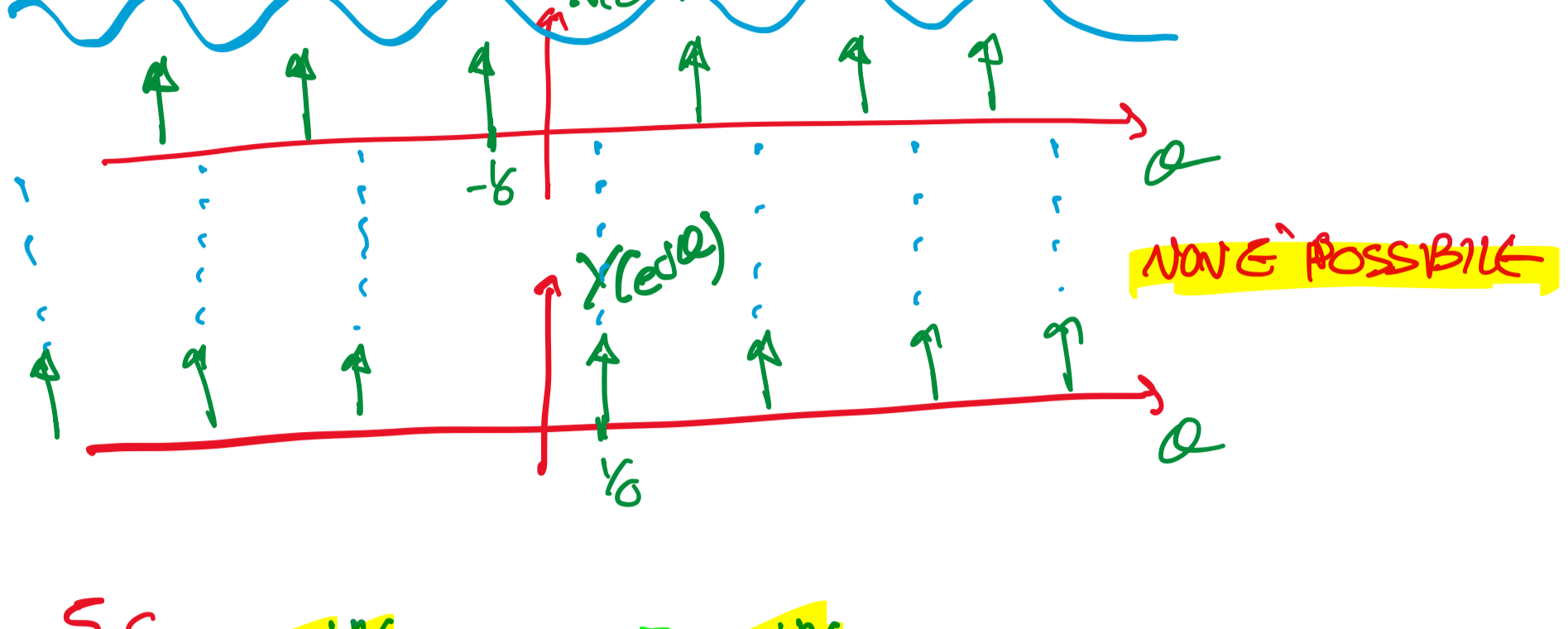
Es 5, Appello 2, 2021

5.a È vero che  $x * y(n) = x(n+\delta) * y(n-\delta)$   
 $= x * y(n)$   
 È VERA

