EE 150L
Signals and Systems Lab

Lab3 Analysis of Periodic Signals in the Frequency Domain

Date Performed:

Class Id:

Name and Student ID:

1. Get to know the frequency domain:
   Find out the amplitude-frequency and phase-frequency of the signal:

$$\mathrm{f(t)} = 1 + 2\sin(\pi \mathrm{t}) - \sin(3\pi \mathrm{t}) + \sin(4\pi \mathrm{t}) + \cos(3\pi \mathrm{t}) - \frac{1}{2}\cos(5\pi \mathrm{t} - \frac{\pi}{4})$$

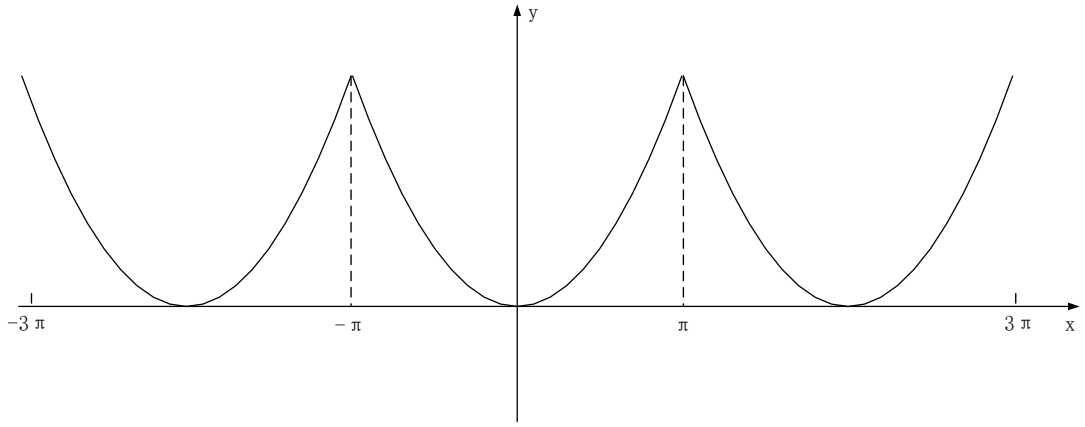
   The necessary steps need to be given.
   提示：
   利用三角、和差化积等公式将 f(t)转换为$\mathrm{f(t)} = c_0 + \sum_{n=1}^{\infty} c_n \cos(n\omega_1 t + \varphi_n)$，或利用欧拉公式$f(t) = \sum_{n=-\infty}^{\infty} F_n e^{jn\omega_1 t + \varphi_n}$的形式后，找出角频率与幅度，角频率与相位的对应关系。如：
   $\omega = 0$时，$\mathrm{c_0} = 1$，$\varphi_0 = 0$

   $\omega = \pi$时，$\mathrm{c_1} = 2, \varphi_1 = -\frac{\pi}{2}$

2. Get to know the Fourier Series:

Find the Fourier series of the following period signal.

$$y = x^2, x \in (-\pi, \pi)$$



提示:

a) 使用三角或指数形式将上述周期函数展开为傅里叶级数，详细方法请参考Lab 3 Analysis of Periodic Signals in the Frequency Domain.pdf。

三角形式：$f(t) = a_{0+} \sum_{n=1}^{\infty} (a_n \cos n\omega_1 t + b_n \sin n\omega_1 t)$

指数形式：$f(t) = \sum_{n=-\infty}^{\infty} F_n e^{jn\omega_1 t}$

b) 请手算（不需要 MATLAB 代码），计算过程中会使用到分部积分法。