## Contents



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%Math 246
%Section 0423
%TA: Thien Ngo
%Matlab Project D
%March 26, 2018
```

```
%Problem 4:
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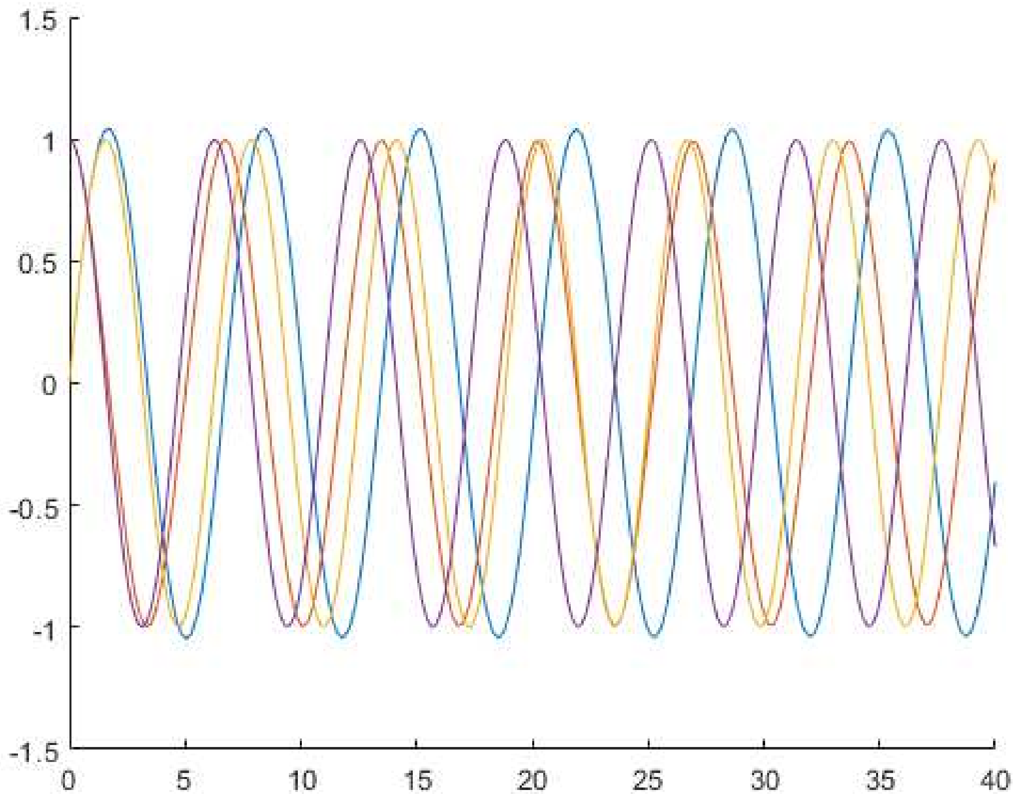
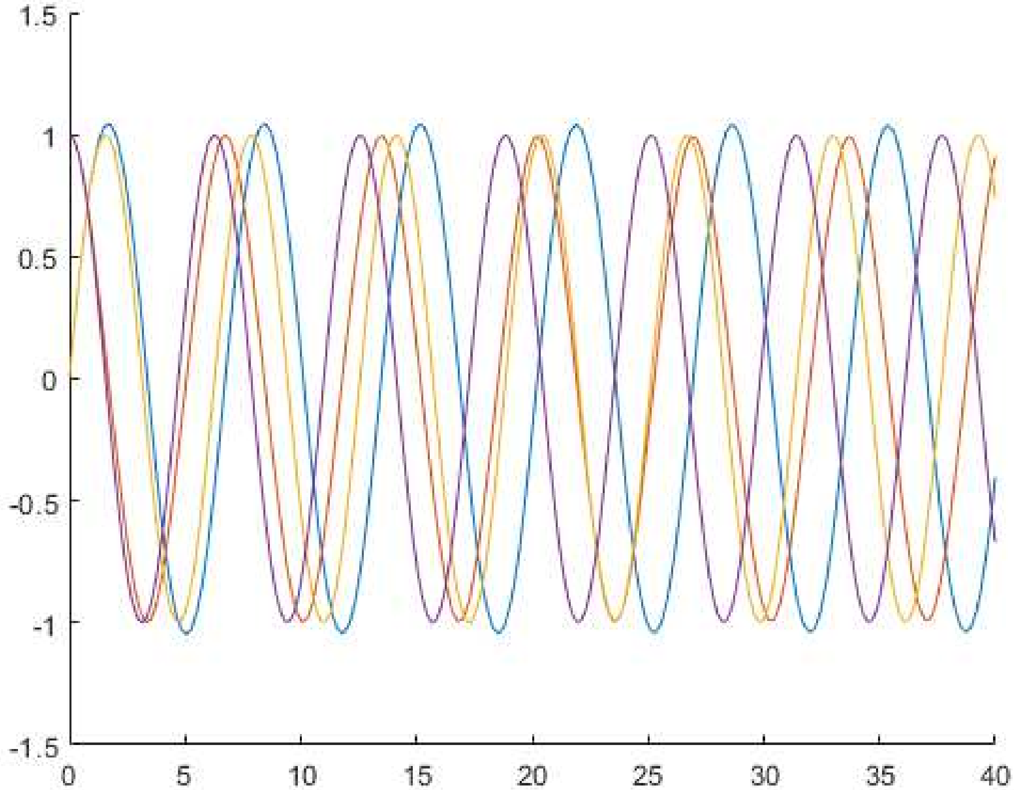
```
%Part a:
hold on;
rhs1 = @(t,theta) [theta(2); -sin(theta(1))];
[xa, ya] = ode45(rhs1, [0 40], [0 1]);
plot(xa, ya)
rhs2 = @(t,theta) [theta(2); -theta(1)];
[xb, yb] = ode45(rhs2, [0 40], [0 1]);
plot(xb, yb)
hold off;
%Part b:
figure;
hold on;
rhs3 = @(t,theta) [theta(2); -sin(theta(1))];
[xc, yc] = ode45(rhs3, [0 40], [0 1]);
plot(xc, yc)
rhs4 = @(t,theta) [theta(2); -theta(1)];
[xd, yd] = ode45(rhs4, [0 40], [0 1]);
plot(xd, yd)
hold off;
figure;
hold on;
rhs5 = @(t,theta) [theta(2); -sin(theta(1))];
[xe, ye] = ode45(rhs5, [0 40], [0 1.99]);
plot(xe, ye)
rhs6 = @(t,theta) [theta(2); -theta(1)];
[xf, yf] = ode45(rhs6, [0 40], [0 1.99]);