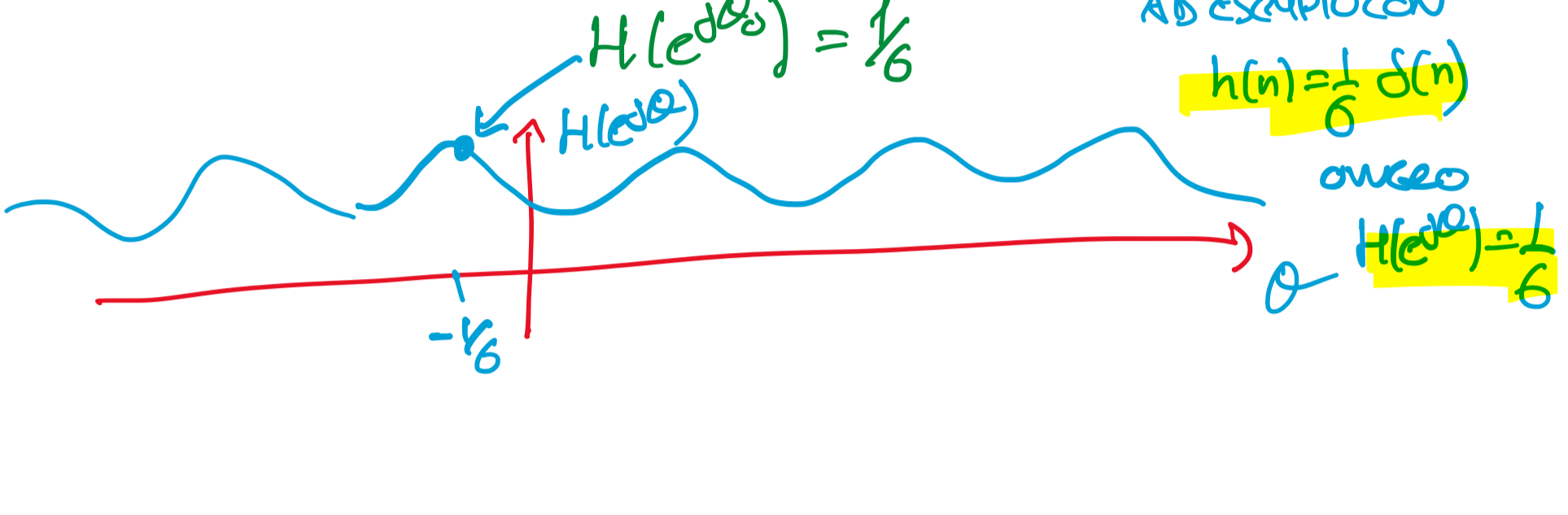
5.b POSSO IDENTIFICARE UNA RISPOSTA IMPULSIVA  $h(n)$  TALE CHE

$x(n) = e^{-j^n/6} \rightarrow h(n) \rightarrow y(n) = \frac{1}{6} e^{jn/6}$

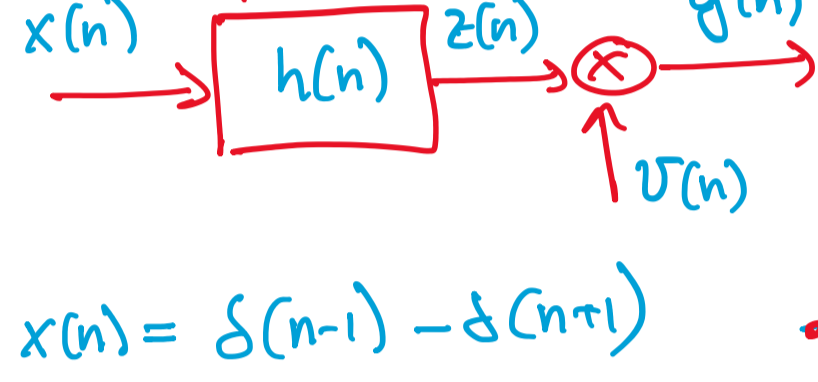
$x(n) = e^{-j^n/6} \rightarrow h(n) \rightarrow y(n) = H(e^{j\theta_0}) x(n)$   
 $\theta_0 = -\frac{1}{6}$   
 $= H(e^{j\theta_0}) e^{-j^n/6}$   
 COSTANTE COMPLESSA



5.c  $x(n) = e^{-j^n/6} \rightarrow h(n) \rightarrow \frac{1}{6} e^{-jn/6} = y(n)$   
 $y(n) = H(e^{j\theta_0}) x(n)$

