# Homework #2

2018110071

## Problem 1

### Script

```
clear all;

clc;


x1=fzero(@(x)4*x^3-3*x^2-30,[0,5])

x2=fzero(@(x)3*exp(2*x)-10,[0,1])

x3=fzero(@(x)5*(10^x)-10*x^2,[-1,1])
```

### Result

```
x1 =    2.2420

x2 =    0.6020

x3 =   -0.4307
```

## Problem 2

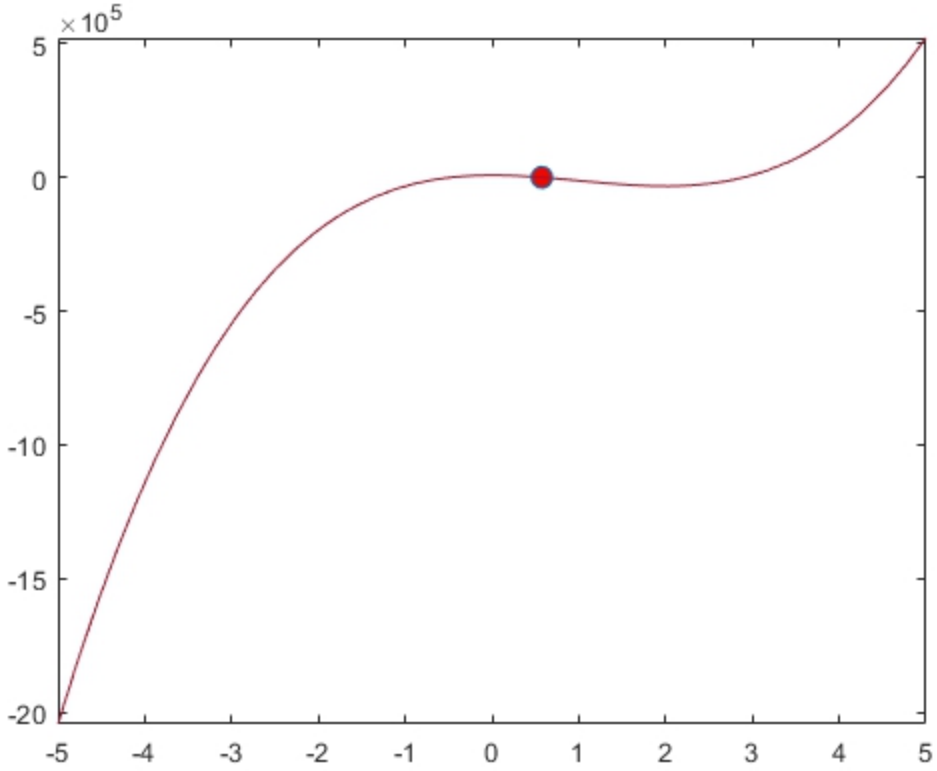
### Script

```
clear

clc


Function = @(x)(1000*9.8*(4/3*pi*1^3-pi*x^2/3*(3*1-x)))-(4/3*pi*1^3*800*9.8);

height = fzero(Function,[0,2])

fplot(Function)

hold on

plot(height,Function(height),'o','MarkerSize',8)
```

### Result

height = 0.5743

### Graph




## Problem 3

### Script

```
clear

clc


syms t0;

syms t1;

Function = @(x)80*exp(-0.2*t0);

i = int(Function,t0,0,t1);

time = solve(i == 200);


t1 = 15;

water = 400- int(Function,t0,0,t1);


fprintf('time=%f\n',time)
```

```
fprintf('water=%f\n',water)
```

