19CCE203

COMPUTATIONAL ELECTROMAGNETICS

Matlab Assignment -3

Trapizoidal rule, Simpson 1/3 rule and Simpson 3/8 rule

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MATLAB CODE:

```matlab
a = input('enter the lower limit');
b = input('enter the upper limit');
a = (a*3.14)/180;
b = (b*3.14)/180;
axis = 2:16;
integral = 0;
integral1 = 0;
integral2 = 0;
integral_cosx = 0;
integral_cosx1 = 0;
integral_cosx2 = 0;
interval =
[b,(a+b)/2,(a+b)/3,(a+b)/4,(a+b)/5,(a+b)/6,(a+b)/7,(a+b)/8,(a+b)/9,(a+b)/10,(a+b)/
11,(a+b)/12,(a+b)/13,(a+b)/14,(a+b)/15];
index = 1;
sinx  = zeros(3,15);
cosx  = zeros(3,15);
while index <= 15
    for i = a:+interval(index):b
        angle1 = i;
        angle2 = i+interval(index);
        anglemid = (angle1+angle2)/2;
        anglesim1 = (angle1+angle2)/3;
        anglesim2 = 2 * (anglesim1);
        for j = 0:+1:4
            c = 1; % Initially assign value 1
            n = 0;
            new = 0;
            old = 0;
            new1 = 0;
            old1 = 0;
            c1 = 0;
            while  n<20
                    if j == 0
                        term = myterm(n,angle1);
                        term1 = myterm1(n,angle1);
                    elseif j == 1
                        term = myterm(n,angle2);
                        term1 = myterm1(n,angle2);
                    elseif j == 2
```

```matlab
                    term = myterm(n,anglemid);
                    term1 = myterm1(n,anglemid);
                elseif j == 3
                    term = myterm(n,anglesim1);