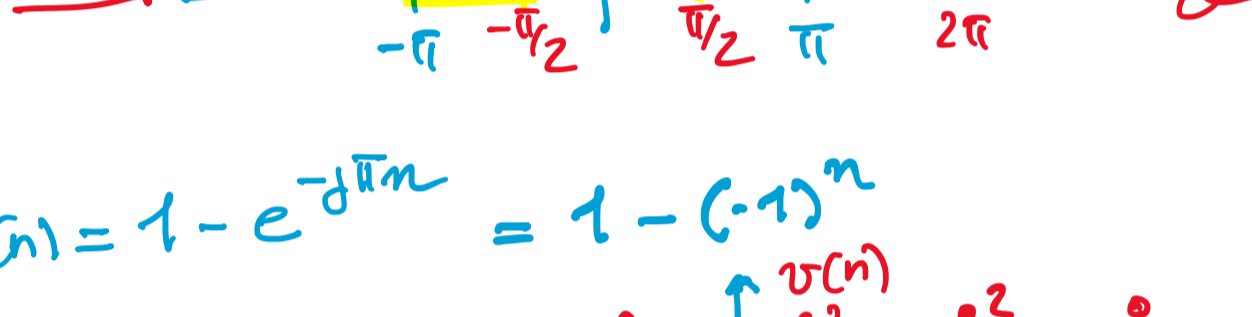


Es 3, SECONDO APPELLO 2021



$x(n) = \delta(n-1) - \delta(n+1)$

FILTRO PASSABASSO CON FASE DITALE  $\theta_0 = \pi/2$   
 COSTANTE  $d = 1/2$  PERIODO  $2\pi$



$v(n) = 1 - e^{-j\pi n} = 1 - (-1)^n$

$y(n) = ?$   
 MOLTIPLICAZIONE  
 TEMPO  $y(n) = z(n)v(n) = z(n) - z(n)e^{-j\pi n}$   
 FASE  $Y(e^{j\theta}) = Z(e^{j\theta}) - Z(e^{j(\theta+\pi)})$

FILTRO TEMPO  $z(n) = x * h(n) = [\delta(n-1) - \delta(n+1)] * h(n) = h(n-1) - h(n+1)$   
 FASE  $Z(e^{j\theta}) = X(e^{j\theta}) H(e^{j\theta})$

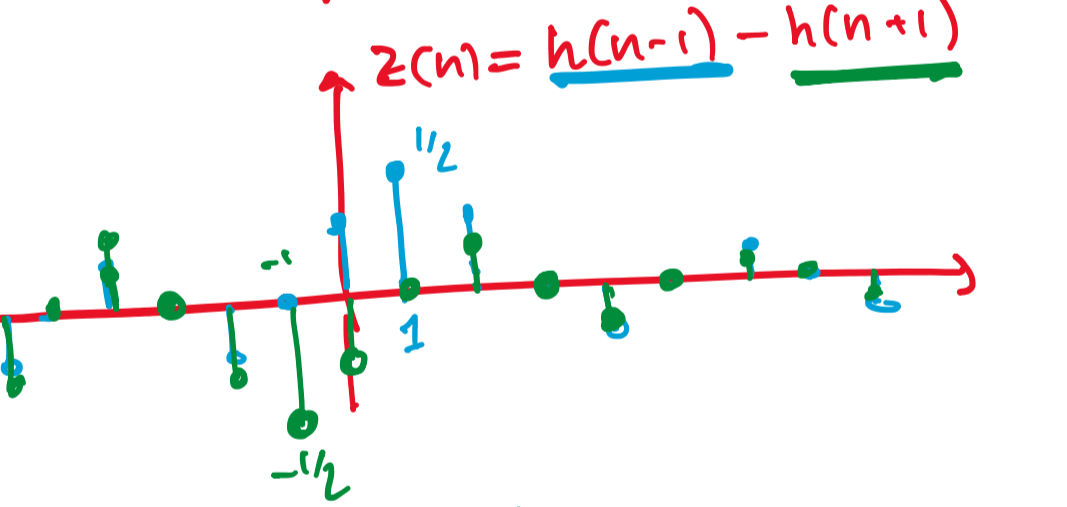
SOLUZIONE NEL DOMINIO DEL TEMPO

$y(n) = z(n)v(n)$   
 $z(n) = h(n-1) - h(n+1)$   
 $H(e^{j\theta}) = 2 \cos(\frac{\theta}{2}) \text{rect}(\frac{\theta}{\pi})$

