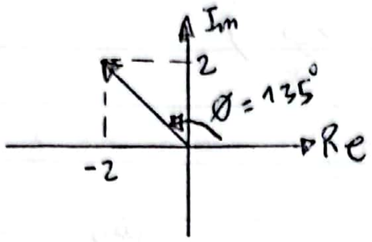
1.-

$Z = -2 + 2j$

(a) $\sqrt{2^2 + 2^2} = \sqrt{8}$

$\phi = \tan^{-1}\left(\frac{2}{-2}\right)$



$\phi = \tan^{-1}(-1)$

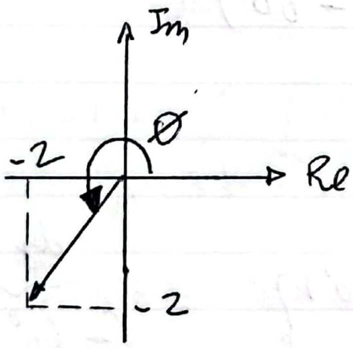
$\phi = -45°$

But it is: $\pi - 45 = \underline{135°}$

b) $z = -2 - 2j$

$\sqrt{(-2)^2 + (-2)^2} = \sqrt{8}$

$\phi = \tan^{-1}\left(\frac{-2}{-2}\right)$

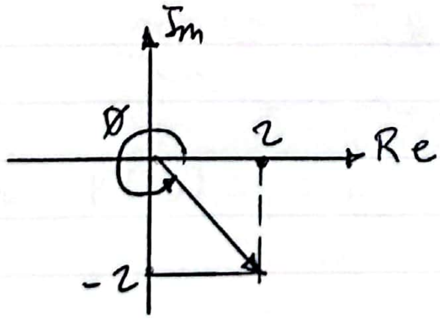


$\phi = \tan^{-1}(1)$

$\phi = 45°$

But it is: $\pi + 45 = 180 + 45 = \underline{225°}$

c) $z = 2 - 2j$



$\phi = \pi + \frac{\pi}{2} + \frac{\pi}{4}$

$\phi = 180 + 90 + 45$

$\phi = 225 + 90 = \underline{315°}$

2 - a) $V(t) = 4\cos(2\pi(10)t + 30^\circ)$

at $t = 0$:

$V(t) = 4\cos(30^\circ)$

deg rad

$30^\circ = \frac{\pi}{6}$

$\rightarrow V(t) = \mathrm{Re}\{4e^{j\pi/6}\}$

b) $V(t) = 2\sin(2\pi(10)t - 60^\circ)$

at $t = 0$:

$V(t) = 2\sin(-60^\circ)$

$= \mathrm{Im}\{2e^{j(-60^\circ)}\}$

deg rad

$-60^\circ = -\frac{\pi}{3}$

$= \mathrm{Im}\{2e^{-j\pi/3}\}$

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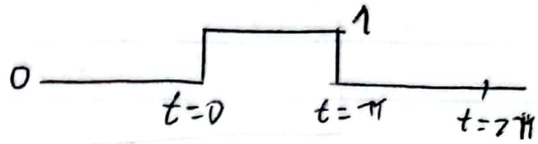
3.- Fourier Analysis

$$F(w) = \int_{-\infty}^{\infty} f(t)\, e^{-jwt}\, dt$$



$$f(t) = \begin{cases} 1, & t \in (0, \pi) \\ 0, & t \in (\pi, 2\pi \end{cases}$$

$$F(w) = \int_{0}^{\pi} 1\, e^{-jwt}\, dt$$

$$F(w) = -\frac{1}{jw}\left[e^{-jwt}\right]_0^{\pi} = \frac{1}{jw}\left[e^{-jwt}\right]_{\pi}^{0}$$

$$F(w) = \frac{1}{jw}\left[1 - e^{-jw\pi}\right] = \frac{e^{-jw\pi/2}}{jw}\left[e^{jw\pi/2} - e^{-jw\pi/2}\right]$$

I am factoring $(e^{-jw\pi/2})$

Then:

$$F(w) = \frac{e^{-jw\pi/2}}{jw}\left[e^{jw\pi/2} - e^{-jw\pi/2}\right] \times \frac{2}{2}$$

$$\sin(x) = \frac{e^{jx} - e^{-jx}}{2j}$$

Thus; $$F(w) = \frac{2e^{-jw\pi/2}}{w}\left(\sin(w\pi/2)\right) \times \frac{\pi}{\pi}$$

$$F(w) = \underbrace{\frac{2\pi e^{-j(w\pi/2)}}{w\pi}}_{1/\tau} \cdot \sin((w\pi/2))$$

$$\frac{w\pi}{2} = \tau$$

$$F(W) = \pi e^{-jT} \frac{\sin(T)}{T}$$

$$\frac{\sin(T)}{T} = \mathrm{sync}(T)$$

$$\Rightarrow F(W) = \pi e^{-jT} \, \mathrm{sync}(T)$$

b) When: $F(W) = 0$??

