```matlab
clear all;
%m equally spaced points over [0,1]
m = 50; n=12;

% Vandermonde matrix t
t = zeros(m,n);
for i = 1:n
    for j = 1:m
        t(j,i) = ((j-1)/(m-1))^(n-i);
    end
end

%fliping the vandermonde matrix t to form A
A = fliplr(t);

%fuction f
tj = zeros(m,1);
for j = 1:m
    tj(j) = (j-1)/(m-1);
end

f = cos(4*tj);

format long
%(a). normal equations
x = (A'*A)\(A'*f);

%(b). QR decomposition using CGS
[q_c,r_c] = CGS(A);
xc = r_c\(q_c'*f);
%xc = (q_c*r_c)\f
%xc = backsub(r_c,q_c,f,n)

%(c). QR decomposition using MGS
[q_m,r_m] = MGS(A);
xm = r_m\(q_m'*f);
%xm = (q_m*r_m)\f;


%(d). QR decomposition using Householder
[v_h,r_h] = house(A);
q_h = house2q(v_h);
x_h = r_h\(q_h'*f);

%(e). QR decomposition using inbuilt Householder
[q,r] = qr(A);
xh = r\(q'*f);

%(f). QR decomposition using inbuilt svd
[u,s,v] = svd(A);
xs = (u*s*v')\f;

Table = table(x,xc,xm,x_h,xh,xs, 'VariableNames',{'Normal equation','CGS','MGS','Householder','Builtin function','SVD'})

%Differences and Similarities

%Plot the difference between AX - b
%a) the Equations method
```

```
Warning: Matrix is close to singular or badly scaled. Results may be inaccurate.
RCOND =  2.800825e-17.

Table =

  12×6 table
```

Normal equation	CGS	MGS	Householder	Builtin function	SVD
0.999999989587329	1.00001318251953	0.999999998520677	1.0000000009966	1.00000000099661	1.0000000009966
2.84029396133336e-06	-0.00225720796774053	3.05080727773958e-07	-4.22742880142516e-07	-4.22742915903599e-07	-4.22742687968714e-07
-8.00010214560535	-7.93913160486272	-8.00000853723409	-7.99998123568728	-7.99998123568936	-7.99998123569402
0.00144399781030622	-0.651916745057654	8.30962169927592e-05	-0.00031876322646563	-0.000318763182123933	-0.000318763136786353
10.6560552366266	14.2711955211007	10.6663571718914	10.6694307959049	10.6694307955344	10.6694307952905
0.0460832179149034	-11.5678311875708	3.8863814958323e-05	-0.0138202880901764	-0.0138202863975713	-0.0138202856094021
-5.81579888120301	17.0680866167968	-5.68634045840887	-5.64707562703058	-5.64707563175731	-5.64707563334524
0.231892082482534	-27.8571950090876	-0.0034568433400209	-0.0753160248519546	-0.0753160164200601	-0.0753160144223081
1.33247545357655	22.3656313402359	1.60875341462289	1.69360696399754	1.69360695433438	1.69360695282722
0.270659249202885	-8.65775021730327	0.0684591563300498	0.00603210846945386	0.00603211536110353	0.00603211596325072
-0.484158233866101	1.28940347151745	-0.400264201000408	-0.374241703362034	-0.374241706147935	-0.374241706226963
0.107803579981325	0.0280984905476861	0.0927344155691747	0.0880405760611674	0.0880405765490434	0.0880405765380861

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