

Roll# Student 1:

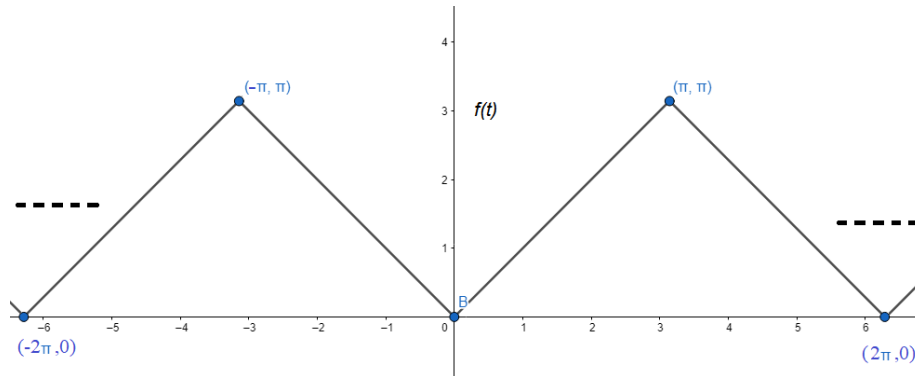
Roll# Evaluator 1:

Roll# Student 2:

Roll# Evaluator 2:

Problem 1 [45 minutes]

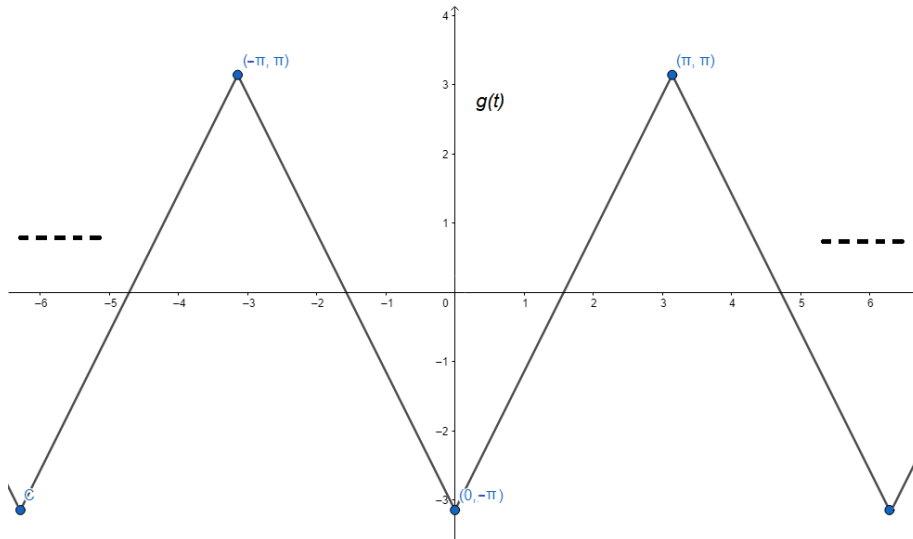
Consider the following periodic function $f(t)$.



- (a) What are time period T and fundamental frequency ω_0 of $f(t)$?
- (b) Specify whether the function is even, odd or neither?
- (c) Write down equation of the function in terms of t in the interval $-\frac{T}{2} \leq t \leq \frac{T}{2}$.
- (d) Using your answer to (b) as a guide, evaluate the Fourier series of $f(t)$, i.e. find the values of a_n and b_n .
- (e) Based on (b) predict the form of c_n (real, pure imaginary or complex).
- (f) Based on (b) predict the relationship between c_n and c_{-n} .
- (g) Evaluate the complex Fourier series of $f(t)$ using a_n and b_n , i.e. evaluate c_n using a_n and b_n .
- (h) Now evaluate the complex Fourier series using the integration formula for c_n .
- (i) Plot its amplitude and phase spectrum.
- (j) Plot its power spectrum against n i.e $|c_n|^2$ against n .

Problem 2 [30 minutes]

Now consider the following periodic function $g(t)$.



Without evaluating any Fourier coefficients again using integration formulas, answer the following using your answers to Problem 1.

- Express $g(t)$ in terms of $f(t)$.
- Evaluate the complex Fourier series of $g(t)$.
- Plot its amplitude and phase spectrum
- Plot its power spectrum against n i.e. $|c_n|^2$ against n .