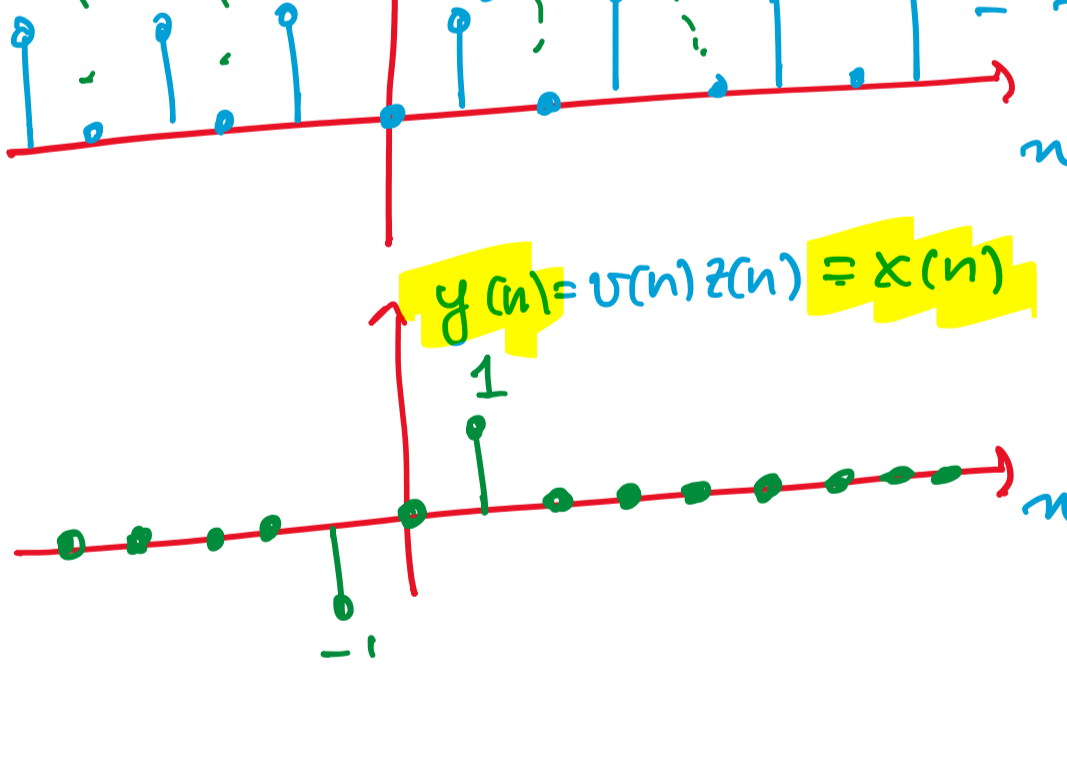
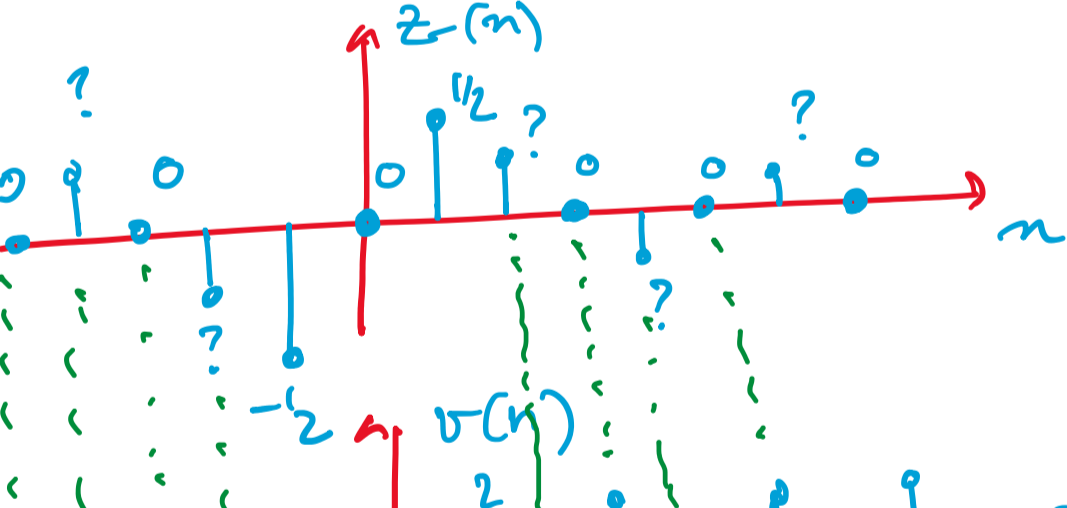
$Q(\theta) = \text{rect}(\frac{2\theta}{\pi})$

