M4. Part A

A is odd & half wave symmetry $\Rightarrow a_0 = 0$

$a_n = 0$

$b_{n,\text{even}} = 0$

First 10 non-zeros are:

$b_1, b_3, b_5, b_7, b_9, b_{11}, b_{13}, b_{15}, b_{17}, b_{19}$

$$4 \cdot \frac{2}{T} \int_0^{T/4} \sin(n\omega_0 t)\, f(t)\, dt$$

$$\frac{8}{T} \frac{1}{n\omega_0} \left(-\cos\left(\frac{n\omega_0 T}{4}\right) + \sin(0) \right)$$

$\omega_0 T = 2\pi$ ⇓

$$\frac{4}{n\pi} \left(-\cos\frac{n\pi}{2} + 1 \right)$$

B is even symmetry $\Rightarrow b_n = 0$

first 10 non-zeros are:

$a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}$

$$a_n = 2 \cdot \frac{2}{T} \int_0^{T/2} f(t) \cos(n\omega_0 t)\, dt$$

$$= \frac{4}{T} \int_{T/5}^{T/2} \cos(n\omega_0 t)\, dt$$

$$= \frac{4}{T n \omega_0} \left(\sin\left(\frac{n\omega_0 T}{2}\right) - \sin\left(\frac{n\omega_0 T}{5}\right) \right)$$

$$= \frac{4}{2n\pi} \left(\sin(n\pi) - \sin\left(\frac{2n\pi}{5}\right) \right)$$

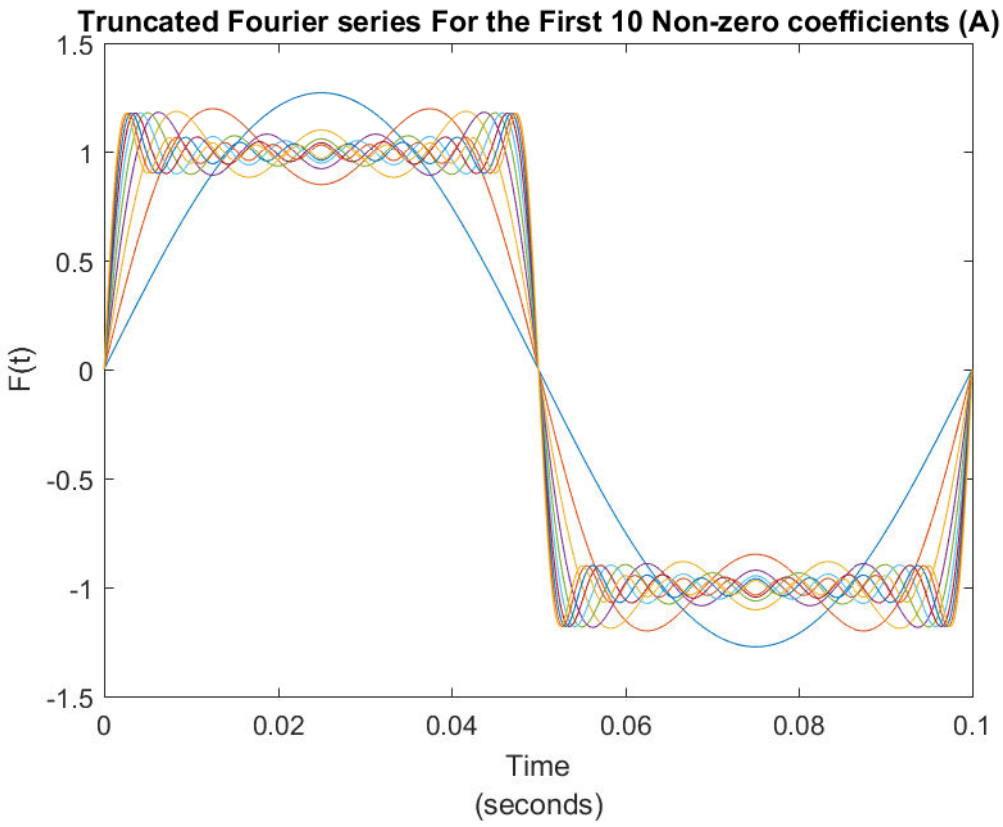
$$= -\frac{2}{n\pi} \left(\sin\left(\frac{2n\pi}{5}\right) \right)$$

