$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(n\omega x) + \sum_{n=1}^{\infty} b_n \sin(n\omega x)$$

Where $\omega = \frac{2\pi}{T}$

$$a_0 = \frac{2}{T} \int_d^{d+T} f(x)\mathrm{dx}$$

$$a_n = \frac{2}{T} \int_d^{d+T} f(x)\cos(n\omega x)\mathrm{dx}$$

$$b_n = \frac{2}{T} \int_d^{d+T} f(x)\sin(n\omega x)\mathrm{dx}$$

$$f(x) = \begin{cases} 1 & 0 \le x < \pi \\ x & \pi \le x < 2\pi \end{cases}$$

NOTE:

1. For Odd Functions :

$$a_0 = 0$$
$$a_n = 0$$

2. For Even Functions

$$b_n = 0$$

Check of Even or Odd function:

$$f(x) = \begin{cases} \phi(x) & a \le x < 0 \\ \psi(x) & 0 \le x < b \end{cases}$$

if $\phi(a + b - x) = \psi(x)$, then $f(x)$ is even

if $\phi(a + b - x) = -\psi(x)$ then $f(x)$ is odd

```
function [fseries] = fourier_series(K, T)
%% functional arguments : K - the number of iterations to perform
%%                      : T - the time period of the function

omega = 2* pi / T;
n = 1: K; % do K number of iterations

syms x;
f1 = 1;
f2 = x;
```

```
a0 = (2/T) * ( int(f1, x, 0, pi) + int(f2, x, pi, 2*pi));
an = (2/T) * ( int(f1 * cos(n * omega * x), x, 0, pi) + int(f2 * cos(n * omega * x), x, pi, 2*p
bn = (2/T) * ( int(f1 * sin(n * omega * x), x, 0, pi) + int(f2 * sin(n * omega * x), x, pi, 2*p

fconstants = [a0 an bn];
fvars = [1/2 cos(n * omega * x) sin(n * omega * x)];

fseries = sum (fconstants .* (fvars));
disp('The Fourier Series is : ')
disp(vpa(fseries, 10));

end
```