### Result

```
time=3.465736

water=19.914827
```

### Problem 4

### Script

```
clear

clc


Year = [1750 1800 1850 1900 1950 1990 2000 2009];

Population = [791 980 1260 1650 2520 5270 6060 6800];

x=1750:1:2009;

%cftool(Year,Population)


%the exponential function

a = 9.911e-08;

b = 0.01241;

exponential = @(x)a*exp(b*x);


%third-order polynomial

p1= 0.001020697301838;

p2= -5.604096642832609;

p3= 1.025536170980091e+04;

p4= -6.253911927981189e+06;

thirdorder = @(x)p1*x^3 + p2*x^2 + p3*x + p4;


% linear and spline interpolations
```

```
linear(x)=interp1(Year,Population,x,'linear');
spline(x)=interp1(Year,Population,x,'spline');

exponential(1980)
thirdorder(1980)
linear(1975)
spline(1975)

figure
hold on
plot(Year ,Population ,'o','Color','r','DisplayName','Origin')
fplot(exponential,[1750 2009],'-','DisplayName','exponential')
legend ('Fontsize',12,'FontWeight','bold')
hold off

figure
hold on
plot(Year ,Population ,'o','Color','r','DisplayName','Origin')
fplot(thirdorder,[1750 2009],'-','DisplayName','thirdorder')
legend ('Fontsize',12,'FontWeight','bold')
hold off

figure
hold on
plot(Year ,Population ,'o','Color','r','DisplayName','Origin')
plot(x,linear(x),'-','DisplayName','exponential')
legend ('Fontsize',12,'FontWeight','bold')
hold off

figure
hold on
```

```
plot(Year ,Population ,'o','Color','r','DisplayName','Origin')

plot(x,spline(x),'-','DisplayName','exponential')

legend ('Fontsize',12,'FontWeight','bold')

hold off
```

