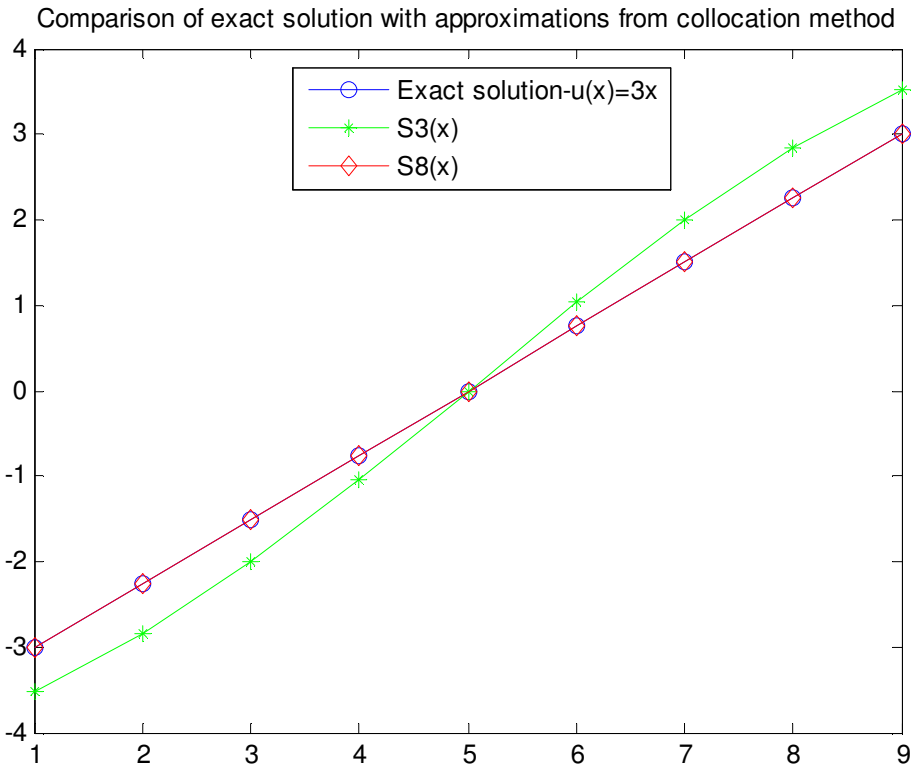

Figure 1: Comparison of exact solution with approximations from Collocation method

x	Exact Solution(u(x)=3x)	S3(x)	S8(x)
-1	-3	-3.51828	-2.99954
-0.75	-2.25	-2.85001	-2.24965
-0.5	-1.5	-2.00453	-1.49977
-0.25	-0.75	-1.03442	-0.74988
0	0	0	0
0.25	0.75	1.034423	0.749884
0.5	1.5	2.004531	1.499768
0.75	2.25	2.850006	2.249652
1	3	3.518282	2.999536

Table 1: Comparison of exact solution with approximations from Collocation method