                    term1 = myterm1(n,anglesim1);
                elseif j == 4
                    term = myterm(n,anglesim2);
                    term1 = myterm1(n,anglesim2);
                end
                if n == 0
                    old = term; % Updating SOld
                    c = round(new - old,6); % Calculating c

                    old1 = term1; % Updating SOld
                    c1 = round(new1 - old1,6); % Calculating c
                else
                    new = old + term; % CAdding term to series
                    c = round(new - old,6);   % Calculating c
                    old = new; % Updating SOld value

                    new1 = old1 + term1; % CAdding term to series
                    c1 = round(new1 - old1,6);   % Calculating c
                    old1 = new1; % Updating SOld value
                end
             n = n + 1;
              end
            if j == 0
                temp1 = old;
                flag1 = old1;
            elseif j == 1
                temp2 = old;
                flag2 = old1;
            elseif j == 2
                tempmid = old;
                flagmid = old1;
            elseif j == 3
                tempsim1 = old;
                flagsim1 = old1;
            elseif j == 4
                tempsim2 = old;
                flagsim2 = old1;
            end
        end
        temp = ((temp1+temp2)/2)*(angle2-angle1); %trapizoidal rule
        integral = integral + temp;
        sinx(1,index) = integral;
        tempsim = ((temp1+4*tempmid+temp2)/3)*((angle2-angle1)/2); %simson 1/3
rule
        integral1 = integral1 + tempsim;
        sinx(2,index) = integral1;
        tempsim2 = ((temp1 + 3*tempsim1 + 3*tempsim2 + temp2)/4)*((angle2-
angle1)/2);
        integral2 = integral2 + tempsim2; %simson 3/8 rule
        sinx(3,index) = integral2;

        flag = ((flag1+flag2)/2)*(angle2-angle1); %trapizoidal rule
        integral_cosx = integral_cosx + flag;
        cosx(1,index) = integral_cosx;
```

```matlab
        flagsim = ((flag1+4*flagmid+flag2)/3)*((angle2-angle1)/2); %simson 1/3
rule
        integral_cosx1 = integral_cosx1 + flagsim;
        cosx(2,index) = integral_cosx1;
        flagsim2 = ((flag1 + 3*flagsim1 + 3*flagsim2 + flag2)/4)*((angle2-
angle1)/2);
        integral_cosx2 = integral_cosx2 + flagsim2;  %simson 3/8 rule
        cosx(3,index) = integral_cosx2;
    end
    fprintf('integral sinx value is %.8f with interval %d using trapizoidal
rule\n', integral, index);
    fprintf('integral sinx value is %.8f with interval %d using simpson 1/3
rule\n', integral1, index);
    fprintf('integral sinx value is %.8f with interval %d using simpson 3/8
rule\n', integral2, index);
    fprintf('integral cosx value is %.8f with interval %d using trapizoidal
rule\n', integral_cosx, index);
    fprintf('integral cosx value is %.8f with interval %d using simpson 1/3
rule\n', integral_cosx1, index);
    fprintf('integral cosx value is %.8f with interval %d using simpson 3/8
rule\n\n', integral_cosx2, index);
index = index + 1;