plot(xf, yf)
hold off;
figure;
hold on;
rhs7 = @(t,theta) [theta(2); -sin(theta(1))];
[xg, yg] = ode45(rhs7, [0 40], [0 2]);
plot(xg, yg)
rhs8 = @(t,theta) [theta(2); -theta(1)];
[xh, yh] = ode45(rhs8, [0 40], [0 2]);
plot(xh, yh)
hold off;
figure;
hold on;
```

```
rhs9 = @(t,theta) [theta(2); -sin(theta(1))];
[xi, yi] = ode45(rhs9, [0 40], [0 2.01]);
plot(xi, yi)
rhs10 = @(t,theta) [theta(2); -theta(1)];
[xj, yj] = ode45(rhs10, [0 40], [0 2.01]);
plot(xj, yj)
hold off;
```

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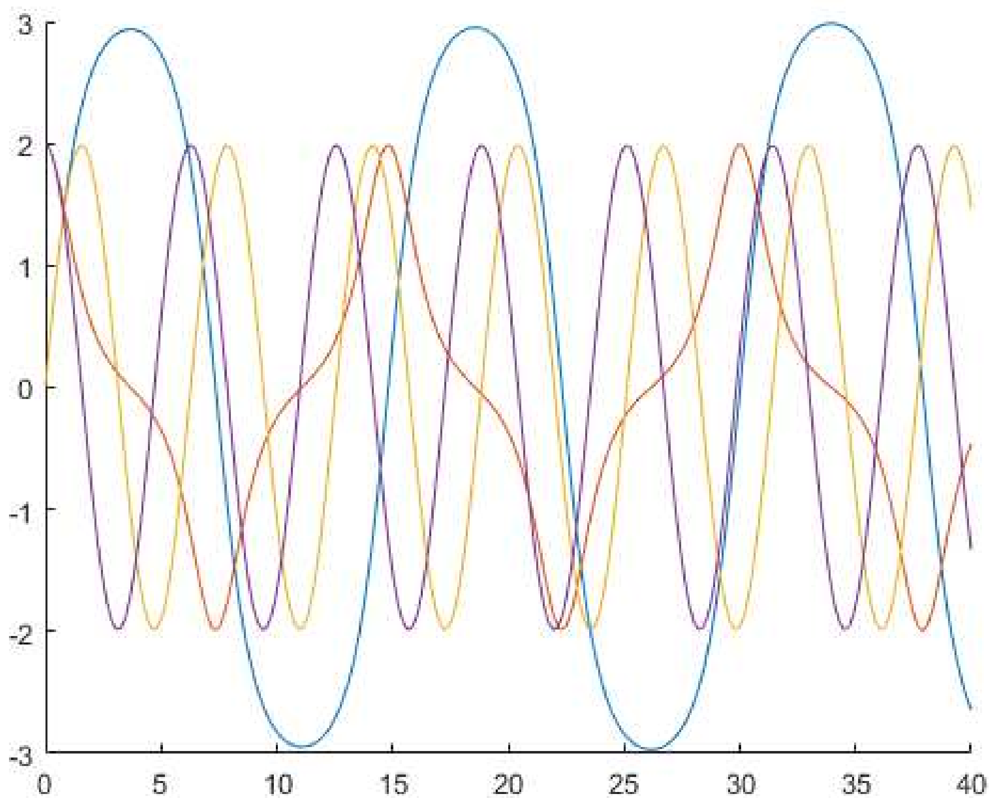
-0.5
-1
-1.5
0 5 10 15 20 25 30 35 40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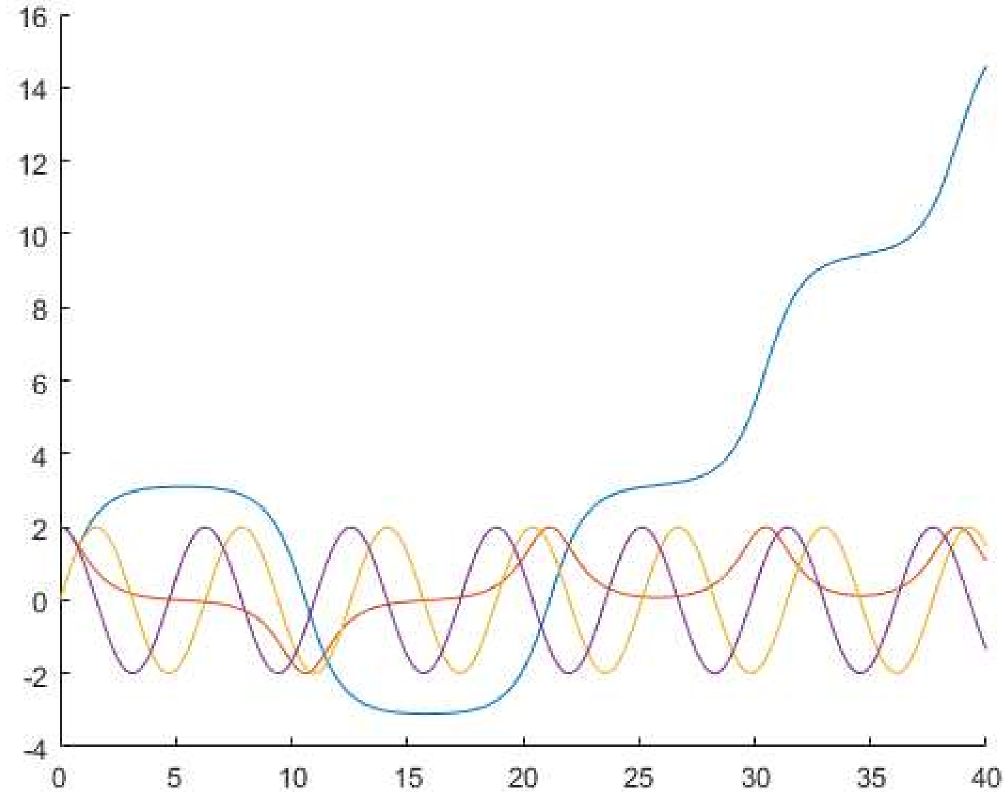
2
1
0
-1
-2
-3
0 5 10 15 20 25 30 35 40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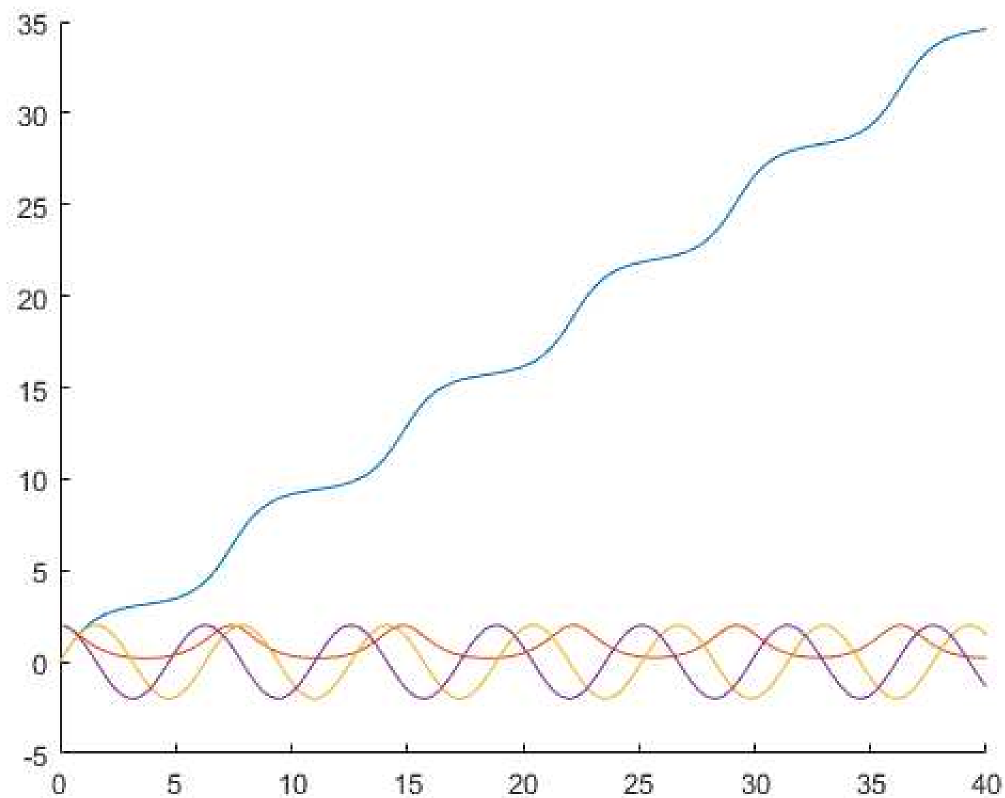
14
12
10
8
6
4
2
0
-2
-4
0
5
10
15
20
25
30
35
40


35
30
25
20
15
10
5
0
-5
0
5
10
15
20
25
30
35
40

```
