ENSC 180 - Assignment 6

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1.
a)b)

```
syms x
f1= 6*x^3+19*x^2-19*x+4;
f2= (x^2-5*x+6)/(x^2-4);

factor1= factor(f1)
factor2= factor(f2)
simpleA= simplify(f1*f2)
simpleB= simplify(f1/f2)
simpleC= simplify((f1*f2)^2)
df1_1= diff(f1)
df1_2= diff(f1,2)
df2_1= diff(f2)
df2_2= diff(f2,2)
int1= int(f1,2,4)
int2= int(f2,2,4)
```

```
Factors of f1=factor1=[ x + 4, 3*x - 1, 2*x - 1]

Factors of f2=factor2=[ x - 3, 1/(x + 2)]

Simplified f1*f2=simpleA=(6*x^4 + x^3 - 76*x^2 + 61*x - 12)/(x + 2)

Simplified f1/f2=simpleB=(6*x^4 + 31*x^3 + 19*x^2 - 34*x + 8)/(x - 3)

Simplified (f1*f2)^2=simpleC=((x^2 - 5*x + 6)^2*(6*x^3 + 19*x^2 - 19*x + 4)^2)/(x^2 - 4)^2

1st derivative of f1=df1_1=18*x^2 + 38*x - 19

2nd derivative of f1=df1_2=36*x + 38

1st derivative of f2=df2_1=(2*x - 5)/(x^2 - 4) - (2*x*(x^2 - 5*x + 6))/(x^2 - 4)^2

2nd derivative of f2=df2_2=2/(x^2 - 4) - (2*(x^2 - 5*x + 6))/(x^2 - 4)^2 - (4*x*(2*x - 5))/(x^2 - 4)^2
+ (8*x^2*(x^2 - 5*x + 6))/(x^2 - 4)^3

Integral of f1=int1=1826/3

Integral of f2=int2=log(32/243) + 2
```

c)

```
syms t
h= -0.12*t^4+12*t^3-380*t^2+4100*t+220;
v= diff(h);
a= diff(h,2);
```

```
%plotting
fplot(h,'r',[0 60])
hold on
fplot(v,'g',[0 60])
fplot(a,'b',[0 60])
grid on
grid minor
xlabel('time')
legend('height','velocity','acceleration')
hold off

%calculation for time and height
possible_maxh_time= double(solve(v));
for i=1:(size(possible_maxh_time)-1)
    if subs(h,t,possible_maxh_time(i+1)) > subs(h,t,possible_maxh_time(i))
      MaxHeightTime= possible_maxh_time(i+1);
      MaxHeight= double(subs(h,t,MaxHeightTime));
    end
end

MaxHeight
MaxHeightTime

landing_time= double(solve(h))
```

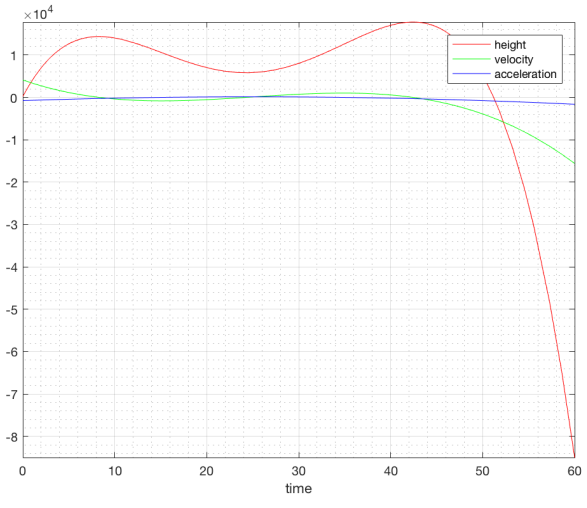
```
MaxHeight = 1.7779e+04

MaxHeightTime = 42.4248

landing_time =

  -0.0534 + 0.0000i
  51.1942 + 0.0000i
  24.4296 - 8.5963i
  24.4296 + 8.5963i
```

The only reasonable landing time is the 2nd value since the last two are complex numbers are the first is negative

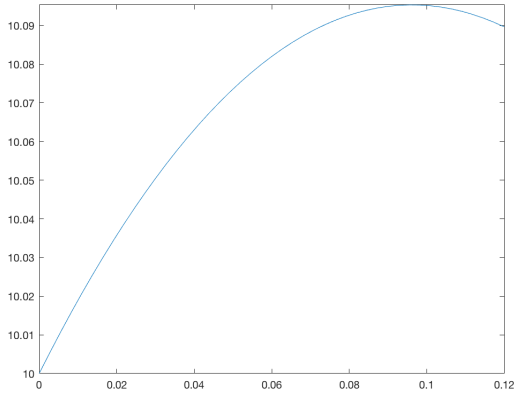


2.
a)

```
syms R L C t
v=dsolve('D2v+(R/L)*Dv+v/(L*C)=0','v(0)=10','Dv(0)=2');
%substitute input values of R,L,C
v1=subs(v,R,2/3);
v2=subs(v1,L,1);
v3=subs(v2,C,1/2)

fplot(v3,[0,0.12]) %0<=t<=120ms
```

