19CCE203

COMPUTATIONAL ELECTROMAGNETICS

ASSIGNMENT 1 – ERROR CONVERGENCE

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MATLAB CODE:

```
angle = [0,0.5233,0.785,1.046,1.57,2.093,3.14,6.28,1.347,2.144]; % Reading angle
l = 10;
i = 1;
a = 2:20;
sinx  = zeros(10,19);
cosx  = zeros(10,19);
tanx  = zeros(10,19);
while i<=l
angle1 = angle(i);
c = 1;
n = 0;
new = 0;
old = 0;
count = 0;
while  n<19
    term = mytermsin(n,angle1);%function for sin x
    if n == 0
      old = term; % Updating SOld
      c = round(new - old,6); % Calculating E
    else
      new = old + term; % CAdding term to series
      c = round(new - old,6);  % Calculating E
      old = new; % Updating SOld value
    end
    if count == 0
      if c == 0
        count = n;
      end
    end
    n = n + 1;
    sinx(i,n) = old;
end
fprintf("\n The sin of %.2f is %.8f, and convergent value if %f \n", angle1, old,
count);% Printing resultant values
i = i+1;
end

i = 1;
while i<=l
angle1 = angle(i);
c = 1;
n = 0;
new = 0;
old = 0;
count = 0;
```

```
while  n<19
    term = mytermcos(n,angle1);%function for cos x
    if n == 0
      old = term; % Updating SOld
      c = round(new - old,6); % Calculating E
    else
      new = old + term; % CAdding term to series
      c = round(new - old,6);  % Calculating E
      old = new; % Updating SOld value
    end
    if count == 0
      if c == 0
        count = n;
      end
    end
    n = n + 1;
    cosx(i,n) = old;
end
fprintf("\n The cos of %.2f is %.8f, and convergent value is %f \n", angle1, old,
count);% Printing resultant values
i = i+1;
end
for i =  1:10
     for n = 1:19
         tanx(i,n) = sinx(i,n)/cosx(i,n); %calculating tan x (i.e) tanx =
sinx/cosx
     end
end

figure;%ploting first 5 terms of sin x
hold on
grid on
plot(a,sinx(1,:),'b');
plot(a,sinx(2,:),'k');
plot(a,sinx(3,:),'r');
plot(a,sinx(4,:),'m');
plot(a,sinx(5,:),'g');
xlabel('No. of terms')
ylabel('Sin Values for each x values')
title('Sinx values:')
legend('x=0','x=π/6','x=π/4','x=π/3','x=π/2')

figure;%ploting last 5 terms of sin x
hold on
grid on
plot(a,sinx(6,:),'b');
plot(a,sinx(7,:),'k');
plot(a,sinx(8,:),'r');
plot(a,sinx(9,:),'m');
plot(a,sinx(10,:),'g');
xlabel('No. of terms ')
ylabel('Sin Values for each x values')
title(' Sinx values :')
legend('x=2π/3','x=π','x=2π','x=0.429π','x=0.683π')

figure;%ploting first 5 terms of cosx
hold on
grid on
plot(a,cosx(1,:),'b');
```

