Question Modification: Since ID=XXXXXXX9X03 the coefficients are $a = 3$; $b = 0$; $c = 9$

Therefore;

$y = f(t) = 3t^2 + 9$ in interval of $0, 1$

Solution:

$T = 1 \rightarrow \omega = {}^{2\pi}/_T = 2\pi$

$a_0 = \frac{2}{1} \int_0^1 f(t)dt = 2 \int_0^1 (3t^2 + 9)dt = 2 \left[t^3 + 9t\right]_0^1 = 20$

$a_n = \frac{2}{1} \int_0^1 (3t^2 + 9)cos(n\omega t)$

$b_n = \frac{2}{1} \int_0^1 (3t^2 + 9)sin(n\omega t)$

Maxima is used to integrate the $f(t) * cos(2\pi n)$ and $f(t) * sin(2\pi n)$ to get cosine and sine compliance. The commands are listed below.

```
ratsimp(integrate((3*t^2+9)*cos(w*t*n),t,0,1));
ratsimp(integrate((3*t^2+9)*sin(w*t*n),t,0,1));
```

$$a_n = 2 \times \frac{6 \cdot n \cdot w \cdot \cos{(n \cdot w)} + \left(12 \cdot n^2 \cdot w^2 - 6\right) \cdot \sin{(n \cdot w)}}{n^3 \cdot w^3}$$

$$b_n = 2 \times \frac{-6 + 9 \cdot n^2 \cdot w^2 + \left(6 - 12 \cdot n^2 \cdot w^2\right) \cdot \cos{(n \cdot w)} + 6 \cdot n \cdot w \cdot \sin{(n \cdot w)}}{n^3 \cdot w^3}$$

Therefore;

$$y(t) = \frac{a_0}{2} + \sum_{n=1}^{100} a_n cos(\omega nt) + b_n sin(\omega nt)$$

To simplify the output; π is set to 3.14 therefore $\omega = 6.28$ since $\omega = 2\pi$

$$y(t) = \frac{20}{2} + \sum_{n=1}^{100} a_n cos(6.28nt) + b_n sin(6.28nt)$$

```
1  sum((2*6*n*(2*3.14)*cos(n*(2*3.14))+(12*n^2*(2*3.14)^2-6)*sin(n*(2*3.14)))/(n^3*(2*3.14)^3)*cos
   ((2*3.14)*n*t)+2*(-6+9*n^2*(2*3.14)^2+(6-12*n^2*(2*3.14)^2)*cos(n*(2*3.14))+6*n*(2*3.14)*sin(n
   *(2*3.14)))/(n^3*(2*3.14)^3)*sin((2*3.14)*t*n), n, 1, 100), simpsum;
```
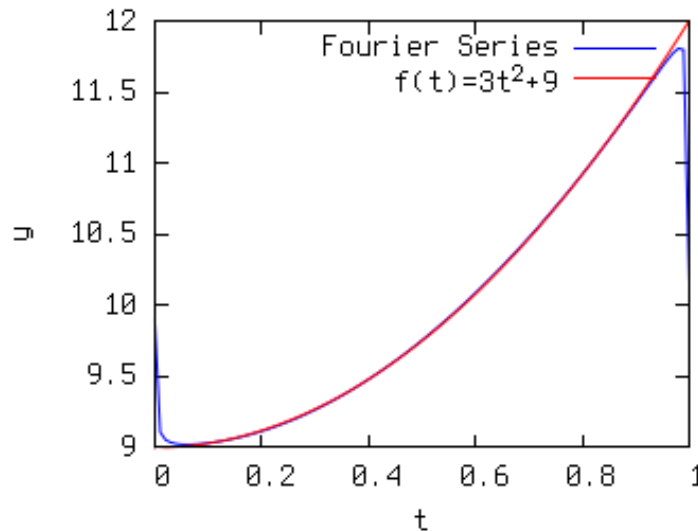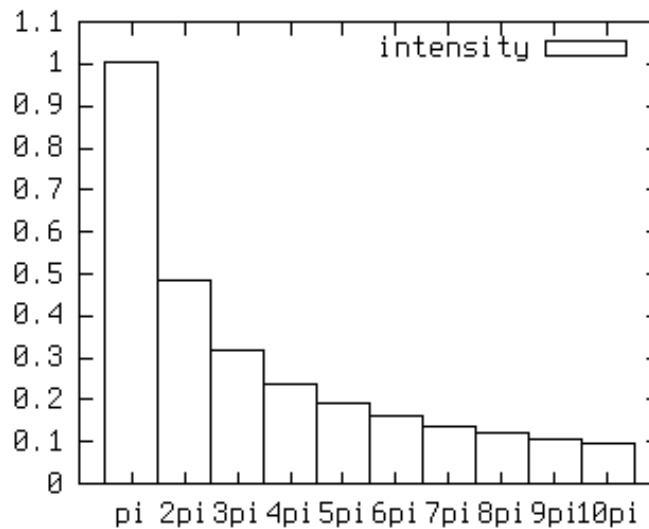

Figure 1: f(t) vs. Fourier Series

Figure 2: Intensity vs. frequency

Following Octave code is used to determine intensity of each sine/cosine component for the frequency from π to 10π

```
function ycos=an(n)
  ycos=2*(6*n*2*pi*cos(n*2*pi)+(12*n^2*(2*pi)^2-6)*sin(n*2*pi))/(n^3*(2*pi)^3);

endfunction

function ysin=bn(n)
  ysin=2*(-6+9*n^2*(2*pi)^2+(6-12*n^2*(2*pi)^2)*cos(n*(2*pi))+6*n*(2*pi)*...
  sin(n*(2*pi)))/(n^3*(2*pi)^3);

endfunction


for i=1:1:10
  m(i,1)=sqrt(an(i)^2+bn(i)^2);
endfor


f1 = fopen('~/YuksekLisans/muzik/hw3_m.dat','w');
for i = 1:length(m)
    fprintf(f1,'%d\n',m(i));
end
fclose(f1);
```