$q(t) = \frac{1}{2} \text{sinc}(\frac{t}{2})$   
 $Q(j\omega) = \frac{1}{2} \text{sinc}(\frac{\omega}{2})$

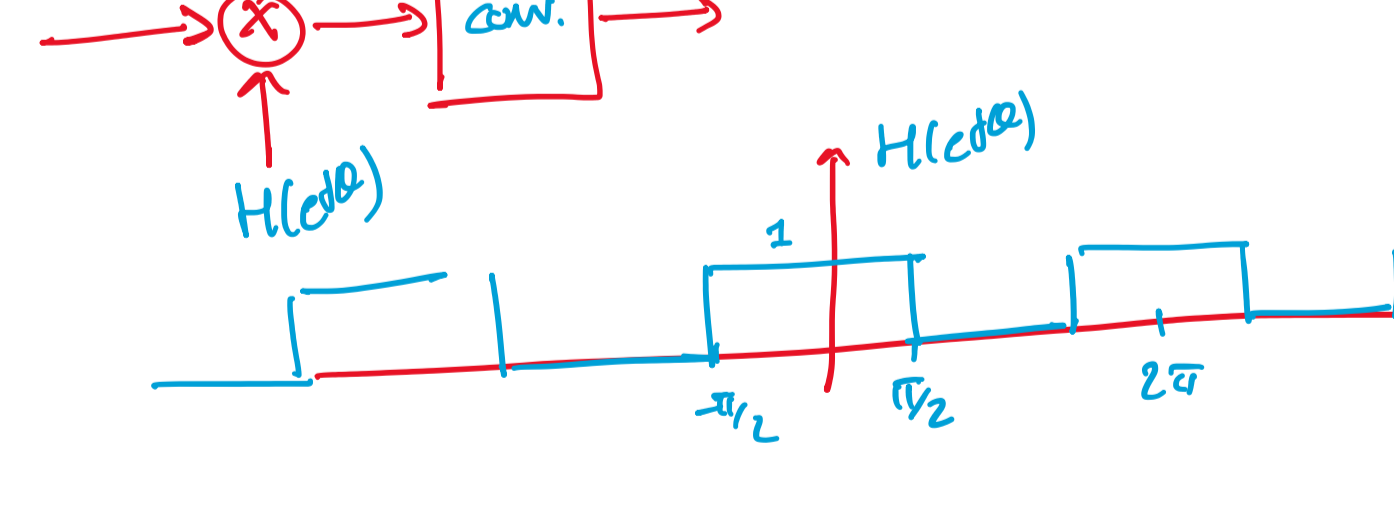
$h(n) = \frac{1}{2} \text{sinc}(\frac{n}{2})$



