ECE 640
HW#2

2.30) The fundamental period N of a periodic sequence with an angular frequency w_0 satisfies Eq. (2.47a) with the smallest value of N & r.

a) $w_0 = 0.5\pi$. Here Eq.(2.47a) reduces to $0.5\pi N = 2\pi r$ which is satisfied with $N=4$, $r=1$.

b) $w_0 = 0.8\pi$ $\quad 0.8\pi N = 2\pi r \rightarrow N=5,\ r=2.$

c) First, determine the fundamental period N_1 of $Re\{e^{j\pi n/5}\} = Cos(0.2\pi n)$.
In this case, $0.2\pi N_1 = 2\pi r_1 \rightarrow N_1 = 10,\ r_1 = 1.$
Then, we determine the fundamental period N_2 of $Im\{e^{j\pi n/10}\} = j Sin(0.1\pi n)$.
In this case, $0.1\pi N_2 = 2\pi r_2 \rightarrow N_2 = 20,\ r_2 = 1.$
Hence, the fundamental ~~frequency~~ period of $\tilde{x}_c(n)$, N, is given by
$LCM(N_1, N_2) = LCM(10, 20) = 20$

d) Determine the fundamental period N_1 of $3Cos(1.3\pi n) \rightarrow 1.3\pi N_1 = 2\pi r_1$ $\quad N_1=20, r_1=13$
Then, determine the fundamental period N_2 of $4Sin(0.5\pi n + 0.5\pi) \rightarrow 0.5\pi N_2 = 2\pi r_2$
$N_2 = 4, r_2 = 1$
Hence, the fundamental period N of $\tilde{x}_4(n)$ is given by $LCM(N_1, N_2) = LCM(20, 4) = 20$

e) Fundamental period N_1 of $Cos(1.5\pi n + 0.75\pi) \rightarrow 1.5\pi N_1 = 2\pi r_1 \rightarrow N_1 = 4,\ r_1 = 3.$
Fundamental period N_2 of $4Cos(0.6\pi n) \rightarrow 0.6\pi N_2 = 2\pi r_2 \rightarrow N_2 = 10,\ r_2 = 3$
Fundamental period N_3 of $Sin(0.5\pi n) \rightarrow 0.5\pi N_3 = 2\pi r_3 \rightarrow N_3 = 4,\ r_3 = 1.$
Hence, the fundamental period N of $\tilde{x}_5(n)$ is given by $LCM(N_1, N_2, N_3) = LCM(4,10,4) = 20$

2.32) $w_0 = 0.08\pi \rightarrow 0.08\pi N = 2\pi r \rightarrow N = 25,\ r = 1$
$\tilde{x}_2(n) = Sin\, w_2 n$ with fundamental period of $N = 25$, $25 w_2 = 2\pi r$
For example, for $r=2$ we have $w_2 = \frac{4\pi}{25} = 0.16\pi$.
Another sequence with the same fundamental period is obtained by setting $r=3$ which leads to $w_3 = \frac{6\pi}{25} = 0.24\pi$. The corresponding periodic sequences are therefore $\tilde{x}_2(n) = Sin(0.16\pi n)$ and
$\tilde{x}_3(n) = Sin(0.24\pi n)$.