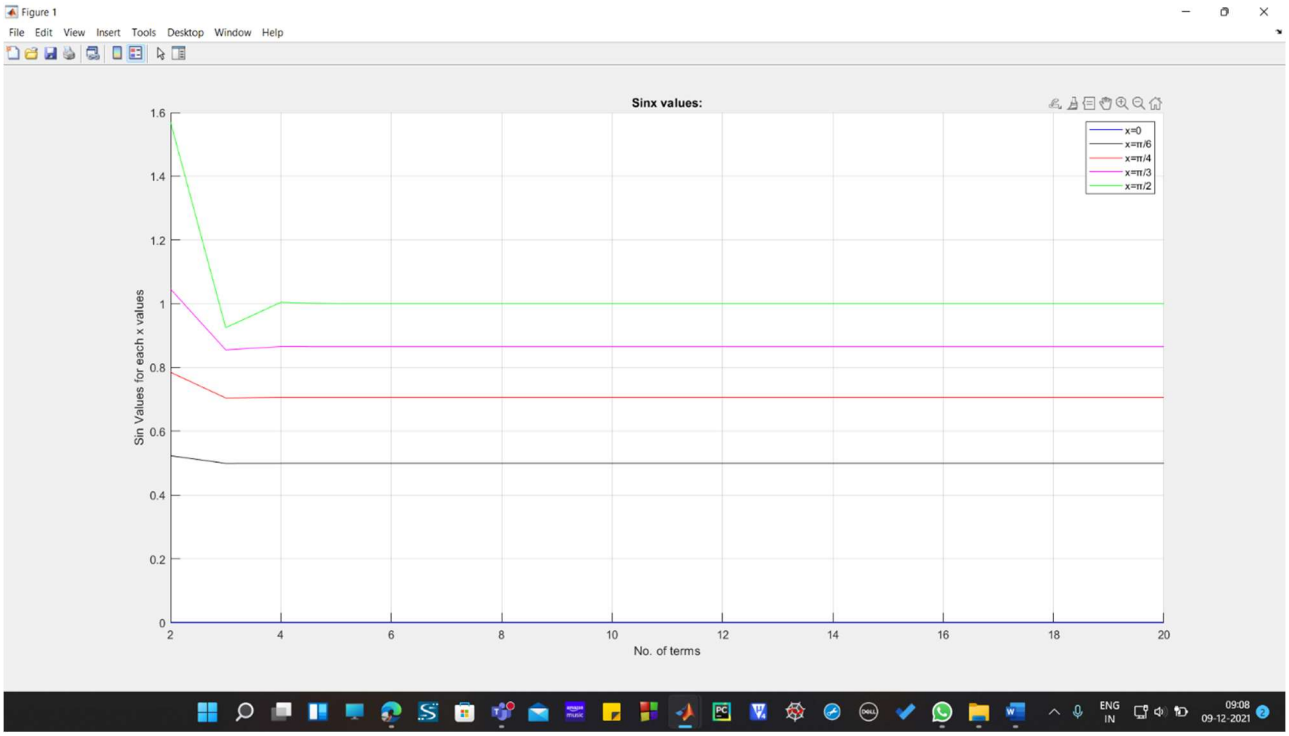
```
plot(a,cosx(2,:),'k');
plot(a,cosx(3,:),'r');
plot(a,cosx(4,:),'m');
plot(a,cosx(5,:),'g');
xlabel('No. of terms ')
ylabel('Cos Values for each x values')
title(' Cosx values :')
legend('x=0','x=π/6','x=π/4','x=π/3','x=π/2')

figure;
hold on
grid on
plot(a,cosx(6,:),'b');
plot(a,cosx(7,:),'k');
plot(a,cosx(8,:),'r');
plot(a,cosx(9,:),'m');
plot(a,cosx(10,:),'g');
xlabel('No. of terms ')
ylabel('Cos Values for each x values')
title(' Cosx values:')
legend('x=2π/3','x=π','x=2π','x=0.429π','x=0.683π')

figure;%ploting first 5 terms of tan x
hold on
grid on
plot(a,tanx(1,:),'b');
plot(a,tanx(2,:),'k');
plot(a,tanx(3,:),'r');
plot(a,tanx(4,:),'m');
plot(a,tanx(5,:),'g');
xlabel('No. of terms ')
ylabel('Tan Values for each x values')
title(' Tanx values :')
legend('x=0','x=π/6','x=π/4','x=π/3','x=π/2')
axis([2 20 -10 10])

figure;%ploting last 5 terms of tan x
hold on
grid on
plot(a,tanx(6,:),'b');
plot(a,tanx(7,:),'k');
plot(a,tanx(8,:),'r');
plot(a,tanx(9,:),'m');
plot(a,tanx(10,:),'g');
xlabel('No. of terms ')
ylabel('Tan Values for each x ')
title(' Tanx values :')
legend('x=2π/3','x=π','x=2π','x=0.429π','x=0.683π')

function [term] = mytermsin(n,angle) %sinx tylor series formula
      term = ( ((-1)^n) / (factorial((2*n) + 1)) ) * ( angle ^ ((2*n) + 1) );
end
function [term] = mytermcos(n,angle) %cos x tylor series formula
      term = ( ((-1)^n) / (factorial((2*n))) ) * ( angle ^ ((2*n) ) );
end
```