integral = 0;
integral1 = 0;
integral2 = 0;
integral_cosx = 0;
integral_cosx1 = 0;
integral_cosx2 = 0;
end
figure;
grid on
plot(axis,sinx(1,:));
xlabel('No. of terms')
ylabel('integral Sin x Values ')
title('Sinx integral trapizoidal rule:')
figure;
grid on
plot(axis,sinx(2,:));
xlabel('No. of terms')
ylabel('integral Sin x Values ')
title('Sinx integral using simpson 1/3 rule:')
figure;
grid on
plot(axis,sinx(3,:));
xlabel('No. of terms')
ylabel('integral Sin x Values ')
title('Sinx integral using simpson 3/8 rule:')
figure;
grid on
plot(axis,cosx(1,:));
xlabel('No. of terms')
ylabel('integral cos x Values ')
title('cosx integral trapizoidal rule:')
figure;
grid on
plot(axis,cosx(2,:));
xlabel('No. of terms')
ylabel('integral cos x Values ')
title('cosx values simpson 1/3 rule:')
```

```matlab
figure;
grid on
plot(axis,cosx(3,:));
xlabel('No. of terms')
ylabel('integral cos x Values ')
title('cosx values simpson 3/8 rule:')
function [term] = myterm(n,angle)
      term = ( ((-1)^n) / (factorial((2*n) + 1)) ) * ( angle ^ ((2*n) + 1) );
end
function [term1] = myterm1(n,angle)
      term1 = ( ((-1)^n) / (factorial((2*n))) ) * ( angle ^ ((2*n) ) );
end
```

OUTPUT:

```
>> integral_sin_x
enter the lower limit0
enter the upper limit120
integral sinx value is 0.90866358 with interval 1 using trapizoidal rule
integral sinx value is 1.51332645 with interval 1 using simpson 1/3 rule
integral sinx value is 1.50577009 with interval 1 using simpson 3/8 rule
integral cosx value is -0.52333156 with interval 1 using trapizoidal rule
