Editor - C:\Users\Nwhybra\Desktop\UW AMATH Masters\AMATH 584\HW\HW5\problem_A2.m

problem_A2.m | problem_A3.m | gecp.m

```
x0 = 1.2;
f_prime_exact = cos(x0);
h = 10.^(0:-1:-16);
f_prime_approx = (sin(x0 + h) - sin(x0)) ./ h;
better_approx = (2 * cos(x0 + h/2) .* sin(h/2)) ./ h;
error_1 = abs(f_prime_exact - f_prime_approx);
error_2 = abs(f_prime_exact - better_approx);

figure;
loglog(h, error_1);
xlabel("h")
ylabel("Error (b)")
title("Error (b) vs. h")

figure;
loglog(h, error_2);
xlabel("h")
ylabel('Error (d)')
title('Error (d) vs. h')
```

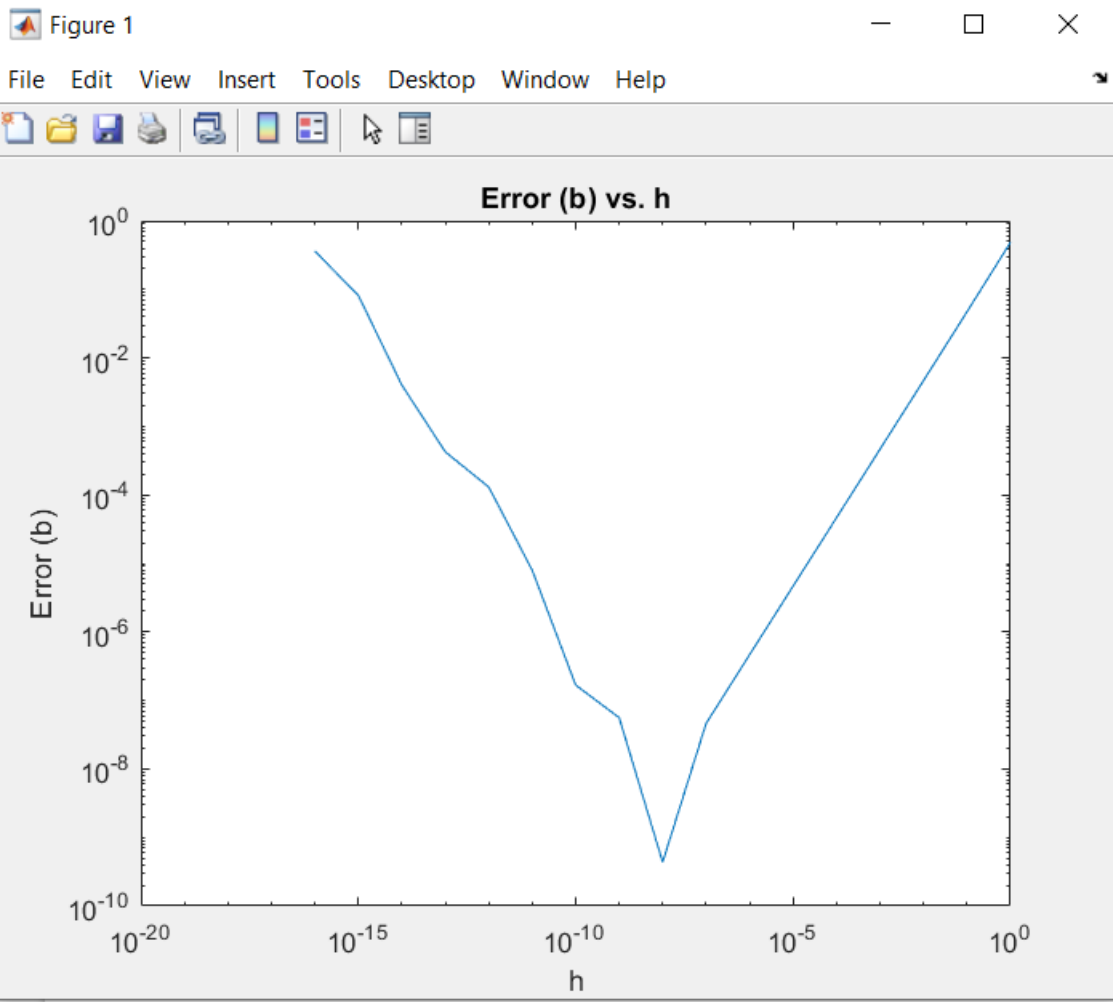
Figure 1
File Edit View Insert Tools Desktop Window Help
Error (b) vs. h
Error (b)
h
10^0
10^-2
10^-4
10^-6
10^-8
10^-10
10^-20
10^-15
10^-10
10^-5
10^0