%Problem 7:
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```
%Part a:
%function [value,isterminal,direction] = myEventsFcn(t,y)
%value = y(1);
%itsterminal= 1;
%direction=-1;
%end
%function z = heit(t,y,a)
%if(t<=a)
%Substitute the value of z.
%z=[y(2);-32+0.005*32*(y(2)^2)/195];
%t > a
%else
%z=[y(2);-32+0.6*32*(y(2)^2)/195];
%end
%end
%Define t and y through ode45.
%n=1;i=0;
%while n
%i=i+0.1;
%[t,y]=ode45(@(t,y) heit(t,y,5+i),[0:0.01:40],[1000;0]);
%i=i+0.1;
%if(y((y(:,1)>-0.1 & y(:,1)<0.1),2)>(-18.028*1.05))
%n=0;
%end
%end
%fprintf('The height which chute opens is %f\n',y(t(:)==5,1));
%fprintf('The time to reach the ground is %f\n',t((y(:,1)>-0.1 & y(:,1)<0.1)));
%[t,y]=ode45(@(t,y) heit(t,y,5),[0:0.01:40],[1000;0]);
%
%
%Function not showing or outputing when published
%%0=192/1950v^2
%%v^2=0
%%The chute opens at a height of 637.363 ft. The time to reach the ground
%%is 39.55 seconds. The velocity she hits the ground is 0 ft/s.