integral cosx value is -0.87157834 with interval 1 using simpson 1/3 rule
integral cosx value is -0.17816917 with interval 1 using simpson 3/8 rule

integral sinx value is 1.81399052 with interval 2 using trapizoidal rule
integral sinx value is 2.00086014 with interval 2 using simpson 1/3 rule
integral sinx value is 1.77280405 with interval 2 using simpson 3/8 rule
integral cosx value is 0.00144453 with interval 2 using trapizoidal rule
integral cosx value is 0.00159334 with interval 2 using simpson 1/3 rule
integral cosx value is 0.23363620 with interval 2 using simpson 3/8 rule
```

```
integral sinx value is 1.85987915 with interval 3 using trapizoidal rule
integral sinx value is 1.93936945 with interval 3 using simpson 1/3 rule
integral sinx value is 1.73048373 with interval 3 using simpson 3/8 rule
integral cosx value is 0.32930448 with interval 3 using trapizoidal rule
integral cosx value is 0.34337879 with interval 3 using simpson 1/3 rule
integral cosx value is 0.46643103 with interval 3 using simpson 3/8 rule

integral sinx value is 1.82259202 with interval 4 using trapizoidal rule
integral sinx value is 1.86541002 with interval 4 using simpson 1/3 rule
integral sinx value is 1.67563119 with interval 4 using simpson 3/8 rule
integral cosx value is 0.48965861 with interval 4 using trapizoidal rule
integral cosx value is 0.50116212 with interval 4 using simpson 1/3 rule
integral cosx value is 0.58157995 with interval 4 using simpson 3/8 rule