$$\pi e^{-jT} \, \mathrm{sync}(T) = 0$$

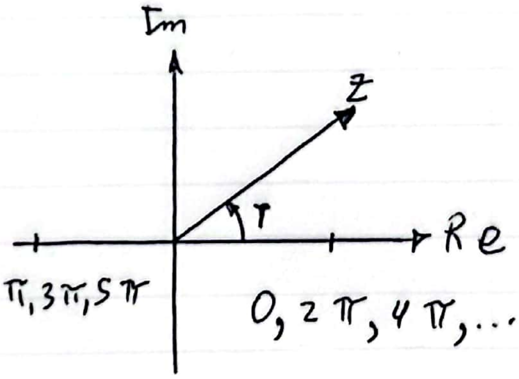
When: $\mathrm{sync}(T) = 0$

$$\frac{\sin(T)}{T} = 0$$

But: $T = \frac{W\pi}{2}$

It is only possible when $\sin(T) = 0$

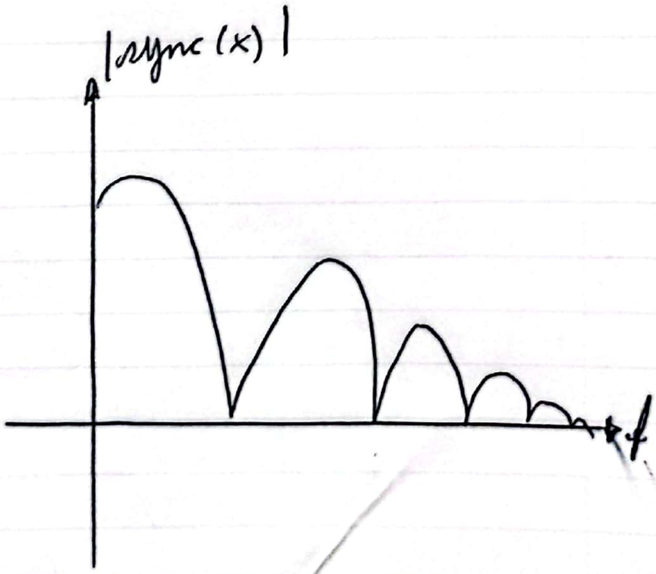
$$\sin\left(\frac{W\pi}{2}\right) = 0$$



so : $\frac{W\pi}{2} = n\pi$

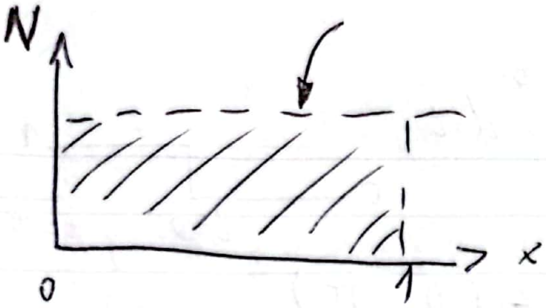
n: is any natural number

$$\Rightarrow \boxed{W = 2n}$$



Probability & statistics

$\sigma = \sqrt{\frac{1}{12}}$



$p(x) = C$

$$\int_0^1 p(x)\,dx = 1$$

$$\int_0^1 c\,dx = 1$$

$$c\,[x]_0^1 = 1$$

$$c(1-0) = 1 \rightarrow c = 1$$

$p(x) = 1$

$$\int_0^1 x\,p(x)\,dx$$

$$\int_0^1 x\,1\,dx = \frac{x^2}{2}\Big|_0^1$$

$$\frac{1}{2} - 0 = \frac{1}{2}$$

$$\sigma^2 = \int_0^1 (x-\mu)^2\,p(x)\,dx = \int_0^1 (x - 1/2)^2\,dx$$

let: $u = x - 1/2$

$$\int_{-1/2}^{1/2} u\,du = \frac{u^3}{3}\Big|_{-1/2}^{1/2} = \frac{1}{3}\left(\frac{1}{8} - -\frac{1}{8}\right)$$

$$= \frac{1}{3}\left(\frac{1}{4}\right) = \frac{1}{12}$$

$$\sigma = \sqrt{\frac{1}{12}}$$