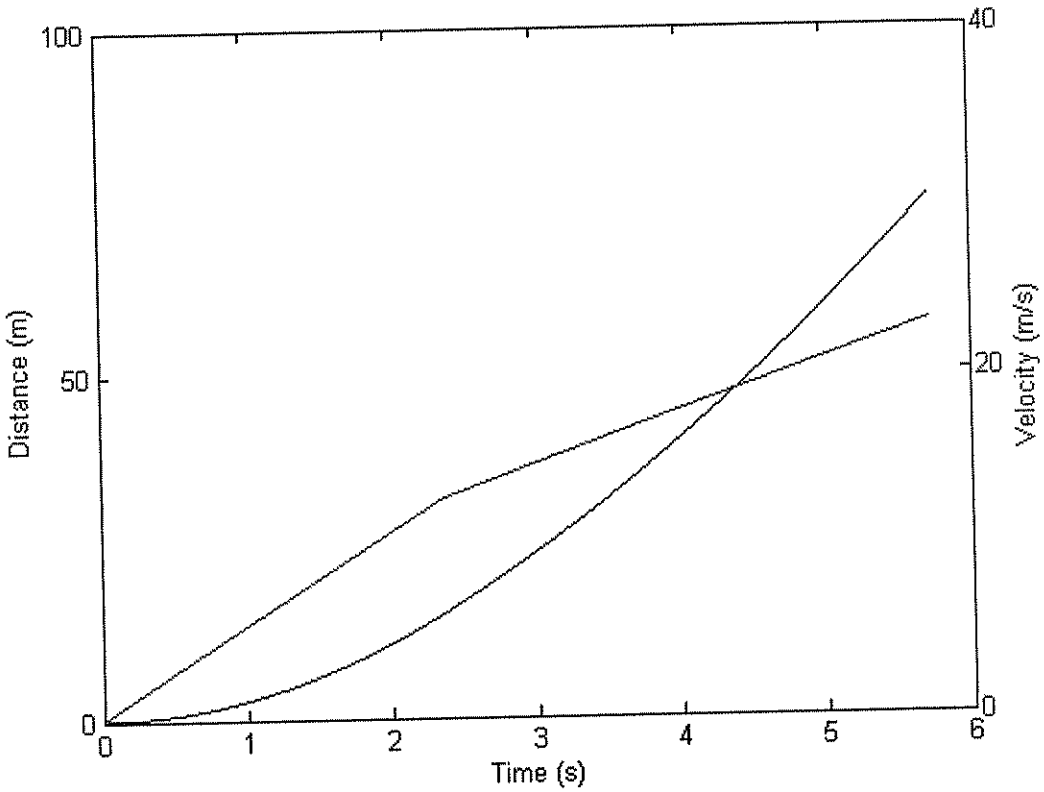
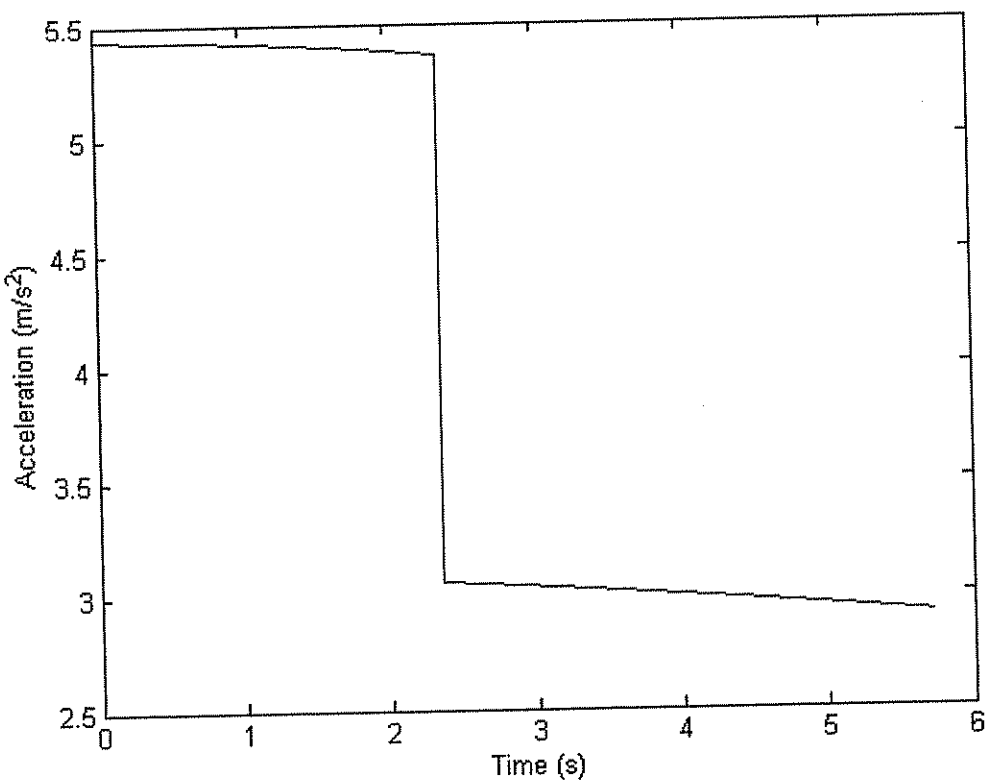
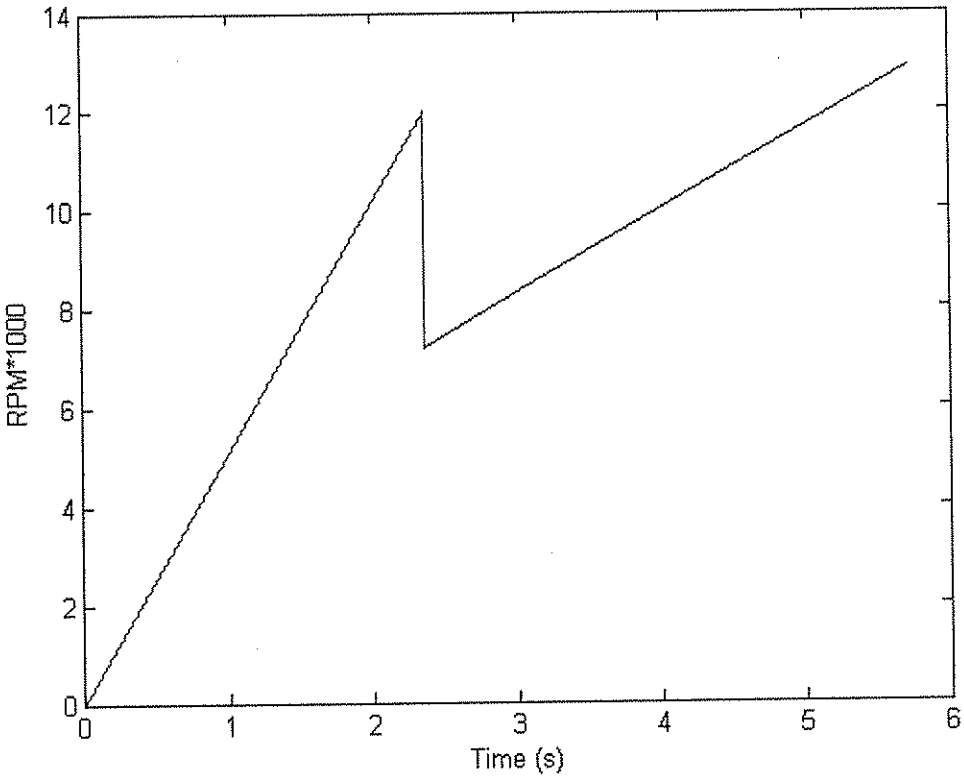
```
%Chris Ohlinger

clear all;
close all;
clc
%Graphing velocity and position as function of time in 1/4 mile
%acceleration

%Parameters
M=800*0.45359;        %mass of vehicle - kg
theta=0;              %Grade angle
A_f=0.65032128;       %frontal area - m^2
C_d=0.45;             %Drage coefficient
C_r=0.04;             %Rolling resistance
T_m=25;             %Engine torque - N-m
rho_a=1.2;            %Density of air - kg/m^3
G_r=25;             %Gear ratio
r_w=10*0.0254;        %Wheel radius - in converted to m
g=9.81;               %Gravity - m/s^2
N_max=12000;          %Maximum engine speed RPM
eta_d=0.85;           %driveline efficiency

%Governing Equations
% F_t=T_m*(G_r/r_w);        %Force from motor - N
F_g=M*g*sind(theta);      %Force from gravity - N
F_r=C_r*M*g*cosd(theta); %Resistance Force - N

%Initial Conditions
x(1)=0;
v(1)=0;
t(1)=0;
DT=0.001;
i=2;
DV(i)=0;

%The if then statements inside of this loop are what allowed me to play
%around with shift points based on rpm or time or distance. In the code
%shown below it is currently set up to shift based on the maximum rpm of
%the engine. It then runs through the loop again in the new gear until it
