```matlab
% Optimization Homework3 Problem2

% Problem2(a)

% Define the function f
f = @(x1, x2) x1.^2 + 5*x2.^2 + 4*x1.*x2 - 6*x1 - 14*x2 + 20;

% Define the gradient of f in terms of x1 and x2
grad_f = @(x1, x2) [2*x1 + 4*x2 - 6; 10*x2 + 4*x1 - 14];

% Initial value
x = [10; 10];
% Tolerance
epsilon = 1e-6;
% Maximum number of iterations
max_iterations = 1000;
% Counter of iterations
iterations = 0;

% Store the values during iterations
results = [];
% Store the path of iterations
path = x';

while norm(grad_f(x(1), x(2))) > epsilon && iterations < max_iterations

    % Compute the gradient at current point x=(x1, x2)
    d_k = -grad_f(x(1), x(2));

    % According to Problem1
    % Minimize f(x_k + alpha * d_k) with respect to alpha
    % Symbol variable declaration
    syms alpha_sym;
    % Establish the function f_alpha = f(x_k + alpha * d_k)
    f_alpha = f(x(1) + alpha_sym * d_k(1), x(2) + alpha_sym * d_k(2));
    % Calculate the derivative of f_alpha with respect to alpha
    df_alpha = diff(f_alpha, alpha_sym);
    % Find optimal alpha when df_alpha=0
    alpha_k = double(solve(df_alpha == 0, alpha_sym));

    % Update x
    x = x + alpha_k * d_k;

    % Store results
    results = [results; x(1), x(2), d_k(1), d_k(2), norm(d_k), alpha_k,
f(x(1), x(2))];
    % Store the path for plotting
    path = [path; x'];
    % Iteration counter
    iterations = iterations + 1;

end
```

```matlab
% Create a table with the results
result_table = array2table(results, 'VariableNames', {'xk1', 'xk2', 'dk1',
'dk2', 'Norm_dk', 'alpha_k', 'f_xk'});

% Display the table
disp(result_table);

% Plot the contour of the function and the iteration path
[x1_vals, x2_vals] = meshgrid(-20:0.1:20, -20:0.1:20);
f_vals = f(x1_vals, x2_vals);

figure;
contour(x1_vals, x2_vals, f_vals, 50);
hold on;
plot(path(:, 1), path(:, 2), '-ro', 'LineWidth', 2, 'MarkerSize', 6);
xlabel('x_1');
ylabel('x_2');
title('Contour Plot with Steepest Descent Iteration Path');
grid on;
legend('Contours', 'Iteration Path');
```
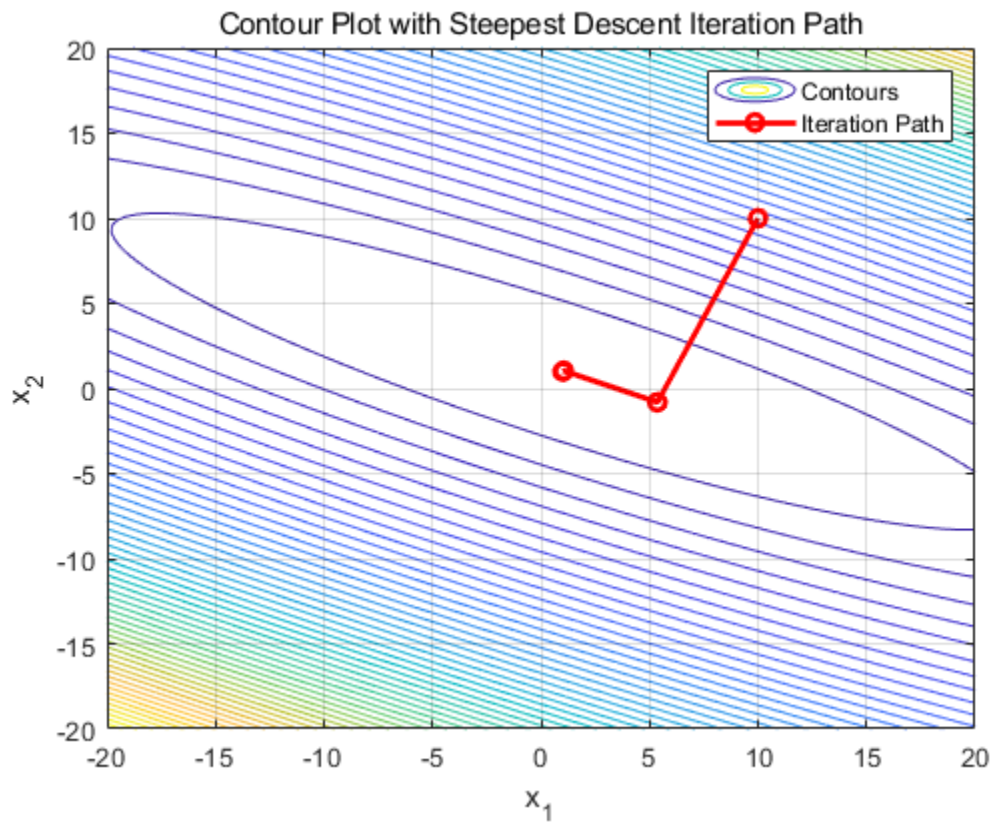
xk1	xk2	dk1	dk2	Norm_dk	alpha_k	f_xk
5.3669	-0.81065	-54	-126	137.08	0.085799	13.834
1.0426	1.0426	-1.4911	0.63905	1.6223	2.9	10.018
1.0207	0.99143	-0.25562	-0.59645	0.64892	0.085799	10
1.0002	1.0002	-0.0070586	0.0030251	0.0076795	2.9	10
1.0001	0.99996	-0.00121	-0.0028234	0.0030718	0.085799	10
1	1	-3.3413e-05	1.432e-05	3.6353e-05	2.9	10
1	1	-5.728e-06	-1.3365e-05	1.4541e-05	0.085799	10

Contour Plot with Steepest Descent Iteration Path

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