```

```
%Part b:
%-32+(192/1950)v^2=0
%v^2=325 ft/s
%v=18.028ft/s downwards in the y-direction
%This terminal velocity is greater than the velocity at the the chute opens
%and the velocity at impact.
```

```
%Part c:
%The height which the chute should open  to strike the ground at a velocity
%within 5% of the terminal veloctiy is 615.432 ft.
```

```
%Problem 11:
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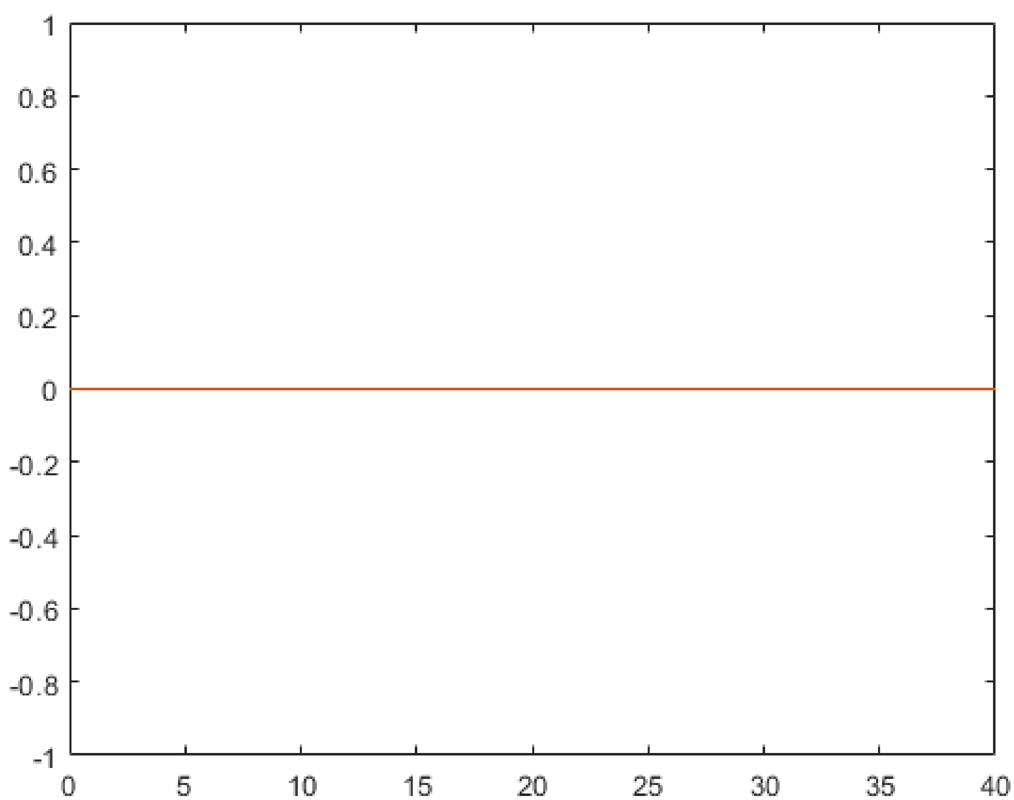
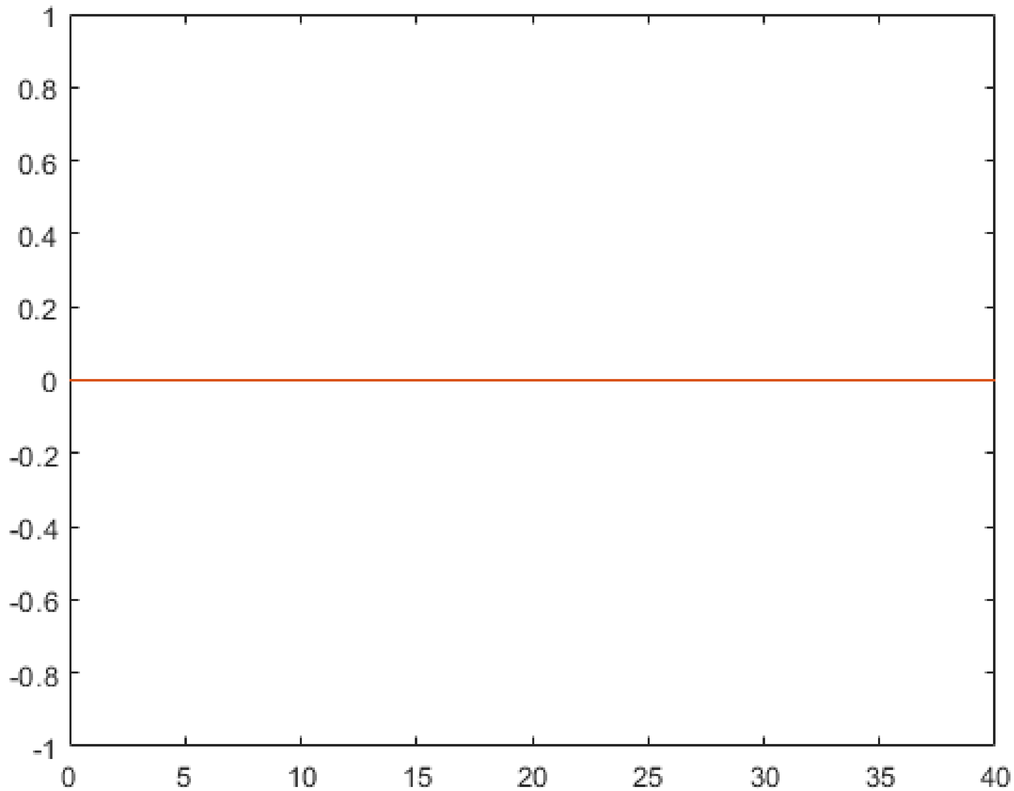
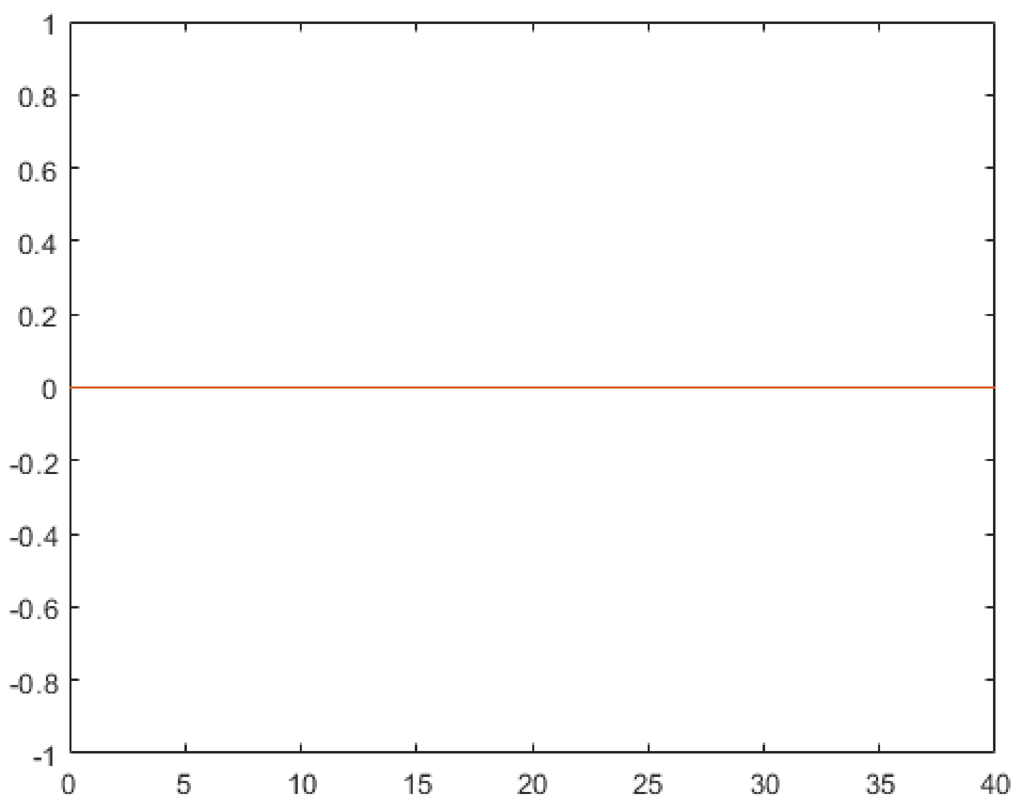
```
%Part a:
figure;
```

```
rhs11 = @(t,y) [y(2); -y(1) - 0*y(1)];
[xk, yk] = ode45(rhs11, [0 40], [0 0]);