%hits max rpm again then it shifts to the next and so on.

while x(i-1)<75
    F_d(i)=0.5*C_d*rho_a*A_f*v(i-1)^2;
    DV(i-1)=(1/M)*eta_d*(((T_m*(G_r/r_w))-(F_d(i)+F_g+F_r))); %acceleration
    DX=v(i-1);
    v(i)=v(i-1)+DV(i-1)*DT;
    x(i)=x(i-1)+DX*DT;
    t(i)=t(i-1)+DT;
    RPM(i)=v(i-1)*((G_r*60)/(2*pi*r_w));

    %Each if loop defines the gear ratio based on engine RPM
```

```
    if RPM(i)>=12000
        G_r=15;
    end

    if RPM(i)>=N_max
        G_r=15;
    end
    i=i+1;
end
t_end=t(end)     %Total time to race 75 meter track
RPM_end=RPM(end)  %engine rpm at end of track
Gr_end=G_r(end)  %gear ratio at end of track
[AX,H1,H2]=plotyy(t,x,t,v,'plot');     %plot of velocity and position vs time
set(get(AX(1),'Ylabel'),'String','Distance (m)');
set(get(AX(2),'Ylabel'),'String','Velocity (m/s)');
xlabel('Time (s)');
figure(2)                    %new figure to plot acceleration vs time
plot(t(1:length(DV)),DV)     %plot of acceleration vs time
xlabel('Time (s)');
ylabel('Acceleration (m/s^2)');
figure(3)
plot(t(1:length(v)),RPM/1000)
xlabel('Time (s)');
ylabel('RPM*1000');
```

```
t_end =

    5.7210


RPM_end =

   1.2866e+04


Gr_end =

    15
```


100
50
0
Distance (m)
40
20
0
Velocity (m/s)
0
1
2
3
4
5
6
Time (s)


5.5
5
4.5
4
3.5
3
2.5
Acceleration (m/s2)
0
1
2
3
4
5
6
Time (s)



Published with MATLAB® 7.14