OUTPUT:

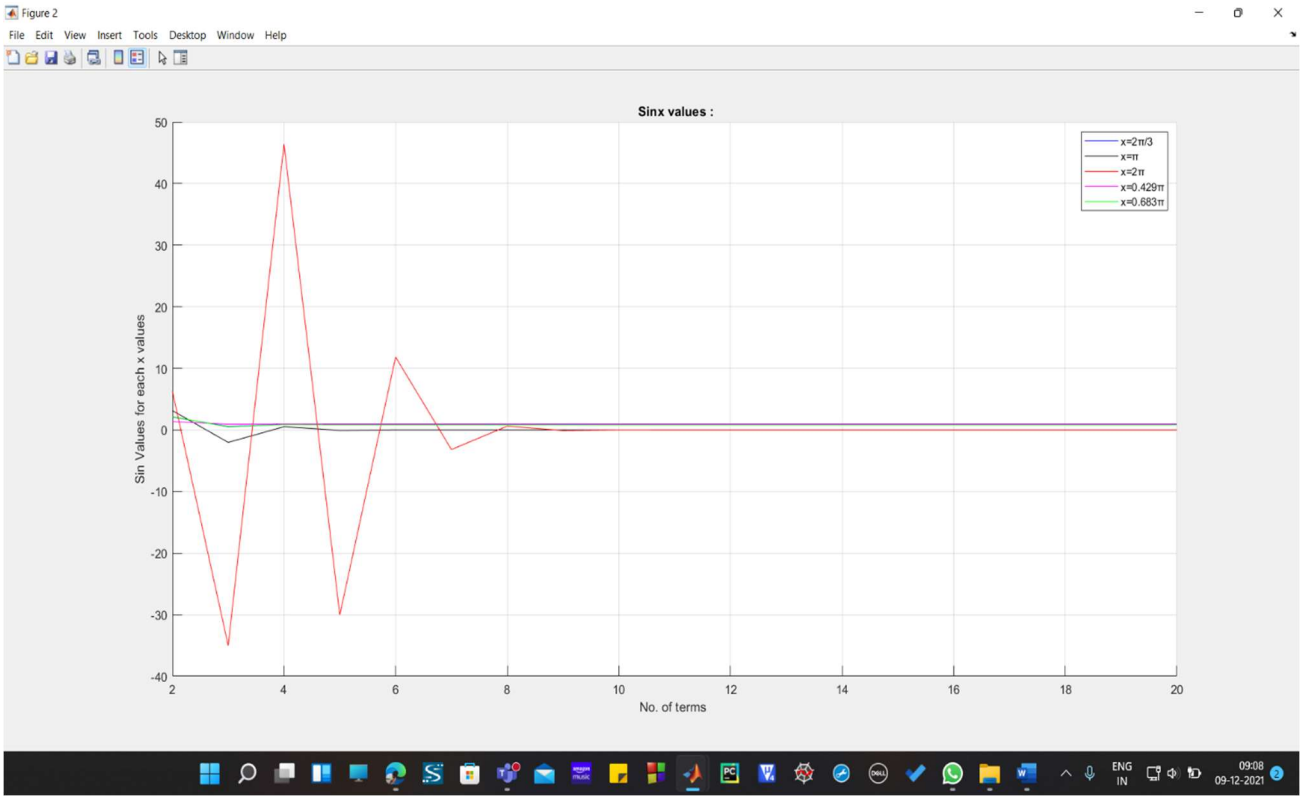
```
New to MATLAB? See resources for Getting Started.

>> sinxfinal

 The sin of 0.00 is 0.00000000, and convergent value if 1.000000

 The sin of 0.52 is 0.49974123, and convergent value if 4.000000

 The sin of 0.79 is 0.70682518, and convergent value if 4.000000

 The sin of 1.05 is 0.86542601, and convergent value if 5.000000

 The sin of 1.57 is 0.99999968, and convergent value if 6.000000

 The sin of 2.09 is 0.86672211, and convergent value if 7.000000

 The sin of 3.14 is 0.00159265, and convergent value if 9.000000

 The sin of 6.28 is -0.00318530, and convergent value if 13.000000

 The sin of 1.35 is 0.97506195, and convergent value if 6.000000

 The sin of 2.14 is 0.84016785, and convergent value if 7.000000


 The cos of 0.00 is 1.00000000, and convergent value is 1.000000

 The cos of 0.52 is 0.86617475, and convergent value is 4.000000

 The cos of 0.79 is 0.70738827, and convergent value is 5.000000

 The cos of 1.05 is 0.50103675, and convergent value is 5.000000

 The cos of 1.57 is 0.00079633, and convergent value is 6.000000

 The cos of 2.09 is -0.49879132, and convergent value is 7.000000

 The cos of 3.14 is -0.99999873, and convergent value is 9.000000

 The cos of 6.28 is 0.99999493, and convergent value is 14.000000

 The cos of 1.35 is 0.22193287, and convergent value is 6.000000

 The cos of 2.14 is -0.54232645, and convergent value is 7.000000

fx >>
```

