Q1 Compute Energy $\mathcal{E}_x = \sum_{-N}^{N} |x[n]|^2$

ar^N $\quad 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots \infty$

$\left(\frac{1}{2}\right)^n$ $\quad \frac{a - ar^N}{1-r}, r \neq 1$ $\quad a N, r = 1$ $\quad \frac{a}{1-r} = \frac{1}{1-\left(\frac{1}{2}\right)^n}$

$\mathcal{E}_x = \sum_{-N}^{N} \left| \frac{1}{1-\left(\frac{1}{2}\right)^n} \right|^2$

When $n=1$, $\mathcal{E}_x = 4$
$n=2$, $\mathcal{E}_x = 1.778$
$n=3$, $\mathcal{E}_x = 1.306$

$\lim_{N \to \infty} \sum_{-N}^{N} \left(\frac{1}{1-\left(\frac{1}{2}\right)^n} \right)^2 = \infty$

Q2 $x[n] = 3(-1)^n + e^{j\frac{4\pi}{3}n} - e^{j\frac{2\pi}{5}n}$

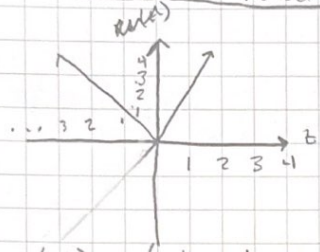
First part = 3

2nd RHS $= e^{j\frac{4\pi n}{3}} = N = \frac{2\pi}{\pi} = \frac{2\pi}{\frac{4\pi}{3}} = m\frac{6\pi}{4\pi} = \frac{3}{2}m$ $\quad N_0 = 3$, $m = 2$

LHS $= e^{-j\frac{2\pi n}{5}} = N = \frac{2\pi}{\pi} = \frac{2\pi}{\frac{2\pi}{5}m} = m\frac{10\pi}{2\pi} = 5$ $\quad N_0 = 5$

Yes, it is Periodic.
Fundamental Period = 45

Q3



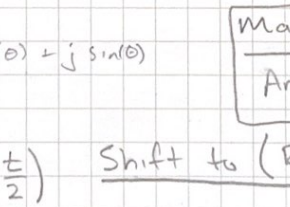
$x(-t) = \begin{cases} t, & t > 0 \\ -2t, & t \leq 0 \end{cases}$

$-t + 2t$

$X_o = \frac{1}{2}[x(t) - x(-t)]$

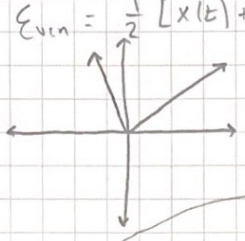
$t > 0 \quad 2t - t = t$

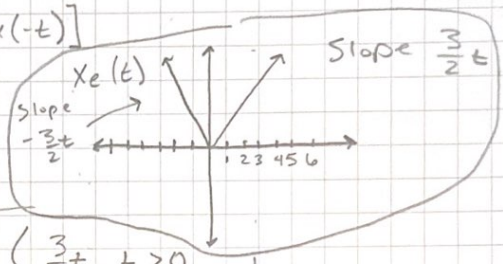
$x_o(t) = \begin{cases} \frac{t}{2}, & t > 0 \\ -\frac{t}{2}, & t \leq 0 \end{cases}$



Slope $= \frac{t}{2}$

$\mathcal{E}_{even} = \frac{1}{2}[x(t) + x(-t)]$





$x_e(t) = \begin{cases} \frac{3}{2}t, & t > 0 \\ -\frac{3}{2}t, & t \leq 0 \end{cases}$

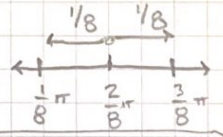
Q4 $z = e^{j\frac{1}{8}\pi} + e^{j\frac{3}{8}\pi} = re^{j\theta}$

$\frac{2}{8} - \frac{1}{8}$

$\frac{2}{8} + \frac{1}{8}$

$2e^{j\frac{\pi}{8}\left(\frac{2}{8} - \frac{2}{8}\right)}$

$r = \cos(\theta) + j\sin(\theta)$

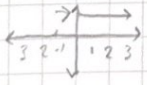


Magnitude = 2

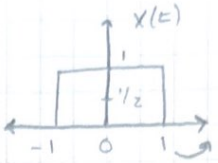
Angle = $\frac{2}{8}\pi$

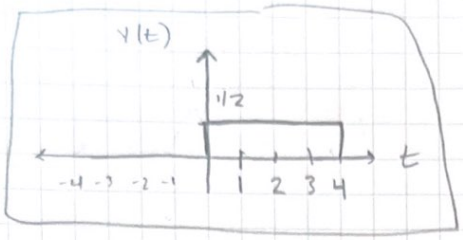
Q5 Scale by $\left(\frac{t}{2}\right)$ $\rightarrow$ $x\left(\frac{t}{2}\right)$ Shift to (RIGHT) by $\left(\frac{3}{2}\right)$ $\rightarrow$ $y(t)$

$x(t)$ Shift to (RIGHT) by (3) $\rightarrow$ $x(t-3)$ Scale by $(t/2)$ $\rightarrow$ $y(t)$



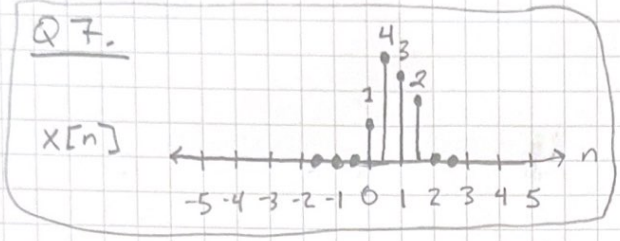
Q6. Sketch $y(t) = \frac{1}{2} x(2t-1)$





Shift to right 1
Scale t by 2
1/2 height

Q7.



- Shift to left
- Scale by 1/2