plot(xk, yk)
%Part b:
figure;
rhs12 = @(t,y) [y(2); -y(1) - 0.1*y(1)];
[xl, yl] = ode45(rhs12, [0 40], [0 0]);
plot(xl, yl)
%Part c:
figure;
rhs13 = @(t,y) [y(2); -y(1) - 0.2*y(1)];
[xl, yl] = ode45(rhs13, [0 40], [0 0]);
plot(xl, yl)
figure;
rhs14 = @(t,y) [y(2); -y(1) - 0.3*y(1)];
[xm, ym] = ode45(rhs14, [0 40], [0 0]);
plot(xm, ym)
%Part d:
figure;
rhs15 = @(t,y) [y(2); -y(1) - (-0.2)*y(1)];
[xn, yn] = ode45(rhs15, [0 40], [0 0]);
plot(xn, yn)
figure;
rhs16 = @(t,y) [y(2); -y(1) - (-0.3)*y(1)];
[xo, yo] = ode45(rhs16, [0 40], [0 0]);
plot(xo, yo)
```

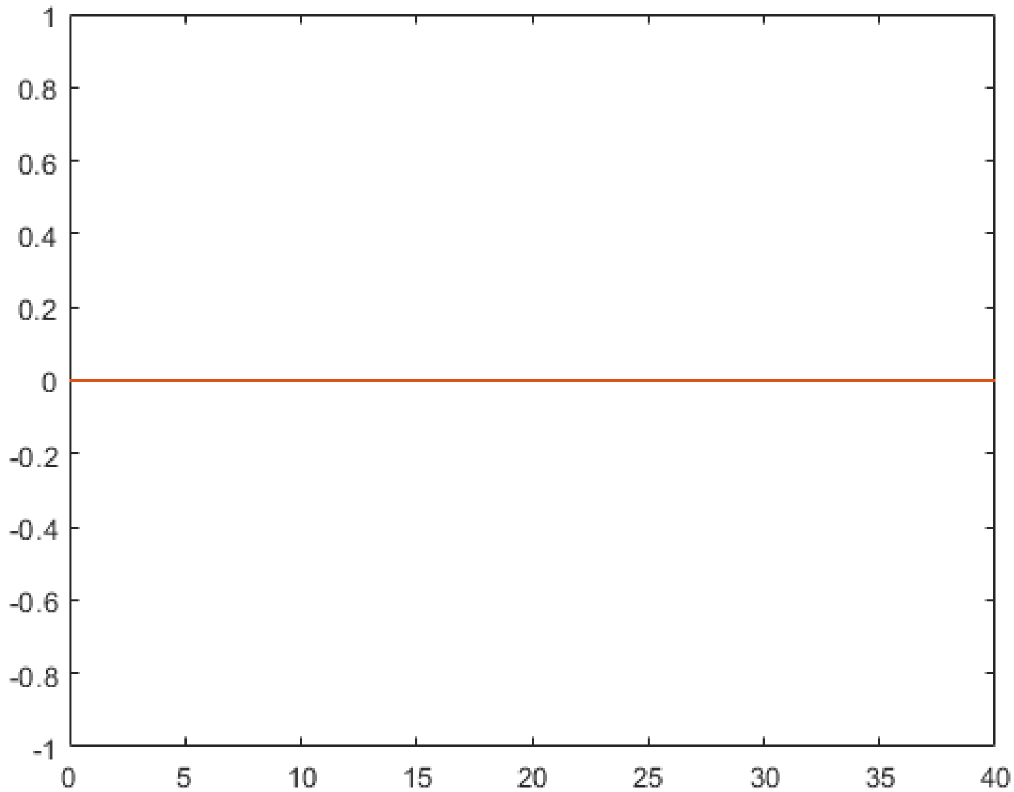




1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
