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%GI07 Homework 1 Question 1 Part 1
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close all;
clear all;

%===========Gradient=Descent============

%produce a simple visualization of a gradient descent algorithm. For
 the
%function f(x,y)=(x-2)^2+2*(y-3)^2

%commence by initalising space for the function in the X and Y
 dimensions
%corresponding to variables X and Y. The 3rd dimension 'z' will
 correspond
%to f(x,y).

[X,Y] = meshgrid(linspace(0,5,15),linspace(0,5,15));

%create matrix of f(x,y) call this f
f=((X-2).^2)+(2*(Y-3).^2);

figure;
mesh(X,Y,f)
xlabel('x');
ylabel('y');
zlabel('f(x,y)');
title('f(x,y)=(x-2)^2+2(y-3)^2');
grid on ;

%Find the minimum of function using modified function graddesc.m

[min,path,path2,path3x,path3y,path3z]=graddesc(@fc,@dfc,
[0,0],0.1,0.1);


figure;
plot3(path3x,path3y,path3z)
xlabel('x');
ylabel('y');
zlabel('f(x,y)');
title('3D Gradient Descent for f(x,y)=(x-2)^2+2(y-3)^2');
view(-37.5,40);
grid on ;

figure;
plot(path3x,path3y)
xlabel('x');
ylabel('y');
title('Gradient Descent projection onto xy plane');
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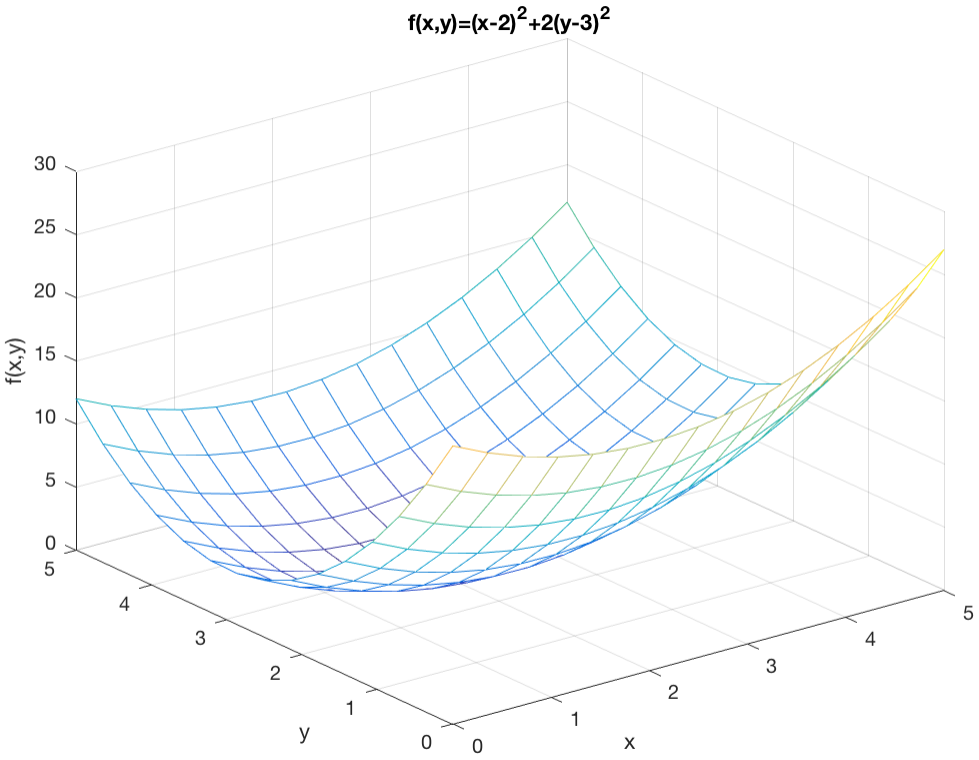
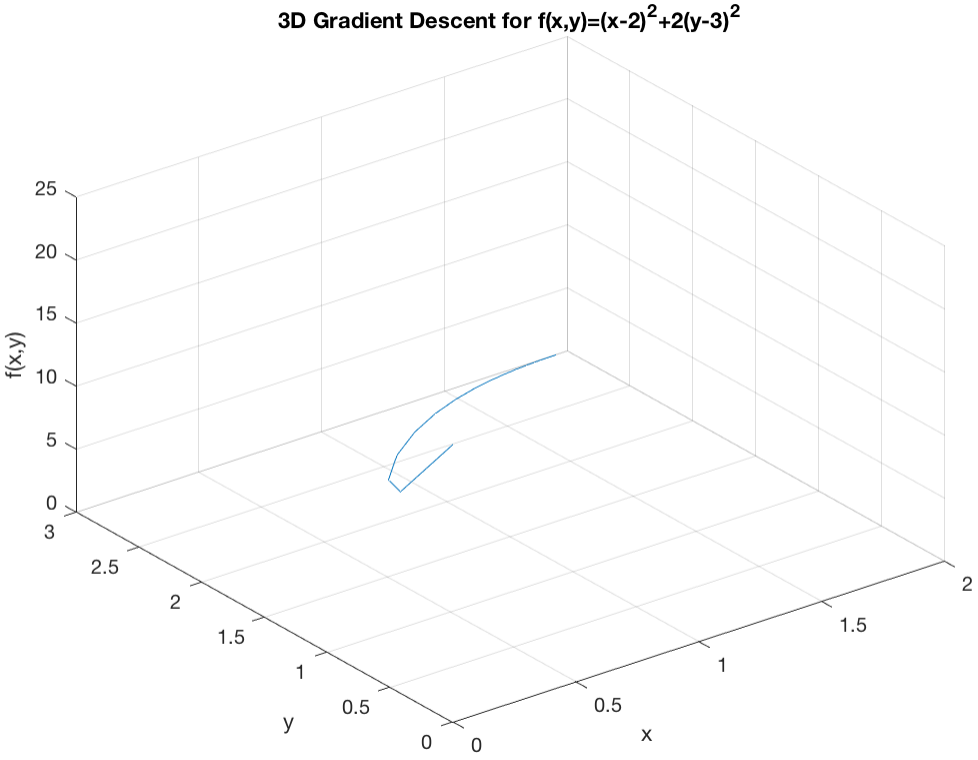
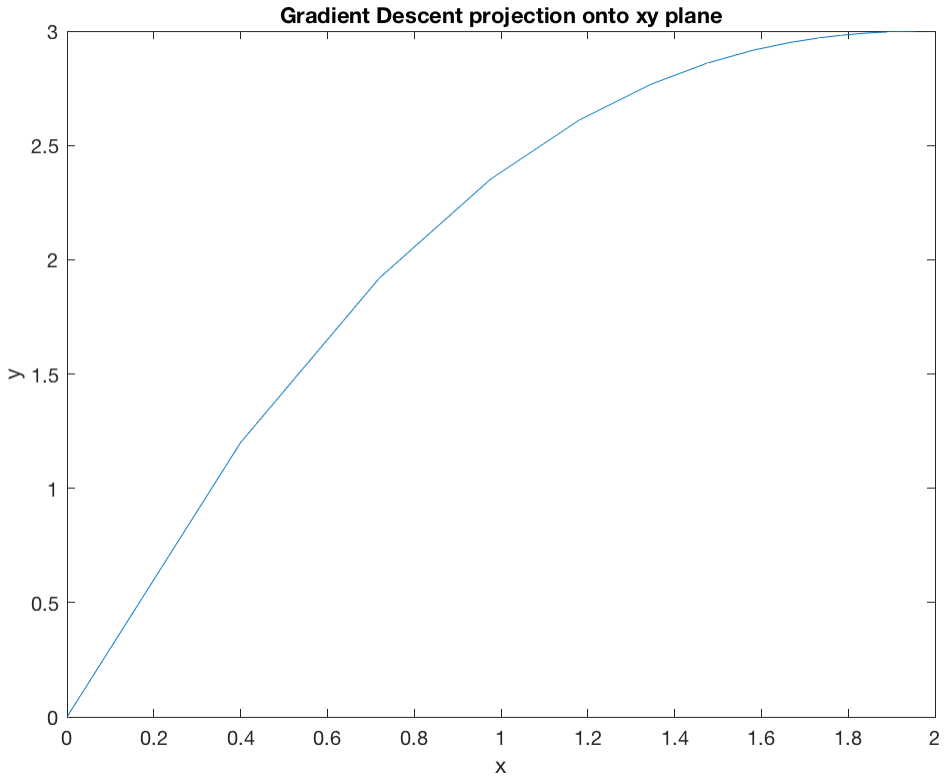
%recreates path almost the same as the one printed in Homework sheet
j=1;
while j<size(path2,2)
fprintf('(%.1f,%.1f,%.1f)',path2(1,j),path2(1,j+1),path2(1,j+2))
j=j+3;
end
```

```
(0.0,0.0,22.0)(0.4,1.2,9.0)(0.7,1.9,4.0)(1.0,2.4,1.9)(1.2,2.6,1.0)
(1.3,2.8,0.5)(1.5,2.9,0.3)(1.6,2.9,0.2)(1.7,2.9,0.1)(1.7,3.0,0.1)
(1.8,3.0,0.0)(1.8,3.0,0.0)(1.9,3.0,0.0)(1.9,3.0,0.0)(1.9,3.0,0.0)
(1.9,3.0,0.0)(1.9,3.0,0.0)(2.0,3.0,0.0)
```




3D Gradient Descent for f(x,y)=(x-2)^2+2(y-3)^2
f(x,y)
25
20
15
10
5
0
3
2.5
2
1.5
1
0.5
0
y
0
0.5
1
1.5
2
x


Gradient Descent projection onto xy plane
y
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
x

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