integral sinx value is 1.78177691 with interval 5 using trapizoidal rule
integral sinx value is 1.80828682 with interval 5 using simpson 1/3 rule
integral sinx value is 1.63203010 with interval 5 using simpson 3/8 rule
integral cosx value is 0.58018961 with interval 5 using trapizoidal rule
integral cosx value is 0.58882188 with interval 5 using simpson 1/3 rule
integral cosx value is 0.64756807 with interval 5 using simpson 3/8 rule

integral sinx value is 1.74730518 with interval 6 using trapizoidal rule
integral sinx value is 1.76525673 with interval 6 using simpson 1/3 rule
integral sinx value is 1.59865083 with interval 6 using simpson 3/8 rule
integral cosx value is 0.63719294 with interval 6 using trapizoidal rule
integral cosx value is 0.64373936 with interval 6 using simpson 1/3 rule
integral cosx value is 0.68965947 with interval 6 using simpson 3/8 rule
```

```
integral sinx value is 1.71929736 with interval 7 using trapizoidal rule
integral sinx value is 1.73223080 with interval 7 using simpson 1/3 rule
integral sinx value is 1.57276218 with interval 7 using simpson 3/8 rule
integral cosx value is 0.67597859 with interval 7 using trapizoidal rule
integral cosx value is 0.68106366 with interval 7 using simpson 1/3 rule
integral cosx value is 0.71860841 with interval 7 using simpson 3/8 rule

integral sinx value is 1.69651495 with interval 8 using trapizoidal rule
integral sinx value is 1.70626443 with interval 8 using simpson 1/3 rule
integral sinx value is 1.55225679 with interval 8 using simpson 3/8 rule