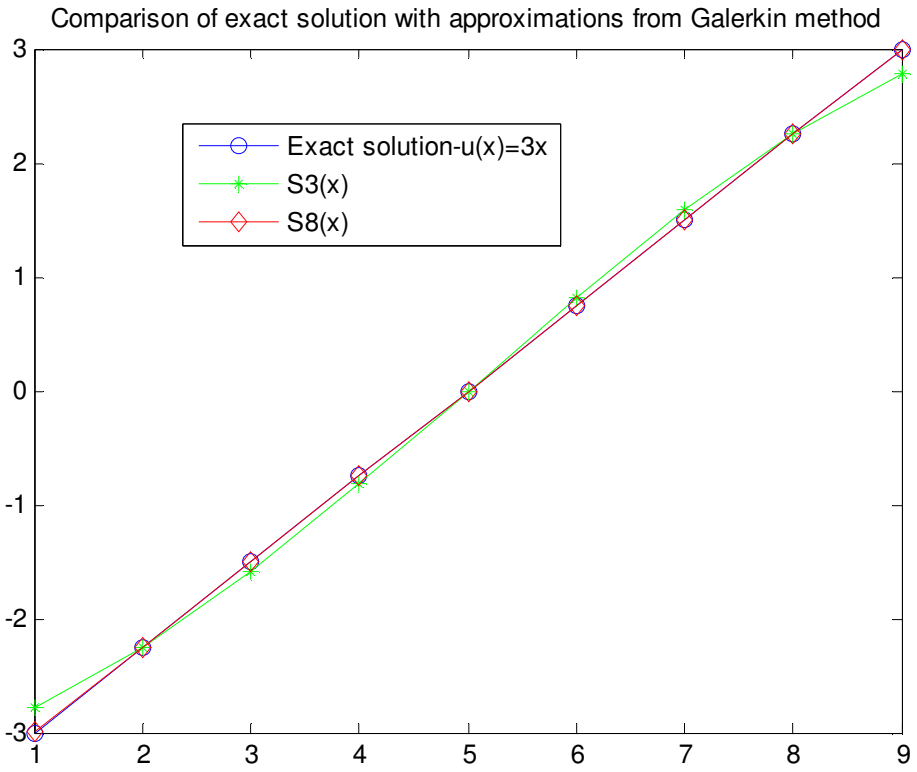

Figure 2: Comparison of exact solution with approximations from Galerkin method

x	Exact Solution(u(x)=3x)	S3(x)	S8(x)
-1	-3	-2.77634	-2.99662
-0.75	-2.25	-2.24899	-2.25032
-0.5	-1.5	-1.58181	-1.49925
-0.25	-0.75	-0.81628	-0.74987
0	0	0	0
0.25	0.75	0.816283	0.749873
0.5	1.5	1.581814	1.499251
0.75	2.25	2.248995	2.250317
1	3	2.776344	2.996624

Table 2: Comparison of exact solution with approximations from Galerkin method

MATLAB CODE:

```
clc;
clear all;

%5.3.7
A=[1 -0.6023+sin(1) cos(1); 1 sin(0) cos(0); 1 0.6023+sin(-1) cos(-1)];
B=[1;0;-1];
c=A\B;

x=[1; 0.75;0.5;0.25;0;-0.25;-0.5;-1];

for j=1:length(x)
    A(j,1)=1;
    A(j,2)=sin(x(j))-0.6023*x(j);
    A(j,3)=cos(x(j));
    A(j,4)=sin(2*x(j))-0.8708*x(j);
    A(j,5)=cos(2*x(j));
    A(j,6)=sin(3*x(j))-0.6914*x(j);
    A(j,7)=cos(3*x(j));
    A(j,8)=sin(4*x(j))-0.2322*x(j);

end;
C=A\x;
i=1;
for y=-1:0.25:1
    yi(i)=y;
    uy_1(i)=3*y;
    uy_2(i)=c(2)*sin(y);
    uy_3(i)=C(2)*sin(y)+C(4)*sin(2*y)+C(6)*sin(3*y)+C(8)*sin(4*y);
    i=i+1;
end;
plot(uy_1,'-ob');hold on; plot(uy_2,'-*g');hold on; plot(uy_3,'-dr');
title('Comparison of exact solution with approximations from collocation
method');
legend('Exact solution-u(x)=3x','S3(x)','S8(x)');

%%
%5.3.9
clc;
clear all;
A1=[2 0 2*sin(1); 0 0.18256 0; 2*sin(1) 0 1+cos(1)*sin(1)];
B1=[0;-2*cos(1)+2*sin(1);0];
c1=A1\B1;

AA(1,:)=[2 0 2*sin(1) 0 sin(2) 0 (2/3)*sin(3) 0];
AA(2,:)=[0 0.182563 0 0.269916 0 0.22739 0 0.0989621];
AA(3,:)=[2*sin(1) 0 1+cos(1)*sin(1) 0 sin(3)/3 0 2*cos(1)^3 0];
AA(4,:)=[0 0.269951 0 0.430912 0 0.431188 0 0.2990];
AA(5,:)=[sin(2) 0 sin(1)+sin(3)/3 0 1+sin(4)/4 0 sin(1)+sin(5)/5 0];
AA(6,:)=[0 0.227446 0 0.43122 0 0.5656 0 0.587083 ];
AA(7,:)=[(2/3)*sin(3) 0 2*(cos(1)^3)*sin(1) 0 sin(1)+sin(5)/5 0 1+sin(6)/6
0];
AA(8,:)=[0 0.09895 0 0.2988 0 0.5870 0 0.8224 ];
```

```
XX=[0;-2*cos(1)+2*sin(1);0;(-2*cos(2)+sin(2))/2;0;(2/9)*(-
3*cos(3)+sin(3));0;(-4*cos(4)+sin(4))/8];
CC=AA\XX;

i=1;
for y=-1:0.25:1
    yi(i)=y;
    uy_1(i)=3*y;
    uy_2(i)=c1(2)*sin(y);
    uy_3(i)=CC(2)*sin(y)+CC(4)*sin(2*y)+CC(6)*sin(3*y)+CC(8)*sin(4*y);
    i=i+1;
end;

plot(uy_1,'-ob');hold on; plot(uy_2,'-*g');hold on; plot(uy_3,'-dr');
title('Comparison of exact solution with approximations from Galerkin
method');
legend('Exact solution-u(x)=3x','S3(x)','S8(x)');

%%
%5.1.1

l=sym('l');

A_mat=[0 -3/5 -1/3 ;4/3 1+3/4 1/2; 4/5 1/2 1+1/4];
f_mat=[563/15; -595/12; -61/2];
c_mat=A_mat\f_mat;
```