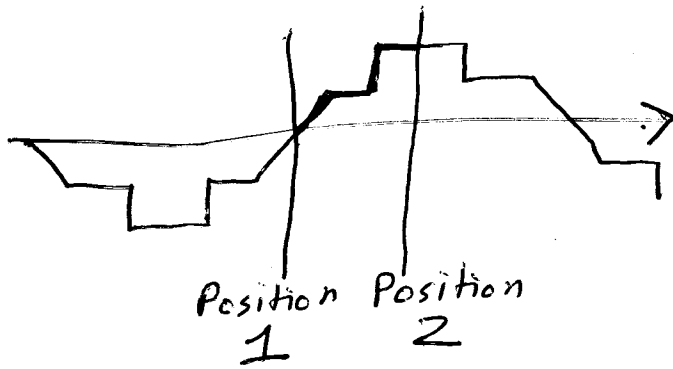


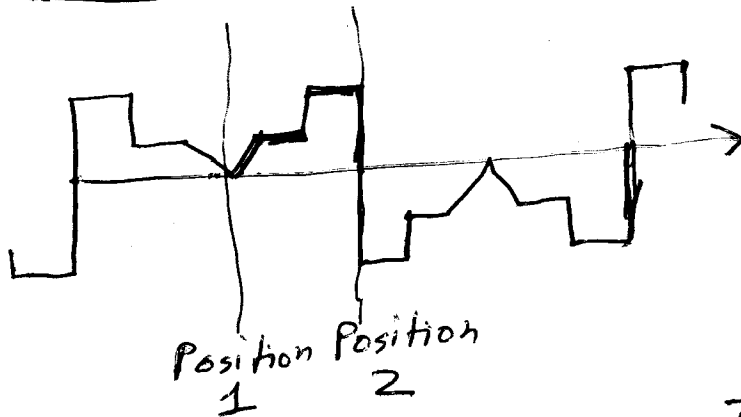
# Answers to Tutorial 3

①



- \* No even harmonics
- \* If  $(t=0)$  is at position 1 then only sin terms
- \* If  $(t=0)$  is at position 2 then only cos terms.
- \* No DC component

OR

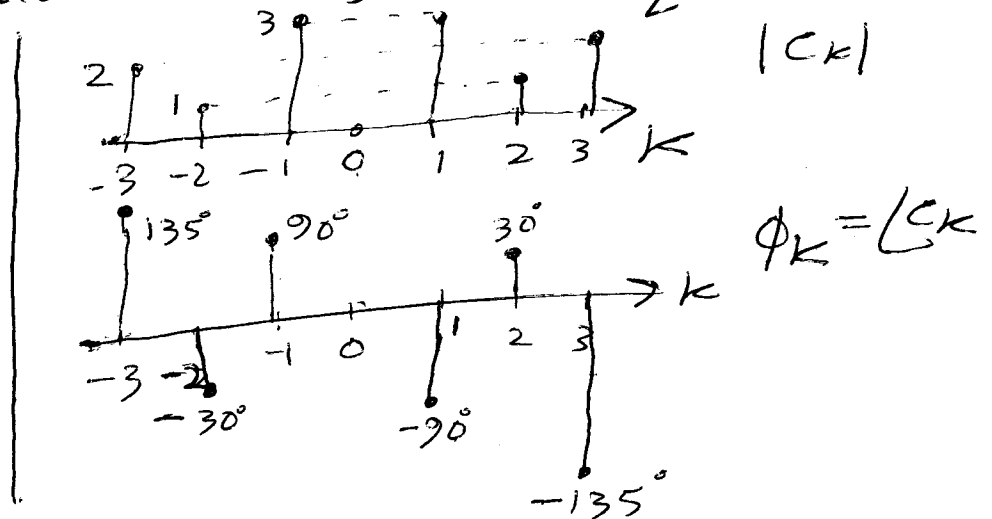


- \* No even harmonics
- \* If  $(t=0)$  is at position 1 then no sin terms
- \* If  $(t=0)$  is at position 2 then no cosine terms
- \* No DC component

② i) YES. Fundamental period =  $\frac{2\pi}{2}$   
 Fundamental angular freq. = 2

ii)

$$\begin{aligned} c_{-3} &= 2 \angle 135^\circ \\ c_{-2} &= 1 \angle -30^\circ \\ c_{-1} &= 3 \angle 90^\circ \\ c_1 &= 3 \angle -90^\circ \\ c_2 &= 1 \angle 30^\circ \\ c_3 &= 2 \angle -135^\circ \end{aligned}$$



③ 
$$a_k = \begin{cases} \frac{8A}{k^2 \pi^2} & \text{for odd } k \\ 0 & \text{for even } k \end{cases}$$

$b_k = 0$  for all  $k$

$c_0 = 0$

$$c_k = \frac{2A}{k^2 \pi^2} (1 - \cos k\pi) = \begin{cases} 0 & \text{for } k \text{ even} \\ 4A/(k^2 \pi^2) & \text{for } k \text{ odd} \end{cases}$$

$$\textcircled{4} \text{ i) } a_k = \begin{cases} 0 & \text{for odd } k \\ \frac{2V}{\pi(1-k^2)} & \text{for even } k \end{cases}$$

$$b_k = \begin{cases} V/2 & \text{if } k=1 \\ 0 & \text{otherwise} \end{cases}$$

$$e_0 = V/\pi$$

$$\text{ii) Even part} \rightarrow \begin{cases} e_0 = \frac{V}{\pi} \\ a_k = \begin{cases} \frac{2V}{\pi(1-k^2)} & \text{for even } k \\ 0 & \text{for odd } k \end{cases} \\ b_k = 0 \text{ for all } k \end{cases}$$

$$\text{odd part} \rightarrow \begin{cases} e_0 = 0 \\ a_k = 0 \text{ for all } k \\ b_k = \begin{cases} V/2 & \text{for } k=1 \\ 0 & \text{otherwise} \end{cases} \end{cases}$$

$$\textcircled{5} c_0 = \frac{T^2}{12} \text{ and } c_k = \frac{T^2}{2k^2\pi^2} e^{-jk\pi} \text{ for } k \neq 0$$

$$P_{av} = \frac{T^4}{80}$$

$$\textcircled{6} \text{ i) } \frac{\pi^2}{8} \quad \text{ii) } \frac{\pi^2}{24} \quad \text{iii) } \frac{\pi^2}{6}$$

$k$	Current Amplitude	Current Phase
1	$25\sqrt{2}/\pi \text{ A}$	$-45^\circ$
2	$5\sqrt{5}/\pi \text{ A}$	$-63.4^\circ$
3	$5\sqrt{10}/(3\pi) \text{ A}$	$-71.6^\circ$