ENGR 219: Numerical Methods Name: Syeduzzaman Khan
Computer Project# 1

3 d)

Case 1: Maximum angle, $\theta_{max} = 180^o$ and number of terms, $n = 1$

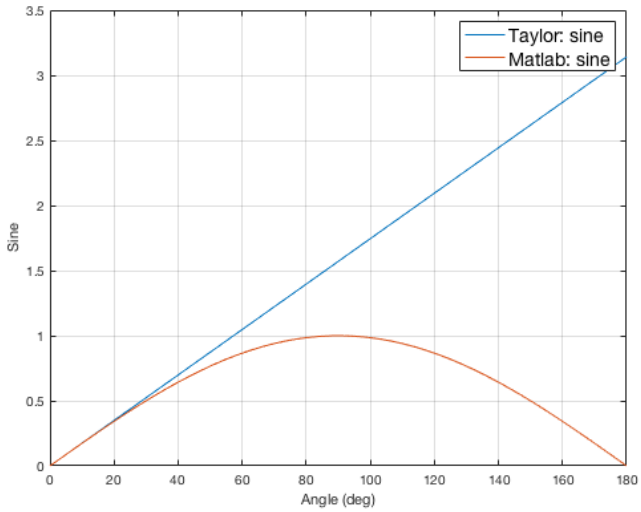

Figure 1: Plot of sine function using Taylor's series (blue color) and Matlab's function (red color). The maximum angle is given as 180 degree and number of terms, n=1. Sine values (using Taylor series) were almost accurate till approximate 25 degrees. Then, it shows fluctuation.

Case 2: Maximum angle, $\theta_{max} = 180^o$ and number of terms, $n = 2$

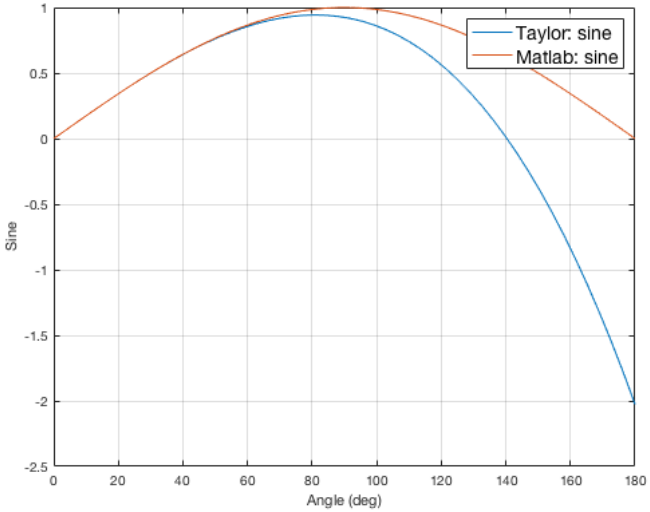

Figure 2: Plot of sine function using Taylor's series (blue color) and Matlab's function (red color). The maximum angle is given as 180 degree and number of terms, n=2. Sine values (using Taylor series) were almost accurate till approximate 62 degrees. Then, it differs from Matlab's sine function.

Case 3: Maximum angle, $\theta_{max} = 360^o$ and number of terms, $n = 4$

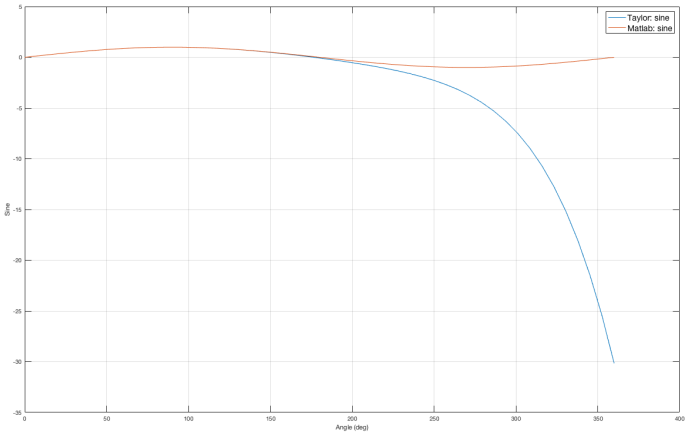

Figure 3: Plot of sine function using Taylor's series (blue color) and Matlab's function (red color). The maximum angle is given as 360 degree and number of terms, n=4. Sine values (using Taylor series) were almost accurate till approximate 180 degrees. Then, it differs from Matlab's sine function.

