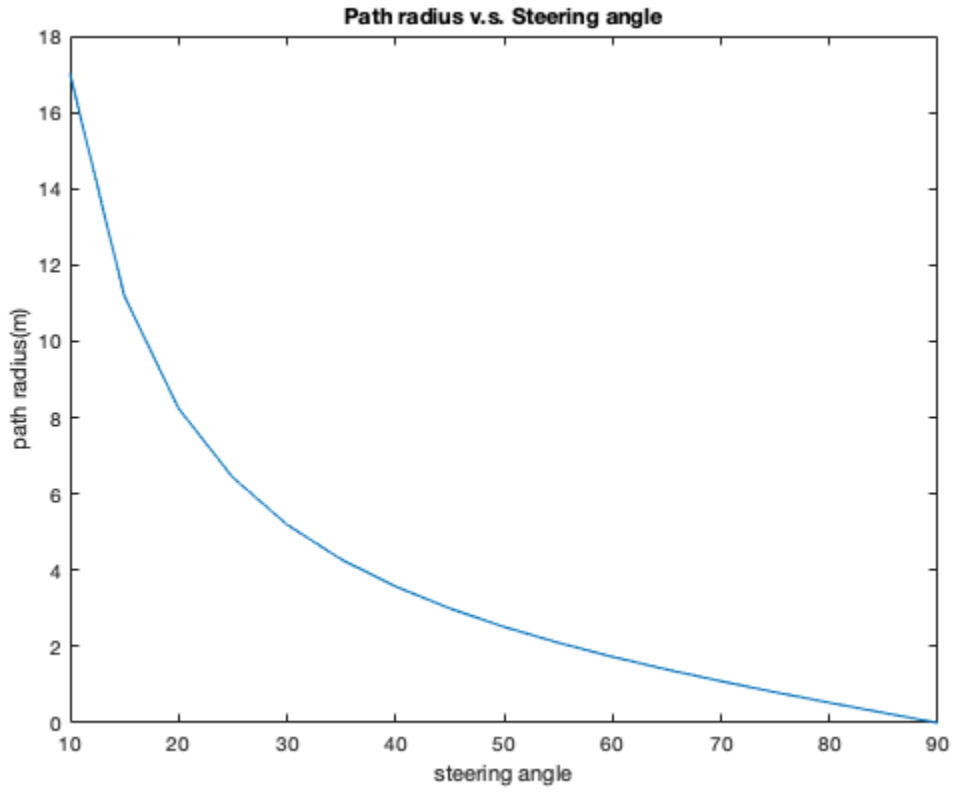
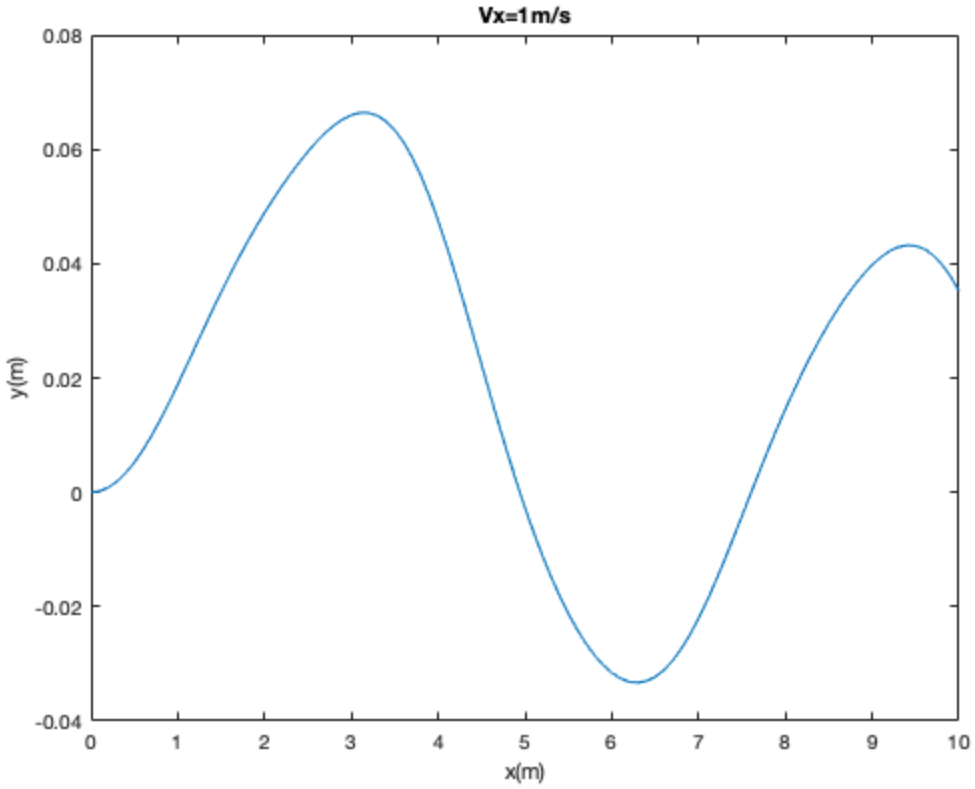
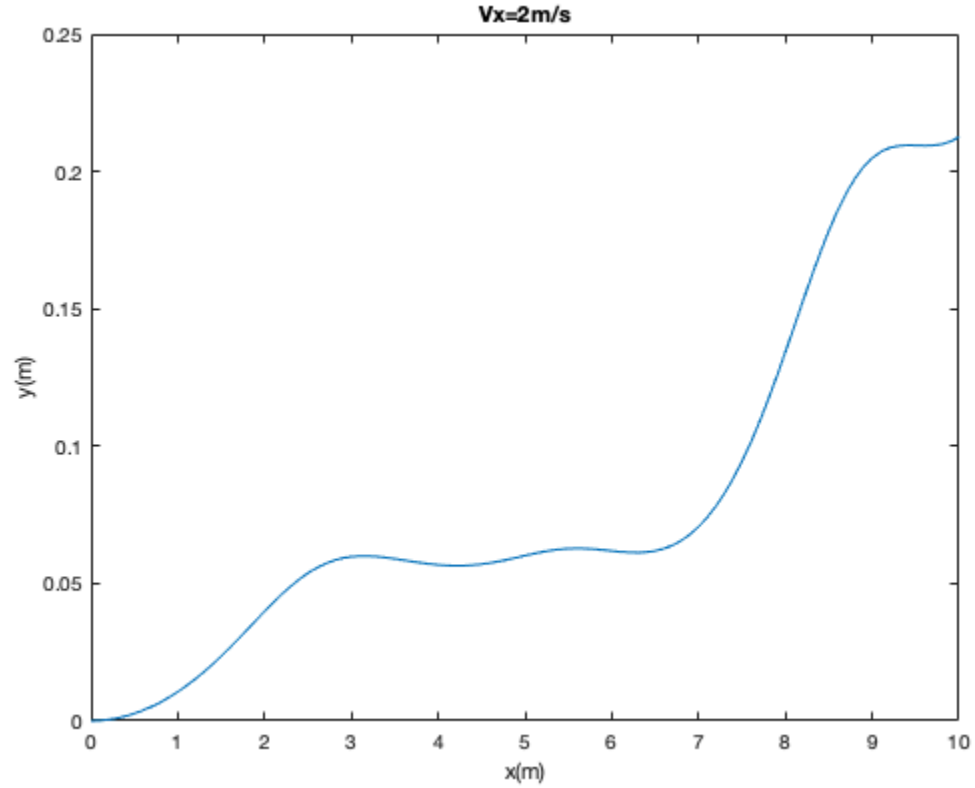
```
function ode45_ex

close all
clear all


lr=1.5;
lf=1.5;

radius=zeros();
steer=zeros();
i=1;

for steering_angle=10:5:90
    steer(i,1)=steering_angle;
    steering_angle_rad=steering_angle*pi()/180;
    radius(i,1)=(lf+lr)/tan(steering_angle_rad);
    i=i+1;
end
plot (steer(:,1), radius(:,1))
ylabel('path radius(m)');
xlabel('steering angle');
title('Path radius v.s. Steering angle')
```