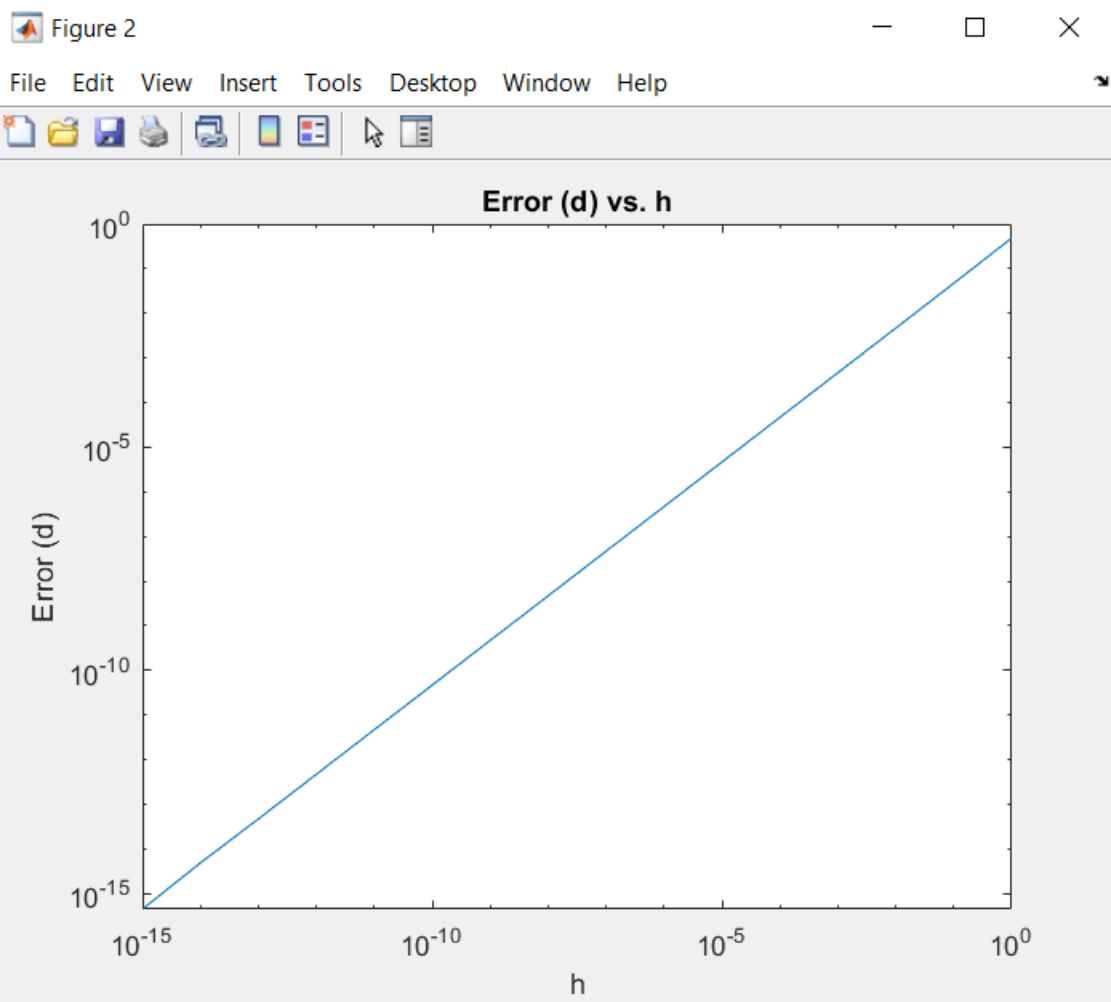
Figure 2
File Edit View Insert Tools Desktop Window Help
Error (d) vs. h
10^{0}
10^{-5}
10^{-10}
10^{-15}
Error (d)
10^{-15}
10^{-10}
10^{-5}
10^{0}
h

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problem_A2.m | problem_A3.m | gecp.m | +

```
% Make the matrix A as defined in the problem.
n = 100;
A = -1 * tril(ones(n), -1) + eye(n);
A(:, end) = 1;

% Make the random vector.
x = randn(100, 1);

% Calculate b.
b = A * x;

% Part (a).
k = cond(A);

% Part (b).
x_ge = A \ b;
norm_error_1 = norm(x - x_ge, 2);

% Part (c).
[Q,R] = qr(A, 0);
x_qr = R \ (Q' * b);
norm_error_2 = norm(x - x_qr, 2);

% Part (d).
% P*A*Q = L*U...
[L, U, P, Q] = gecp(A);
x_gecp = Q * inv(U) * inv(L) * P * b;
norm_error_3 = norm(x - x_gecp, 2);
```