Case 4: Maximum angle, $\theta_{max} = 360^o$ and number of terms, $n = 8$

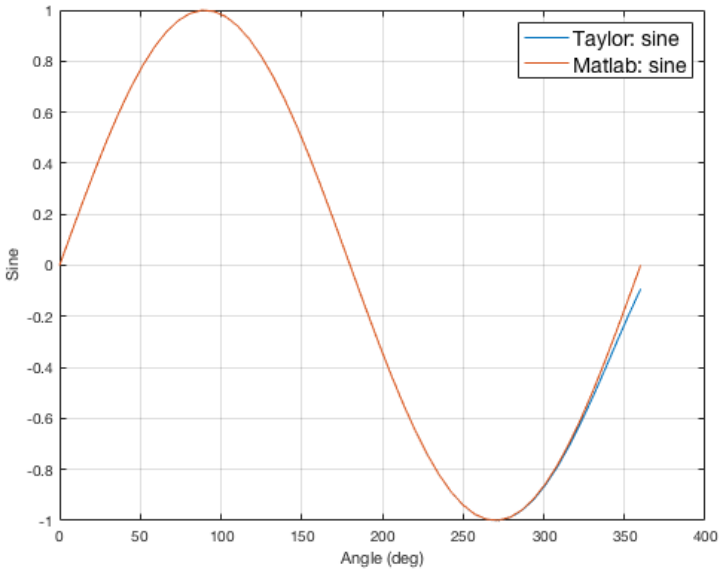

Figure 4: Plot of sine function using Taylor's series (blue color) and Matlab's function (red color). The maximum angle is given as 360 degree and number of terms, n=8. Sine values (using Taylor series) were almost accurate till approximate 325 degrees. Then, it differs from Matlab's sine function.

Taylor series function to calculate nth term sine function

```
function y = sine_khan(theta,n)
% function to approximate sine by taylor series
% Syeduzzaman Khan
% input: theta= angle in degrees
% n=number of temrs in approx series
% output: y=sine value (dimensionless)
% sample: sine_khan(60,4)
sum=0;
x=theta/180*pi; % convert angle to radians
    for i=1:n
        k=2*i-1;
        sum=sum+(-1)^(i-1)*x.^k/factorial(k); % calculate sine value
    end
y=sum;

end
```

Taylor series & Matlab sine function comparsion and plot

```
function y = graph_sine_khan(theta_max,n)
% function to plot sine function from 0 to max_angles
% Syeduzzaman Khan
% input: theta= angle in degrees
% n=number of temrs
% output: 1. y=sine value (dimensionless) from Taylor series
         %2. y=sin value from Matlab's sine function
% sample: graph_sine_khan(180,1)

npts=50; % smapline points
del_theta=theta_max/(npts-1); % step size
x=0:del_theta:theta_max; %theta_max -> max angle in degrees
y=sine_khan(x,n);% call sine_khan function and pass angle and term value

plot(x,y,'DisplayName','Taylor: sine') % plot graph
xlabel('Angle (deg)')
ylabel('Sine');
hold on;
grid on;

% Matlab's sine function
x1=0:del_theta:theta_max; % step size

y1=sin(x/180*pi); % degree to rad conversion and sine value calculation
plot(x1,y1,'DisplayName','Matlab: sine')
xlabel('Angle (deg)')
ylabel('Sine');

%legend([y y1],'sin','Matlab sine')
lgd = legend;
lgd.FontSize = 14;
end
```