Natural response =




```
- (17^(1/2)*exp(t*((17^(1/2)*1i)/3 -
1/3))*((17^(1/2)*5i)/3 + 8/3)*3i)/17 -
(17^(1/2)*exp(-t*((17^(1/2)*1i)/3 +
1/3))*((17^(1/2)*5i)/3 - 8/3)*3i)/17
```

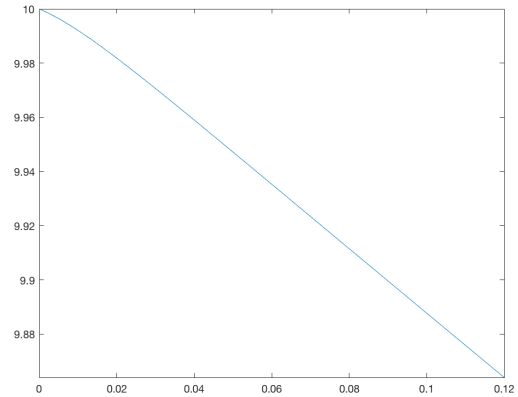
b)

```
syms R L C t
v=dsolve('D2v+(R/L)*Dv+v/(L*C)=0','v(0)=10','Dv(0)=-0.6');
%substitute input values of R,L,C
v1=subs(v,R,25/3);
v2=subs(v1,L,0.1);
v3=subs(v2,C,1)

fplot(v3,[0,0.12]) %0<=t<=120ms
```

Natural response =

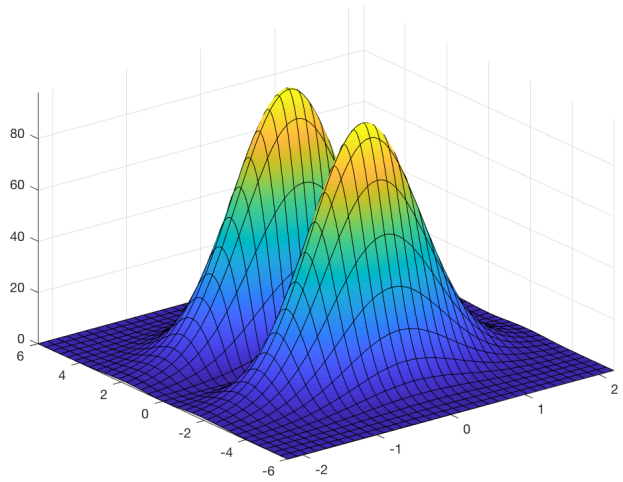
```
(45^(1/2)*3107^(1/2)*exp(5*t*((45^(1/2)*3107^(1/2))/45 - 25/3))*((5*45^(1/2)*3107^(1/2))/9 +
6241/30))/15535 + (45^(1/2)*3107^(1/2)*exp(-5*t*((45^(1/2)*3107^(1/2))/45 +
25/3))*((5*45^(1/2)*3107^(1/2))/9 - 6241/30))/15535
```

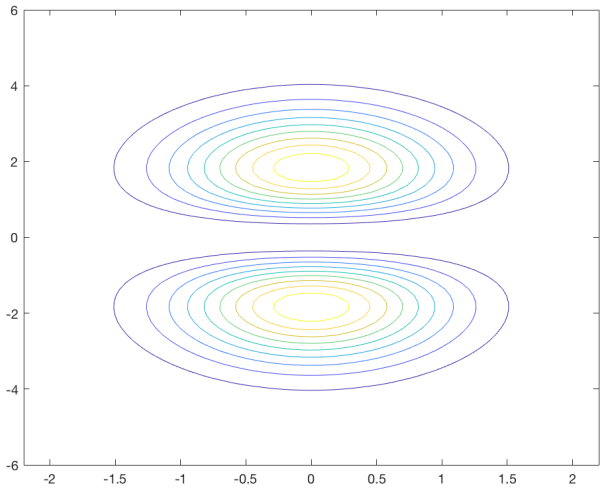


5.
a)

```
syms x y
T=80*y^2*exp(-x^2-0.3*y^2);

fsurf(T,[-2.2,2.2,-6,6])
figure
fcontour(T,[-2.2,2.2,-6,6])
```





b)