**Result**

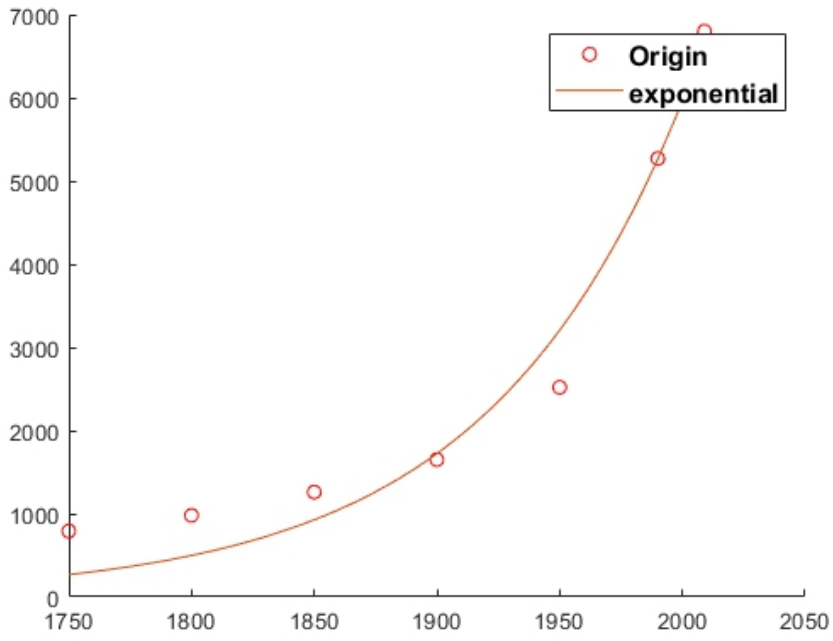
`exponential` = 4.6507e+03

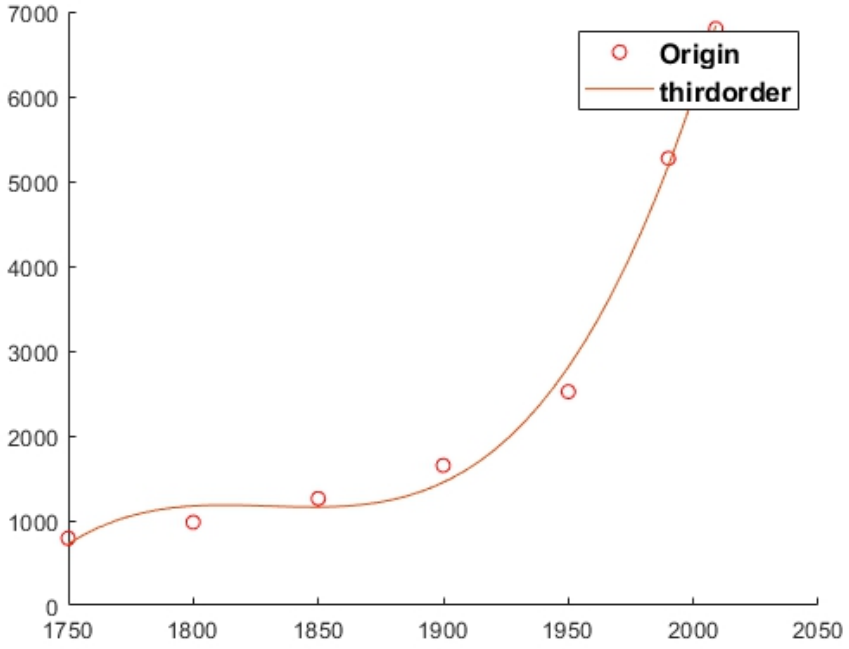
`thirdorder` = 4.4563e+03

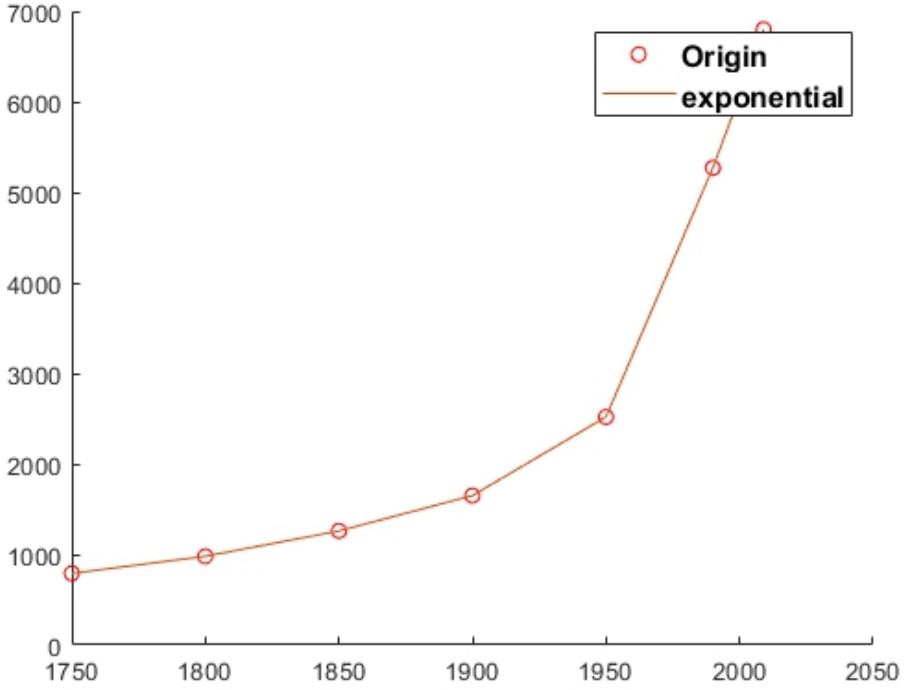
`linear` = 4.2388e+03

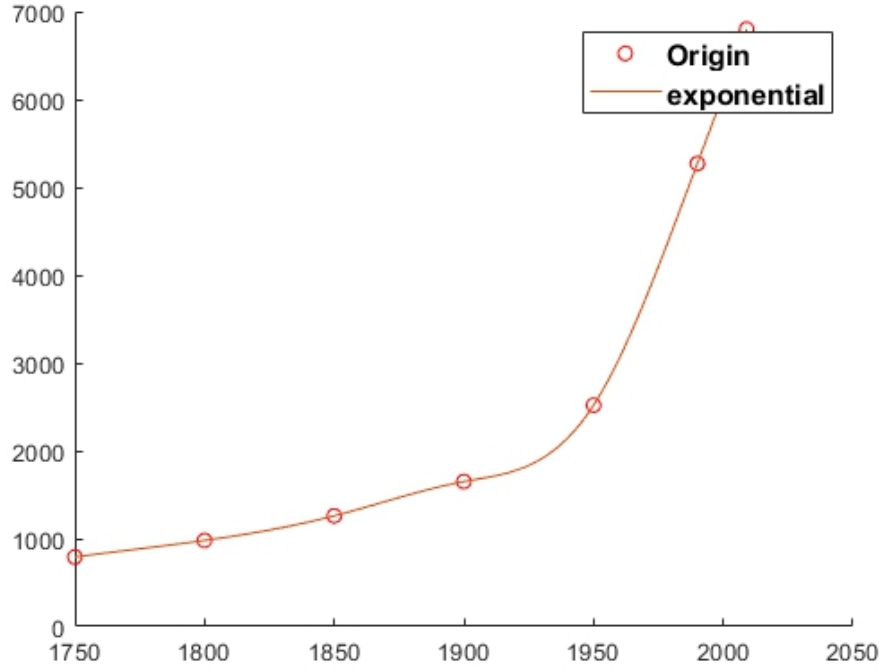
`spline`= 4.0986e+03

**Graph**




Origin
thirdorder
7000
6000
5000
4000
3000
2000
1000
0
1750
1800
1850
1900
1950
2000
2050


