

```

clear all;
close 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

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

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

f = cos(4*tj);

format long
%block matrix Ablock
Ablock = [eye(m) A; A' zeros(n)];
b = [f;zeros(n,1)];
[qb,rb] = qr(Ablock); xb = rb\qb'*b);

%solution x, extracted from xb
xblock = xb(m+1:end)

%solution r
fprintf('Solution of r\n\n');
r = xb(1:m);

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

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

Table = table(x,xh,xblock, 'VariableNames',{'Normal equation','Builtin function','Block Matrix'})

residual = norm((xh - xblock),2);

fprintf('The solution, xblock, solution is almost similar to the computed solutions although some little values are off. \n And the residual %f is sma'

```

xblock =

```

1.0000000003176009
-0.000001053361969
-7.999957773466207
-0.000661681286866
10.672037092264638
-0.025505465801884
-5.614140276352710
-0.135309892771110
1.764148110435273
-0.045663530262449
-0.352769283842230
0.084180130494221

```

Solution of r

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

Table =

12×3 table

Normal equation	Builtin function	Block Matrix
0.999999998587329	1.00000000099661	1.000000000317601
2.84029396133336e-06	-4.22742915903599e-07	-1.05336196876486e-06
-8.00010214560535	-7.99998123568936	-7.99995777346621
0.00144399781030622	-0.000318763182123933	-0.000661681286865863
10.6560552366266	10.6694307955344	10.6720370922646
0.0460832179149034	-0.0138202863975713	-0.0255054658018845
-5.81579888120301	-5.64707563175731	-5.61414027635271
0.231892082482534	-0.0753160164200601	-0.13530989277111
1.33247545357655	1.69360695433438	1.76414811043527
0.270659249202885	0.00603211536110353	-0.0456635302624494

-0.484158233866101	-0.374241706147935	-0.35276928384223
0.107803579981325	0.0880405765490434	0.084180130494221

The solution, xblock, solution is almost similar to the computed solutions although some little values are off.
And the residual 0.113807 is small.