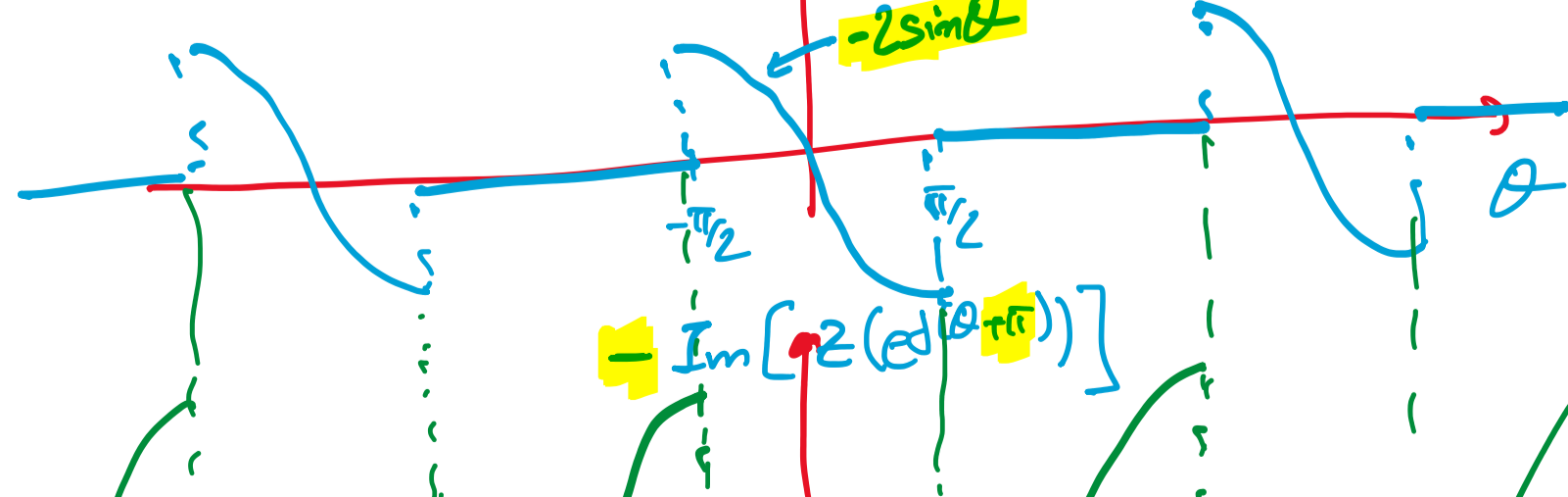
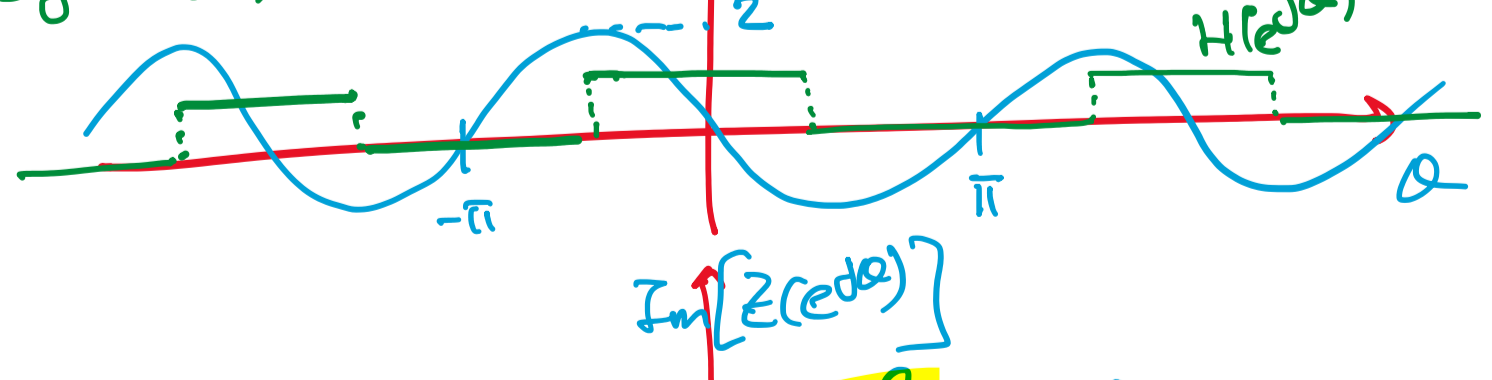
$z(n) = h(n-1) - h(n+1)$



SOLUZIONE NEL DOMINIO DELLA FASE



$x(n) = \delta(n-1) - \delta(n+1)$   
 $X(e^{j\theta}) = \sum_n [\delta(n-1) - \delta(n+1)] e^{j\theta n}$   
 $= e^{j\theta} - e^{-j\theta}$   
 $= -(e^{-j\theta} - e^{j\theta})$   
 $= -2j \sin(\theta)$



$+ (+2 \sin(\theta + \pi)) = -2 \sin(\theta)$

$Y(e^{j\theta}) = -2 \sin(\theta) = X(e^{j\theta})$