GRAPHS:

1) First 5 terms of sin x (0, π/6, π/4, π/3, π/2)

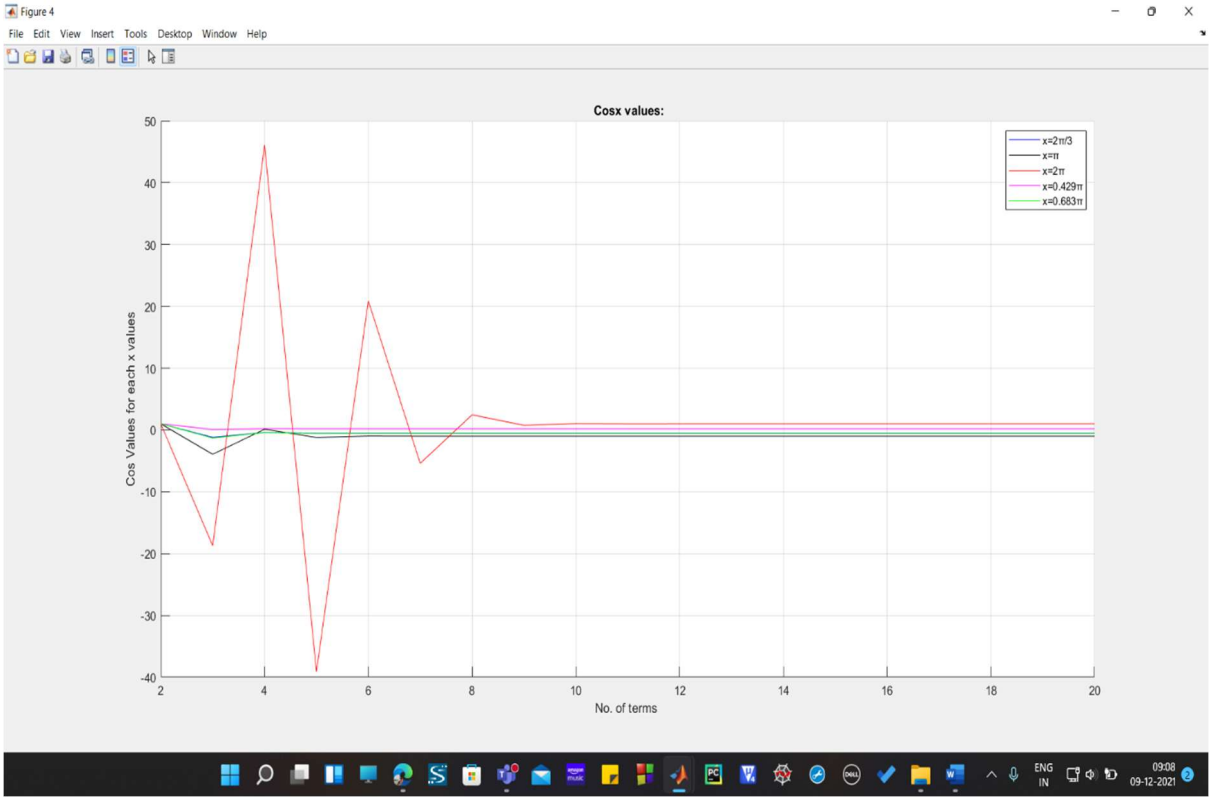


2) Last 5 terms of sin x (2π/3, π, 2π, 0.429π, 0.683π)