5
10
15
20
25
30
35
40

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
5
10
15
20
25
30
35
40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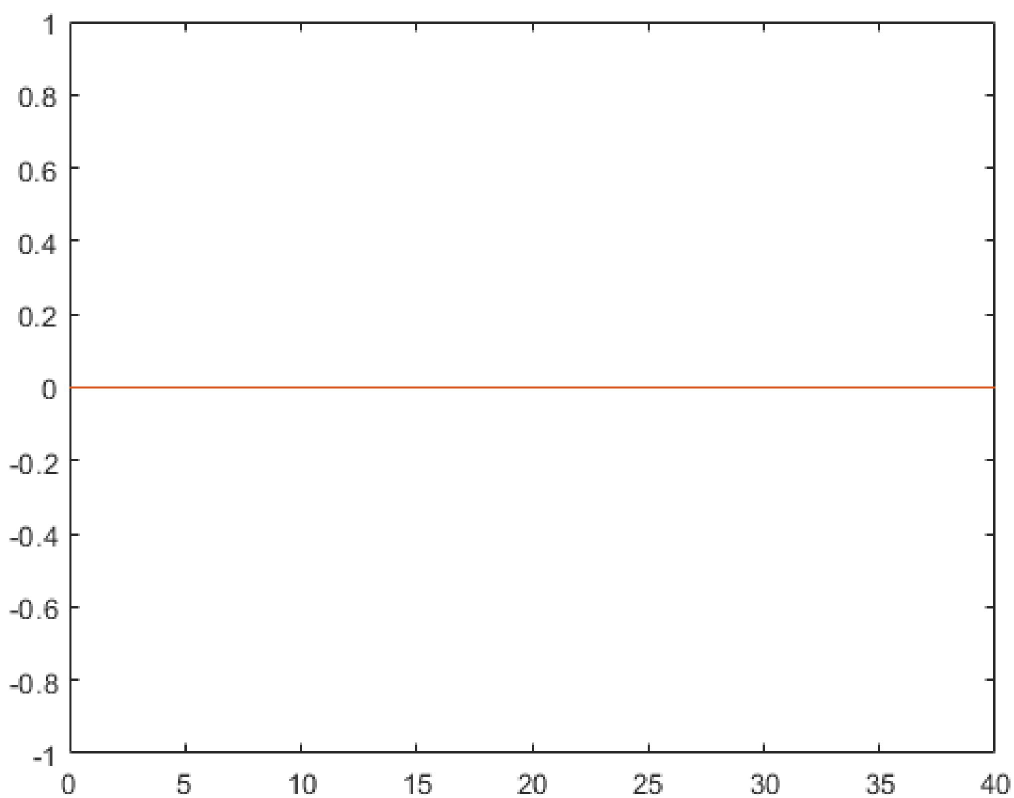
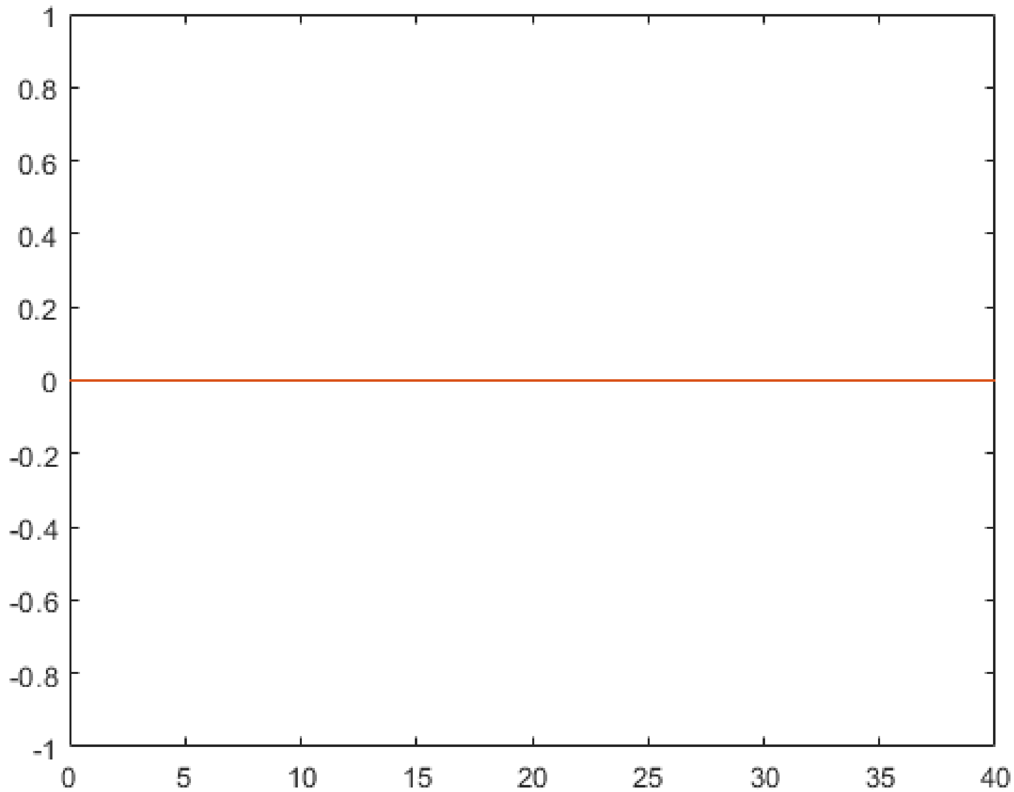
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
5
10
15
20
25
30
35
40


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
5
10
15
20
25
30
35
40




```
%Problem 15:
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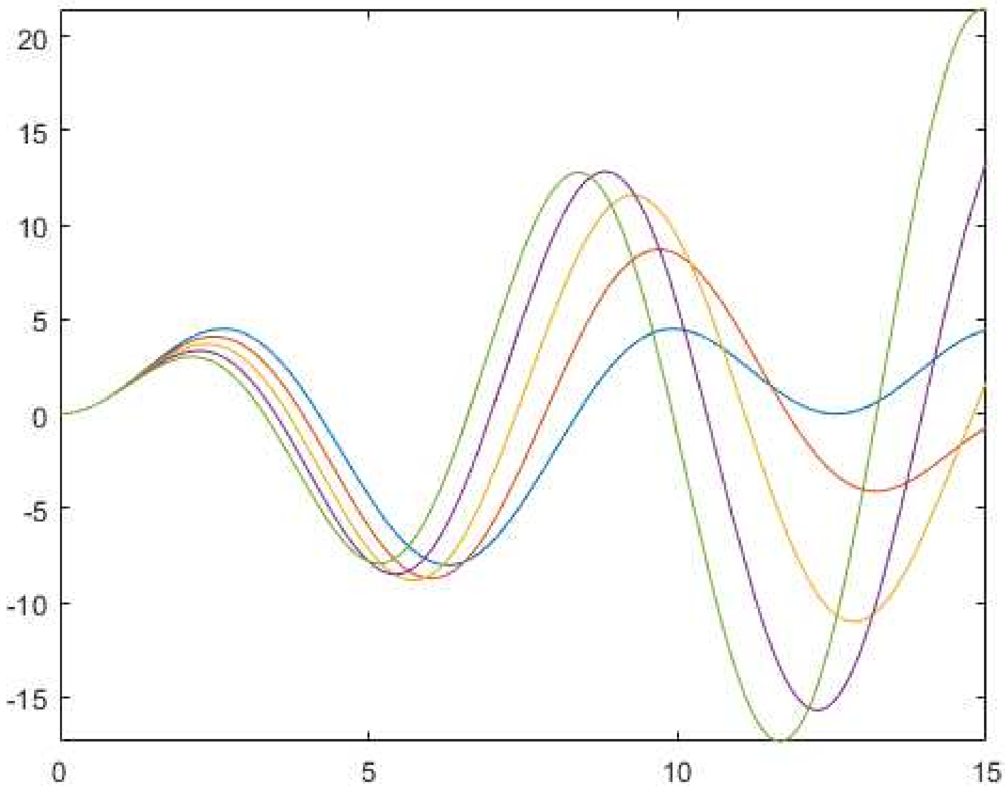
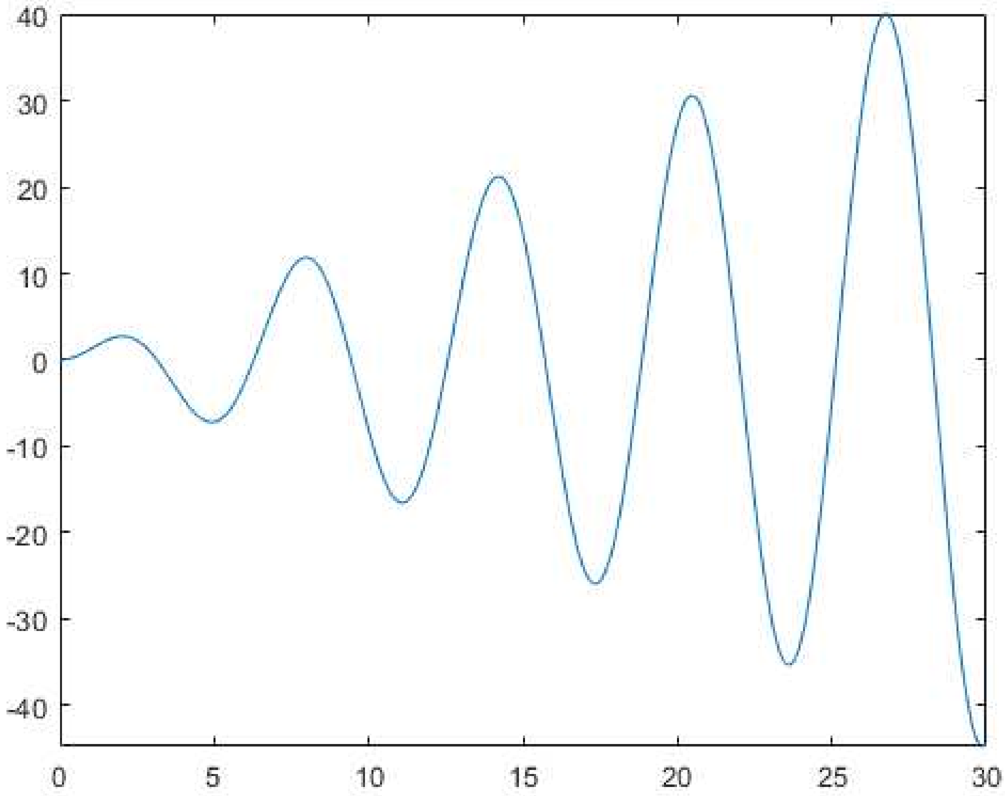
## Part a:

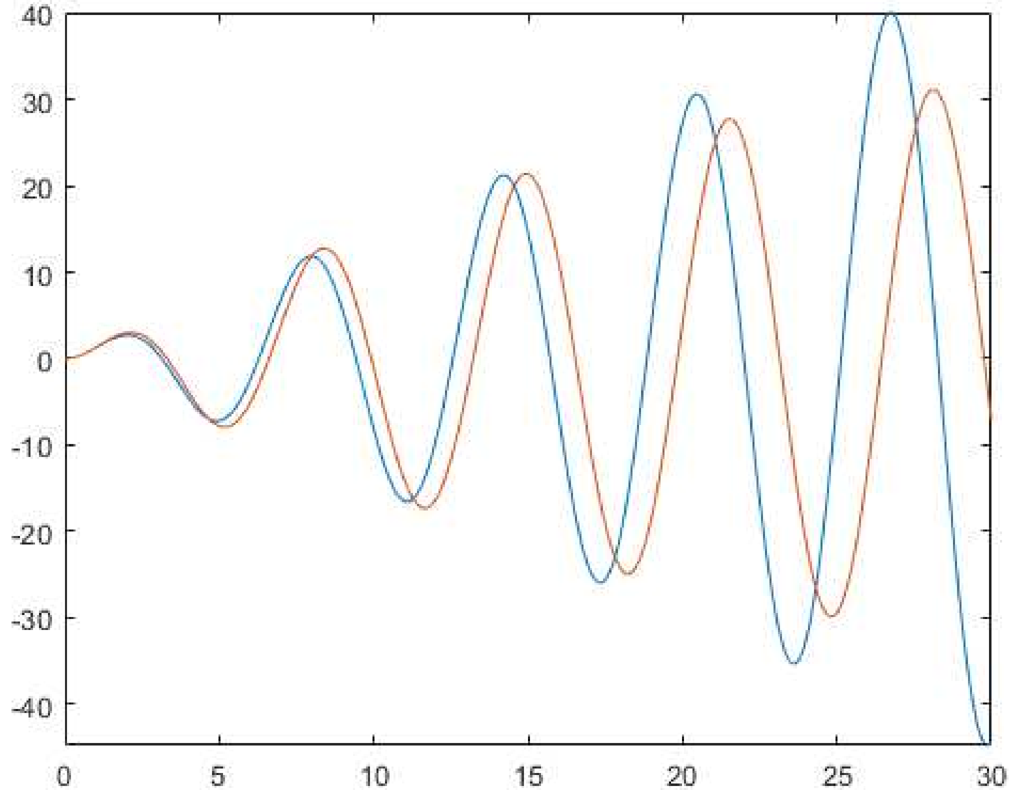
```
syms u(t) w;
eqn1 = diff(u,t,2) == 3*cos(0.5*t)-u;