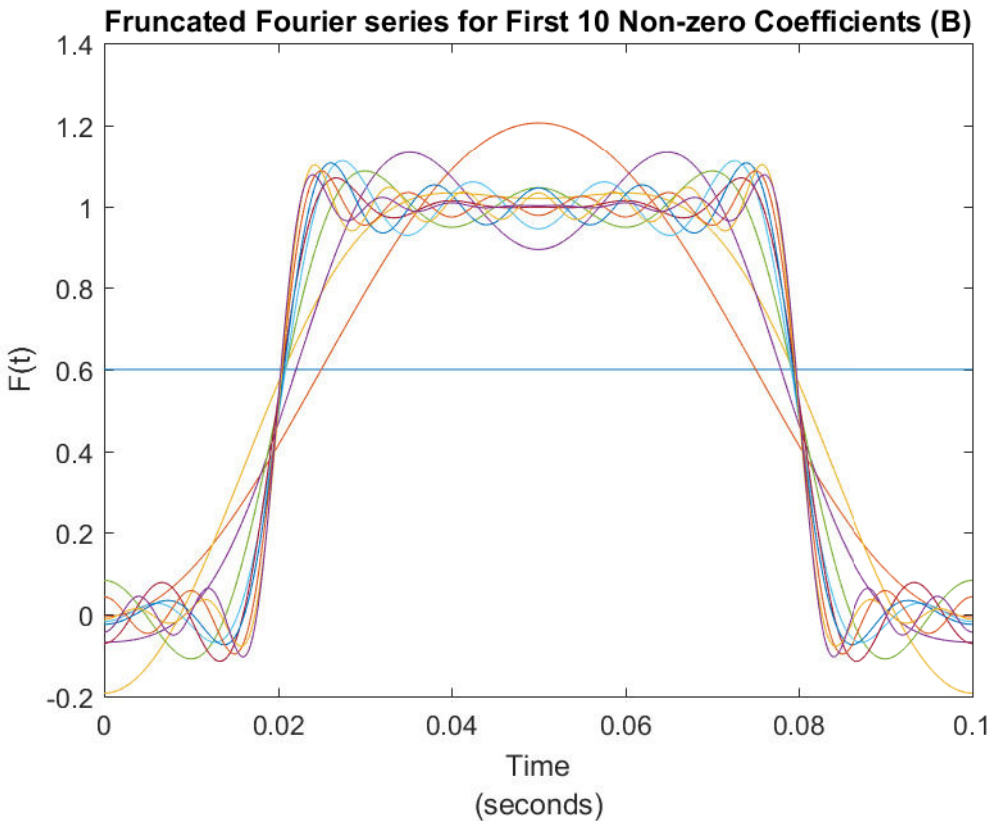
$a_0 = 1 * \frac{3}{5} = \frac{3}{5}$

```
%Xi Kun Zou m4
n=[1;3;5;7;9;11;13;15;17;19];
T=0.1;
w0=(2*pi)/T;
bnodd=8./(w0*n*T).*(-cos(n*w0*T/4)+1)
t = linspace(0,T,800);
plot1 = bnodd(1)*sin(w0*t*n(1));
plot2 = plot1+bnodd(2)*sin(w0*t*n(2));
plot3 = plot2+bnodd(3)*sin(w0*t*n(3));
plot4 = plot3+bnodd(4)*sin(w0*t*n(4));
plot5 = plot4+bnodd(5)*sin(w0*t*n(5));
plot6 = plot5+bnodd(6)*sin(w0*t*n(6));
plot7 = plot6+bnodd(7)*sin(w0*t*n(7));
plot8 = plot7+bnodd(8)*sin(w0*t*n(8));
plot9 = plot8+bnodd(9)*sin(w0*t*n(9));
plot10 = plot9+bnodd(10)*sin(w0*t*n(10));
plot(t,plot1,t,plot2,t,plot3,t,plot4,t,plot5,t,plot6,t,plot7,t,plot8,t,plot9,t,↙
plot10)
xlabel({'Time','(seconds)'})
ylabel({'F(t)'})
title('Truncated Fourier series For the First 10 Non-zero coefficients (A)')
```

```
%Xi Kun Zou m4
n = [1;2;3;4;6;7;8;9;11;12]; % a5,a10 are zeros
T=0.1;
w0=2*pi/T;
aneven =(-4./(n*w0*T)).*(sin(n*w0*T/5))
a0 = 3/5
t=linspace(0,T,800);
plot0=a0*ones(size(t)); % a0 plot
plot1 =plot0 + aneven(1)*cos(w0*t*n(1));
plot2 =plot1 + aneven(2)*cos(w0*t*n(2));
plot3 =plot2 + aneven(3)*cos(w0*t*n(3));
plot4 =plot3 + aneven(4)*cos(w0*t*n(4));
plot5 =plot4 + aneven(5)*cos(w0*t*n(5));
plot6 =plot5 + aneven(6)*cos(w0*t*n(6));
plot7 =plot6 + aneven(7)*cos(w0*t*n(7));
plot8 =plot7 + aneven(8)*cos(w0*t*n(8));
plot9 =plot8 + aneven(9)*cos(w0*t*n(9));
plot10 =plot9 + aneven(10)*cos(w0*t*n(10));
plot(t,plot0,t,plot1,t,plot2,t,plot3,t,plot4,t,plot5,t,plot6,t,plot7,t,plot8,t,↙
plot9,t,plot10)
xlabel({'Time','(seconds)'})
ylabel({'F(t)'})
title('Fruncated Fourier series for First 10 Non-zero Coefficients (B)')
```

```
Trial>> m4a

bnodd =

    1.2732
    0.4244
    0.2546
    0.1819
    0.1415
    0.1157
    0.0979
    0.0849
    0.0749
    0.0670

Trial>> m4b

aneven =

   -0.6055
   -0.1871
    0.1247
    0.1514
   -0.1009
   -0.0535
    0.0468
    0.0673
   -0.0550
   -0.0312


a0 =

    0.6000

Trial>>
```


Truncated Fourier series For the First 10 Non-zero coefficients (A)
1.5
1
0.5
0
-0.5
-1
-1.5
F(t)
0
0.02
0.04
0.06
0.08
0.1
Time
(seconds)


Fruncated Fourier series for First 10 Non-zero Coefficients (B)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
F(t)
0
0.02
0.04
0.06
0.08
0.1
Time
(seconds)