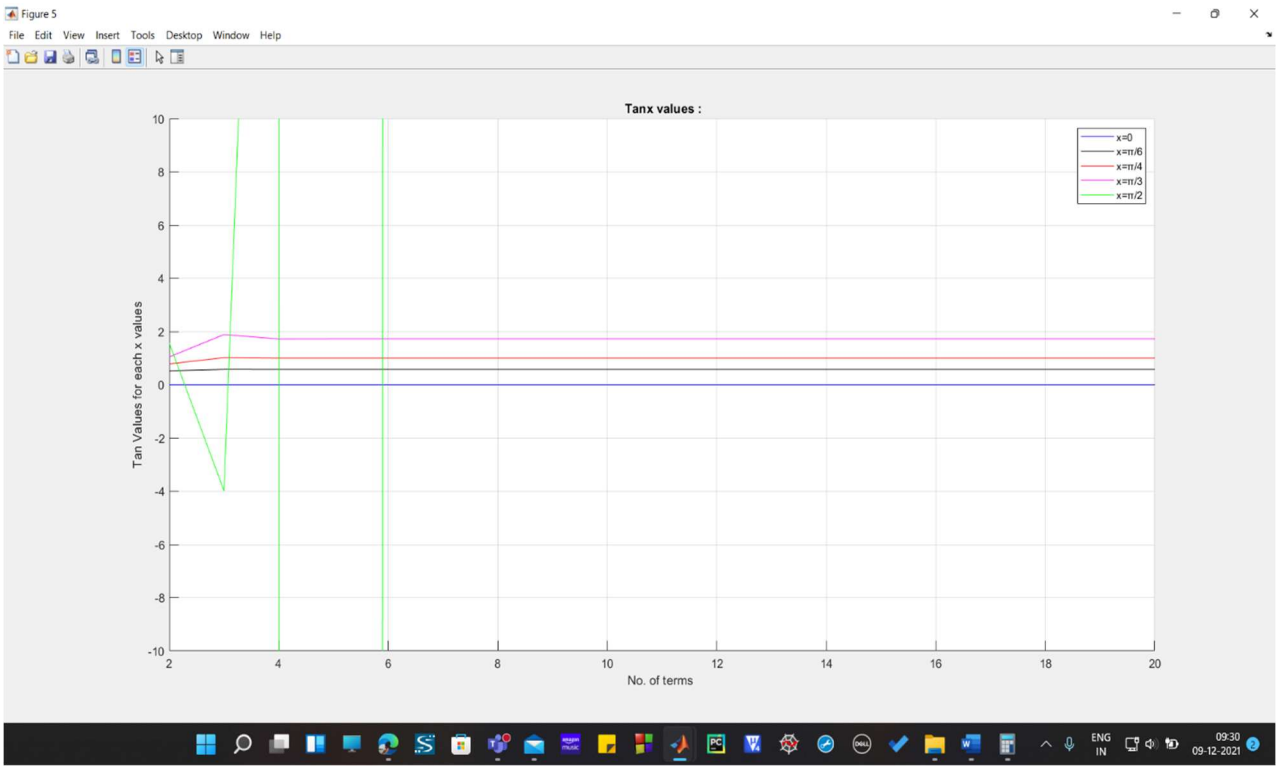


3) First 5 terms of cos x (0, π/6, π/4, π/3, π/2)

4) last 5 terms of cos x (2π/3, π, 2π, 0.429π, 0.683π)



5) First 5 terms of tan x (0, π/6, π/4, π/3, π/2)



6) Last 5 terms of tan x (2π/3, π, 2π, 0.429π, 0.683π)