Du = diff(u,t);
cond = [u(0)==0, Du(0)==0];
ySol1(t) = dsolve(eqn1,cond);
eqn2 = diff(u,t,2) == 3*cos(0.6*t)-u;
ySol2(t) = dsolve(eqn2,cond);
eqn3 = diff(u,t,2) == 3*cos(0.7*t)-u;
ySol3(t) = dsolve(eqn3,cond);
eqn4 = diff(u,t,2) == 3*cos(0.8*t)-u;
ySol4(t) = dsolve(eqn4,cond);
eqn5 = diff(u,t,2) == 3*cos(0.9*t)-u;
ySol5(t) = dsolve(eqn5,cond);
fplot(ySol1,[0,15])
hold on
fplot(ySol2,[0,15])
fplot(ySol3,[0,15])
fplot(ySol4,[0,15])
fplot(ySol5,[0,15])
hold off
%As w gets closer to w0, the period of the solution curves decrease,
%whereas the amplitude of the solution somewhat increase
```



```
%Part b:
syms u(t) w;
eqn = diff(u,t,2) == 3*cos(t)-u;
Du = diff(u,t);
cond = [u(0)==0, Du(0)==0];
ySol(t) = dsolve(eqn,cond);
fplot(ySol, [0,30])
%For the value of w=1 the phenomena exhibited shoudld be a underdamped
%vibration
```




```
%Part c:
syms u(t) w;
eqn = diff(u,t,2) == 3*cos(t)-u;
Du = diff(u,t);
cond = [u(0)==0, Du(0)==0];
ySol(t) = dsolve(eqn,cond);
eqn5 = diff(u,t,2) == 3*cos(0.9*t)-u;
ySol5(t) = dsolve(eqn5,cond);
fplot(ySol, [0,30])
hold on
fplot(ySol5, [0,30])
hold off
%The phenomena exhibited by the curve when w=0.9 is essentially the same
%where w=1, and where a phenomena of underdamped vibration is shown.
```

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