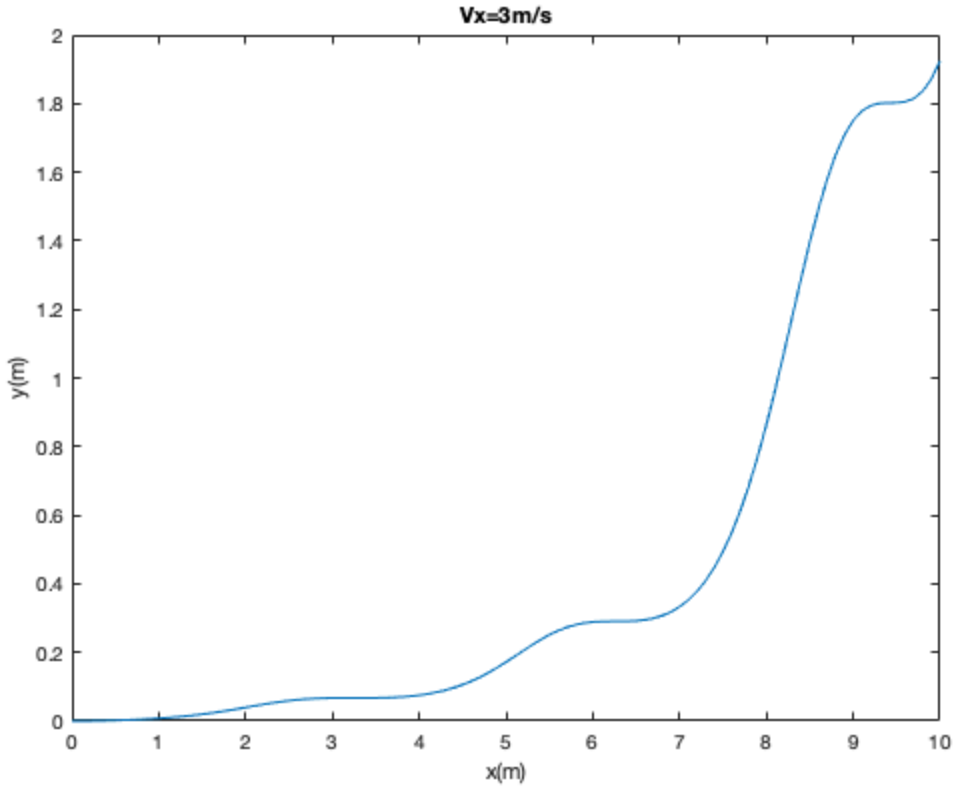


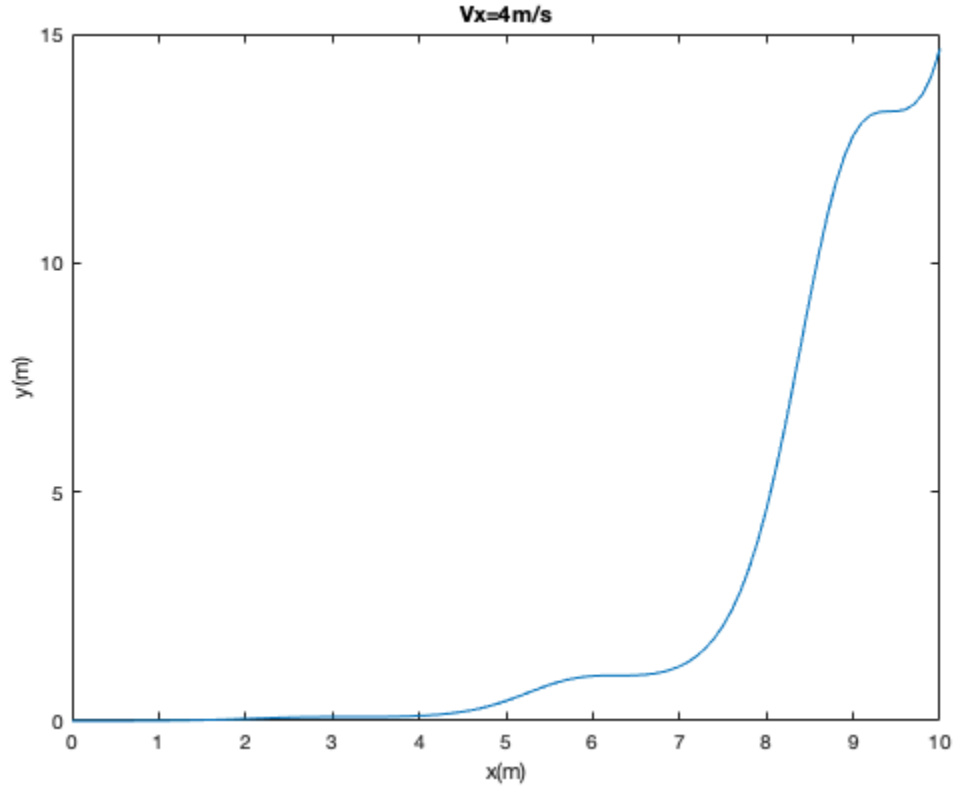

```
%B
```

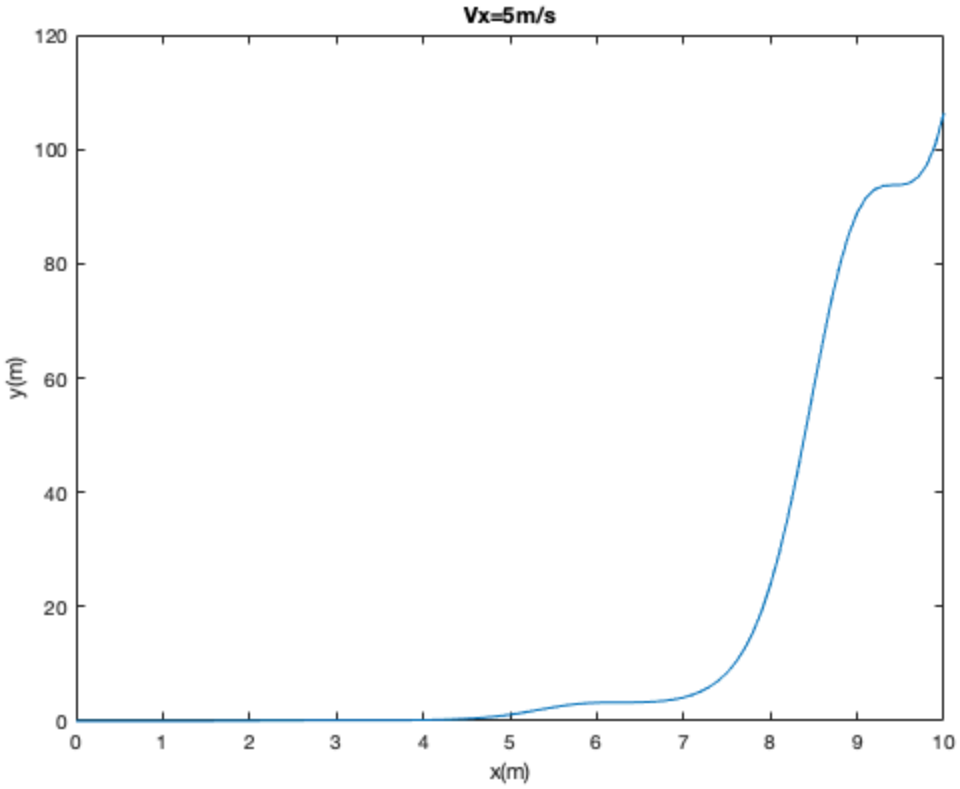
```
%Initial Condition:
xo=[0;0;0];


%timespan:
t=0:0.1:10;
x=zeros();
y=zeros();

for Vx=1:1:5
    [t,x]=ode45(@sys,t,xo);
    figure
    plot(t, x(:,3))
    ylabel('y(m)');
    xlabel('x(m)');
    title(['Vx=',num2str(Vx), 'm/s'])


end



function  dx = sys(t, x)

%Parameters:

%Vx=4; %(m/s)
m=50; %(kg)
Iz=100; %(kg-m^2);
Caf=8000; %(N/rad)
Car=8000;  %(N/rad)

%sinusoid input
steerangle=5*sin(t);
steerangle=steerangle*pi()/180;

A=-(cos(steerangle)*Caf+Car)/m*Vx;
B=(-(cos(steerangle)*Caf*lf+lr*Car)/(m*Vx))-Vx;
C=(-cos(steerangle)*Caf*lf+lr*Car)/Iz*Vx;
D=-(cos(steerangle)*Caf*lf*lf+lr*lr*Car)/Iz*Vx;
E=Caf*cos(steerangle)/m;
F=lf*Caf*cos(steerangle)/Iz;

u=steerangle;
dx(1,:)=A*x(1)+C*x(2)+E*u;
dx(2,:)=B*x(1)+C*x(2)+F*u;
dx(3,:)=x(1);

end
```


Vx=1m/s
0.08
0.06
0.04
0.02
0
-0.02
-0.04
y(m)
0
1
2
3
4
5
6
7
8
9
10
x(m)


Vx=2m/s
0.25
0.2
0.15
0.1
0.05
0
y(m)
0
1
2
3
4
5
6
7
8
9
10
x(m)


Vx=3m/s
y(m)
x(m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
1
2
3
4
5
6
7
8
9
10


Vx=4m/s
y(m)
x(m)
0
5
10
15
0
1
2
3
4
5
6
7
8
9
10




```
end
```

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