# HW Assignment 3

Due date: Thursday 20/4/2017
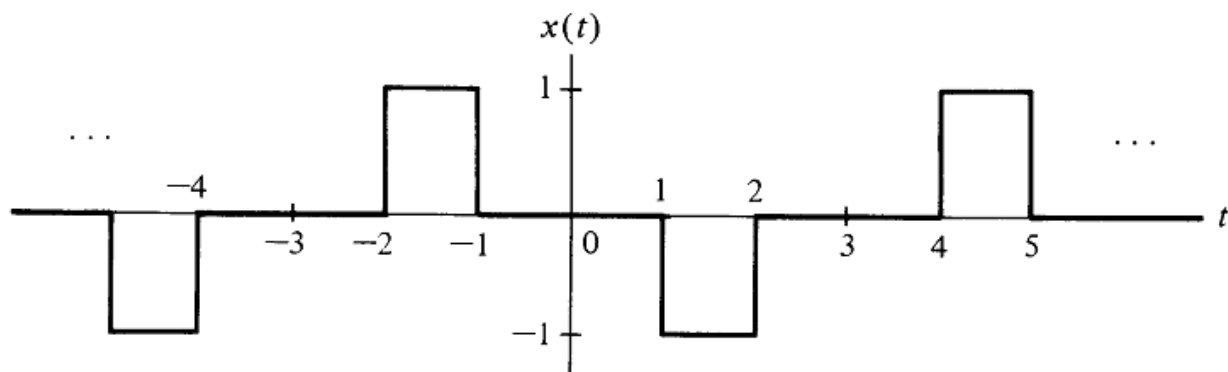
**Question 1**

Find The complex Fourier series coefficients for each of the following signals (note the choice of $\omega_0$ explicitly):

1.  $x(t) = 1 + \cos\left(5\pi t + \dfrac{\pi}{3}\right)$

2.  $x(t) = \cos^2(\dfrac{\pi}{2}t)\sin(\pi t)$

3.  $x(t) = (1 + \sin(2\pi t))\cos\left(4\pi t + \dfrac{\pi}{3}\right)$

**Question 2**

Calculate the complex Fourier series of the following signal. Which coefficients are zero? Can you make any observation about the coefficients decay rate?



**Question 3**

Calculate the complex Fourier series of the following signal:

$$f(t) = \begin{cases} t^2 & |t| < 1 \\ 0 & else \end{cases}$$

Can you make any observation about the coefficients decay rate? Compare it to the coefficients decay rate from Question 3.
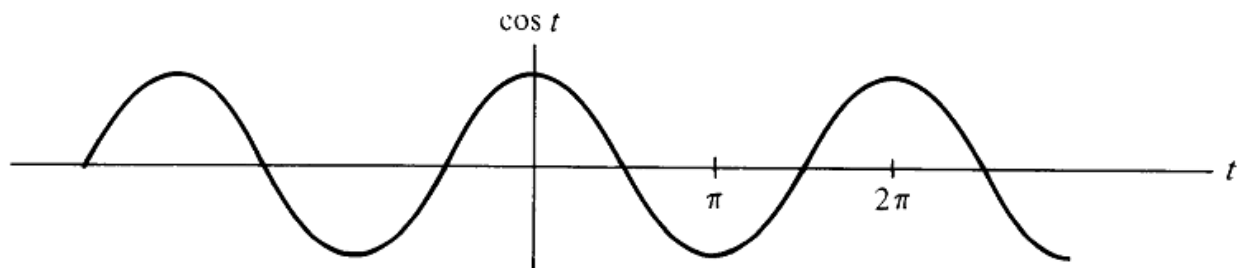
**Question 4**

Prove the following properties

- If $f(t) \in \mathbb{R}$ then $d_n = d_{-n}^*$.

- if $f(t) = f(-t)$ then $d_n \in \mathbb{R}$.

- if $f(t) = -f(-t)$ then $d_n \in j\mathbb{R}$.

- linearity: if $\begin{cases} f(t) \leftrightarrow d_n \\ g(t) \leftrightarrow c_n \end{cases}$ then $\alpha f(t) + \beta g(t) \leftrightarrow \alpha d_n + \beta c_n$.
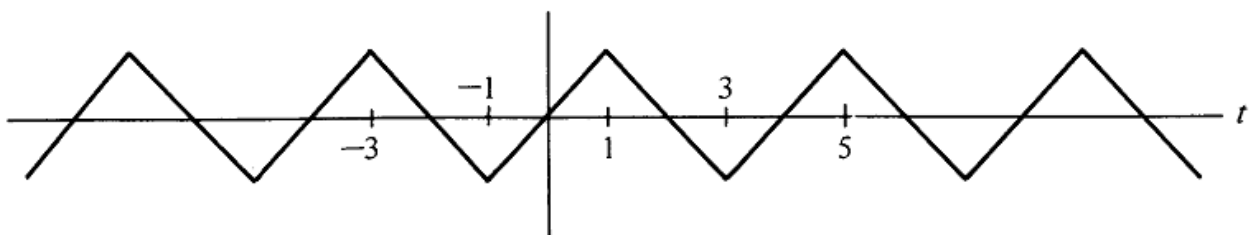
## Question 5

which of the following has pure/imaginary Fourier coefficients?

1.



2.



3.