Origin
exponential
7000
6000
5000
4000
3000
2000
1000
0
1750
1800
1850
1900
1950
2000
2050




**Problem 5**

**Script**

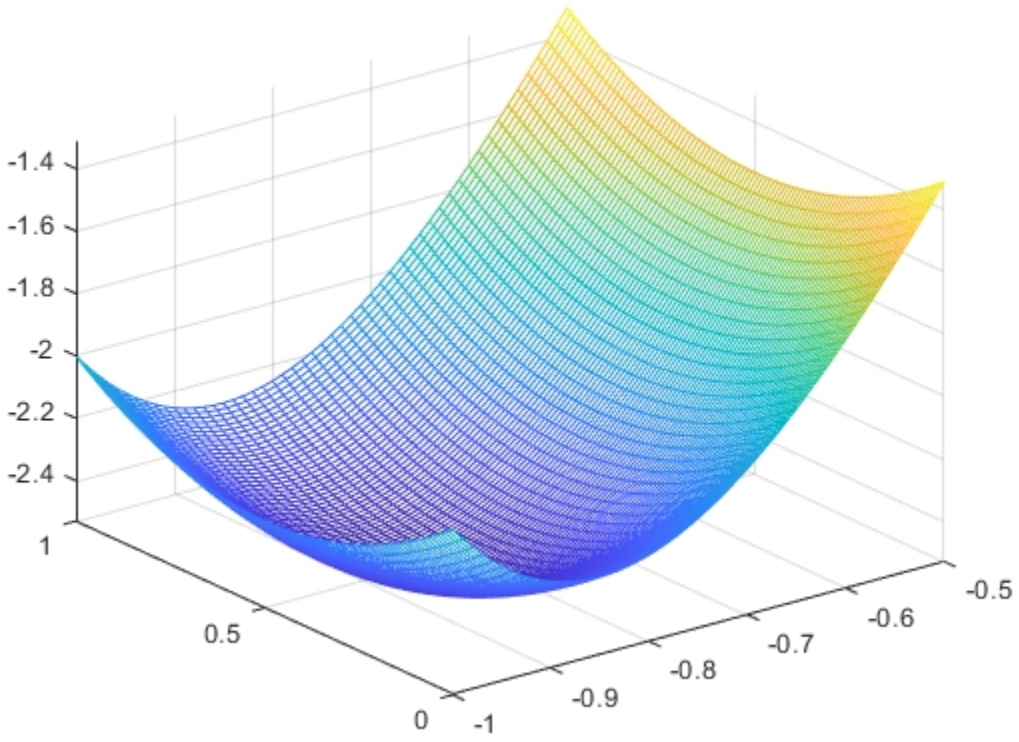
```
clear all;

clc;


Function=@(x)3*x(1)^4-2*x(1)^2+4*x(1)+1+x(2)^2-x(2);

[x1,min]=fminsearch(Function,[-5,-5])

x1=-1:0.01:-0.5;

range_x2=0:0.01:1;

[x1,x2]=meshgrid(x1,range_x2);

Y = 3*x1.^4-2*x1.^2+4*x1+1+x2.^2-x2;

mesh(x1,x2,Y)
```

**Result**

x =  -0.8514  0.5000

min =  -2.5290

**Graph**




**Problem Bonus**

**Script**

```
clear

clc

clc

format compact


Function = @(x)x^2*cos(2*pi*x);

[x0,y0] = fminbnd(Function,0,1)

fplot(Function,[-1 1])

hold on

plot(x0,y0,'o')

plot(-x0,y0,'o')
```

**Result**

x0= ±0.5799

y0= -0.2948

**Graph**