integral cosx value is 0.70390687 with interval 8 using trapizoidal rule
integral cosx value is 0.70795206 with interval 8 using simpson 1/3 rule
integral cosx value is 0.73964061 with interval 8 using simpson 3/8 rule

integral sinx value is 1.67777801 with interval 9 using trapizoidal rule
integral sinx value is 1.68538476 with interval 9 using simpson 1/3 rule
integral sinx value is 1.53567766 with interval 9 using simpson 3/8 rule
integral cosx value is 0.72489691 with interval 9 using trapizoidal rule
integral cosx value is 0.72818347 with interval 9 using simpson 1/3 rule
integral cosx value is 0.75556676 with interval 9 using simpson 3/8 rule

integral sinx value is 1.66216574 with interval 10 using trapizoidal rule
integral sinx value is 1.66826331 with interval 10 using simpson 1/3 rule
integral sinx value is 1.52202487 with interval 10 using simpson 3/8 rule
integral cosx value is 0.74120724 with interval 10 using trapizoidal rule
integral cosx value is 0.74392632 with interval 10 using simpson 1/3 rule
integral cosx value is 0.76802127 with interval 10 using simpson 3/8 rule
```
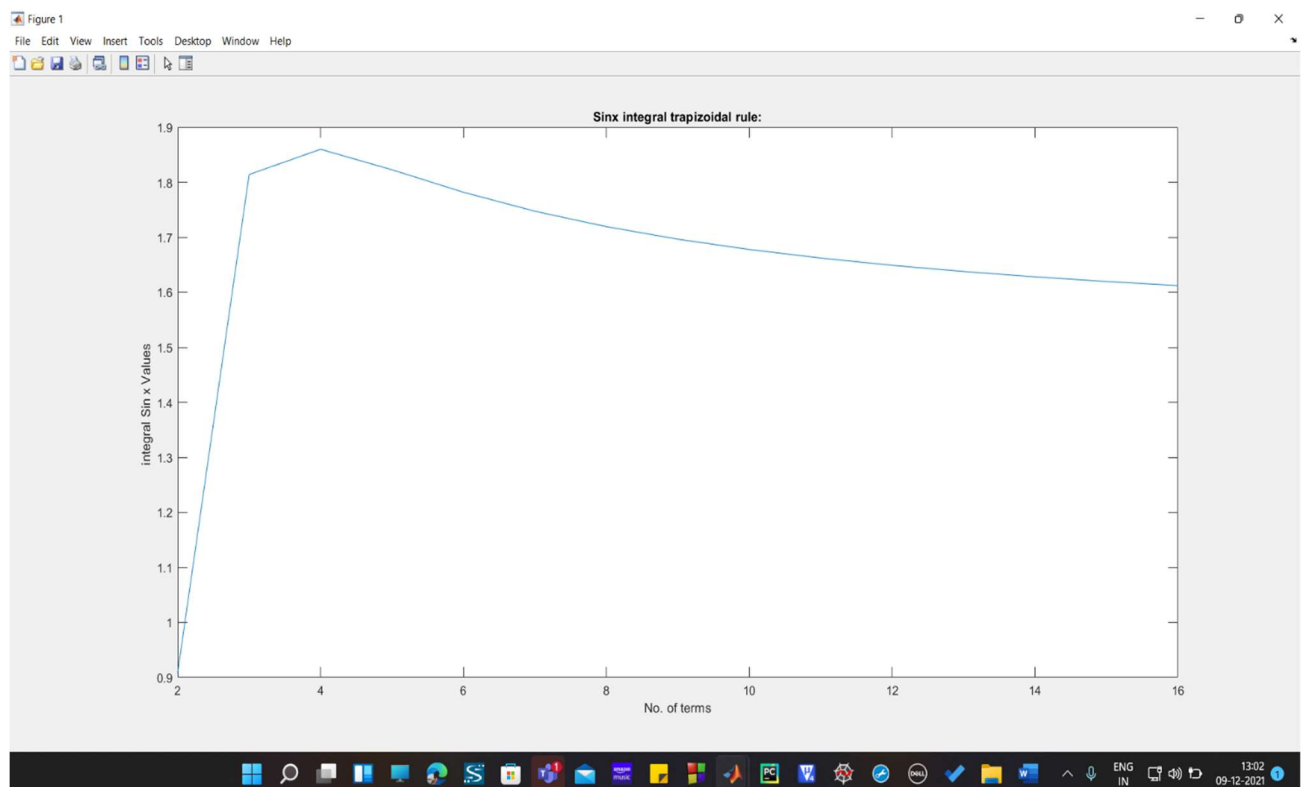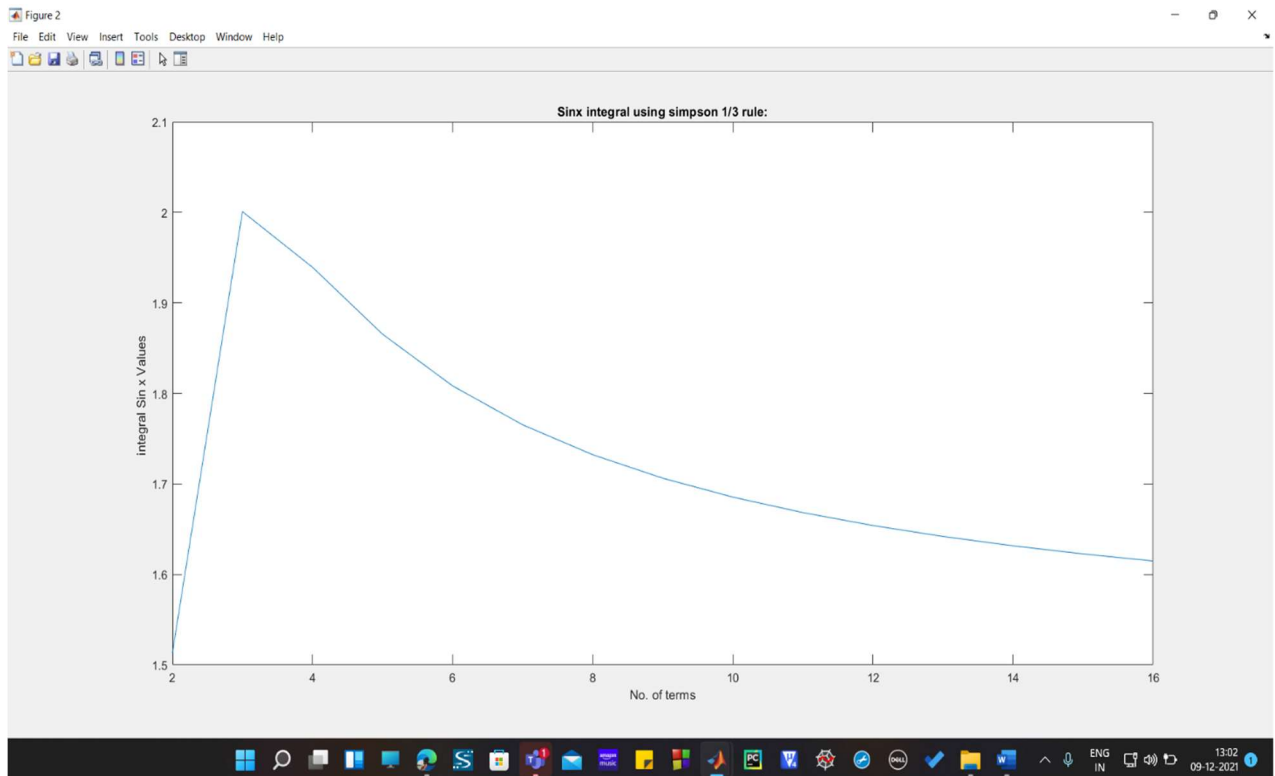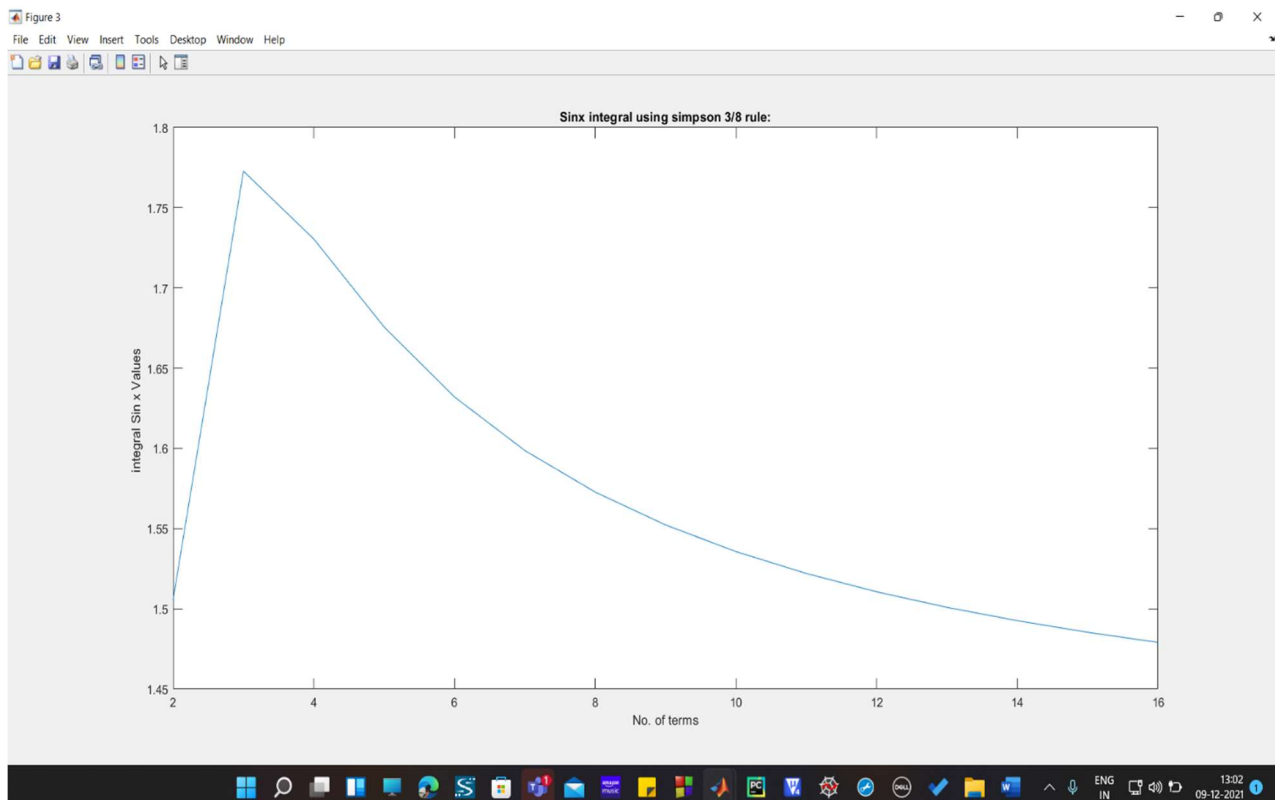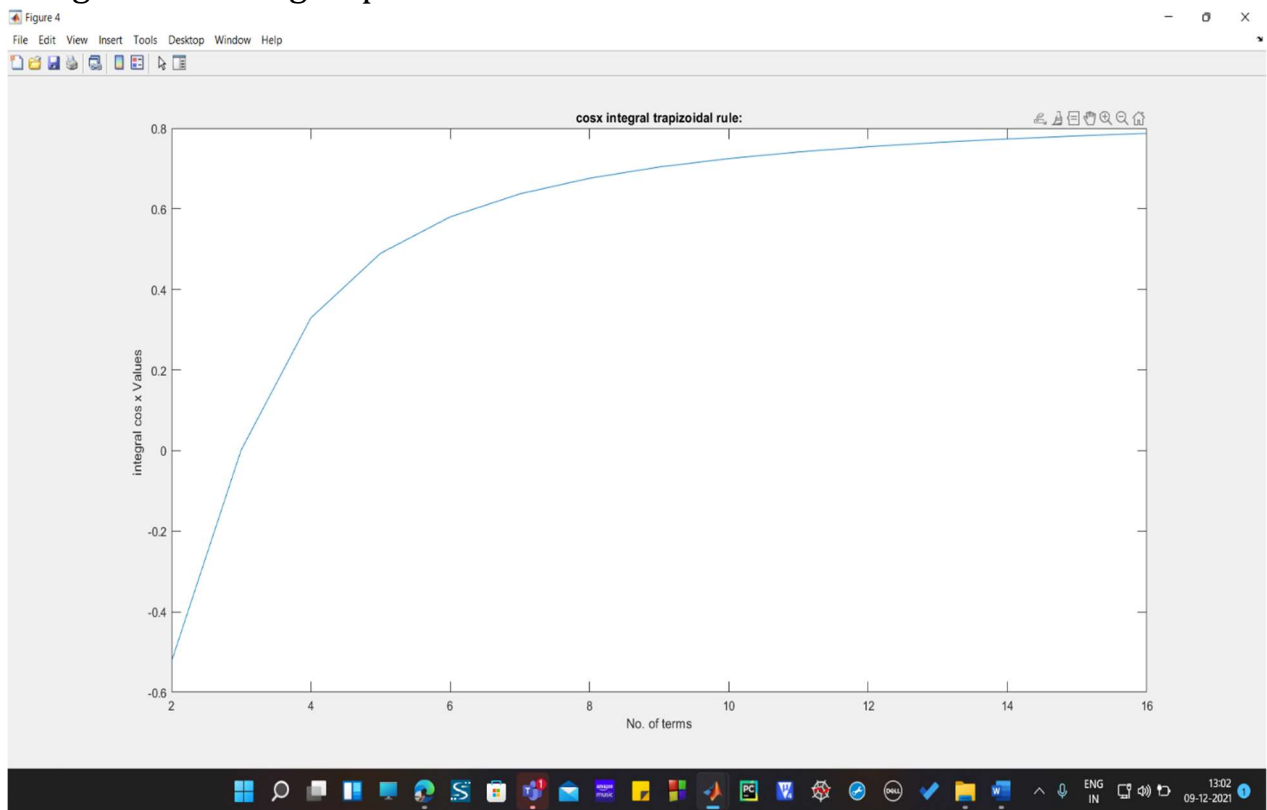
GRAPHS:

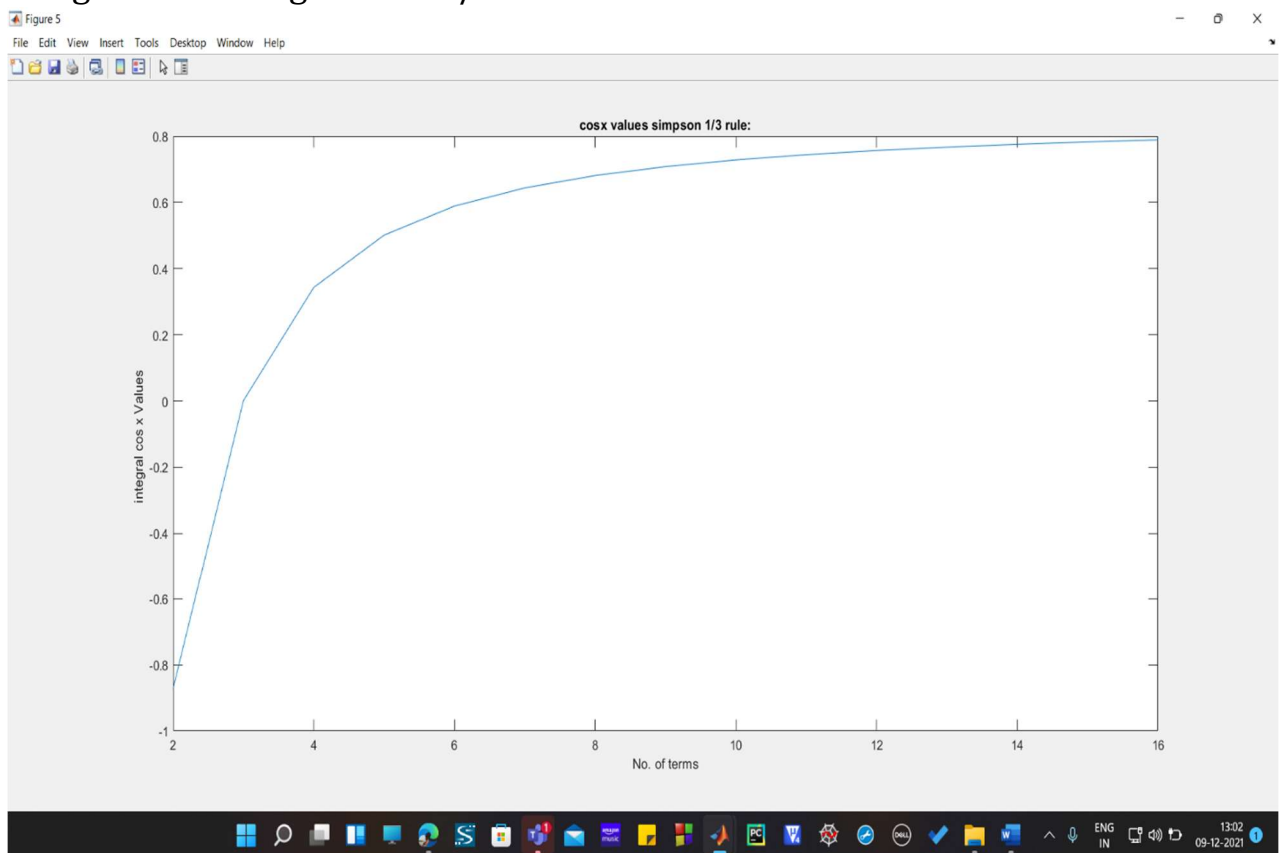Integral sinx using trapizoidal rule:

Integral sinx using simson 1/3 rule:

Integral sinx using simson 3/8 rule:

Integral cosx using trapizoidal rule:

Integral cosx using simson 1/3 rule:

Integral cosx using simson 3/8 rule: