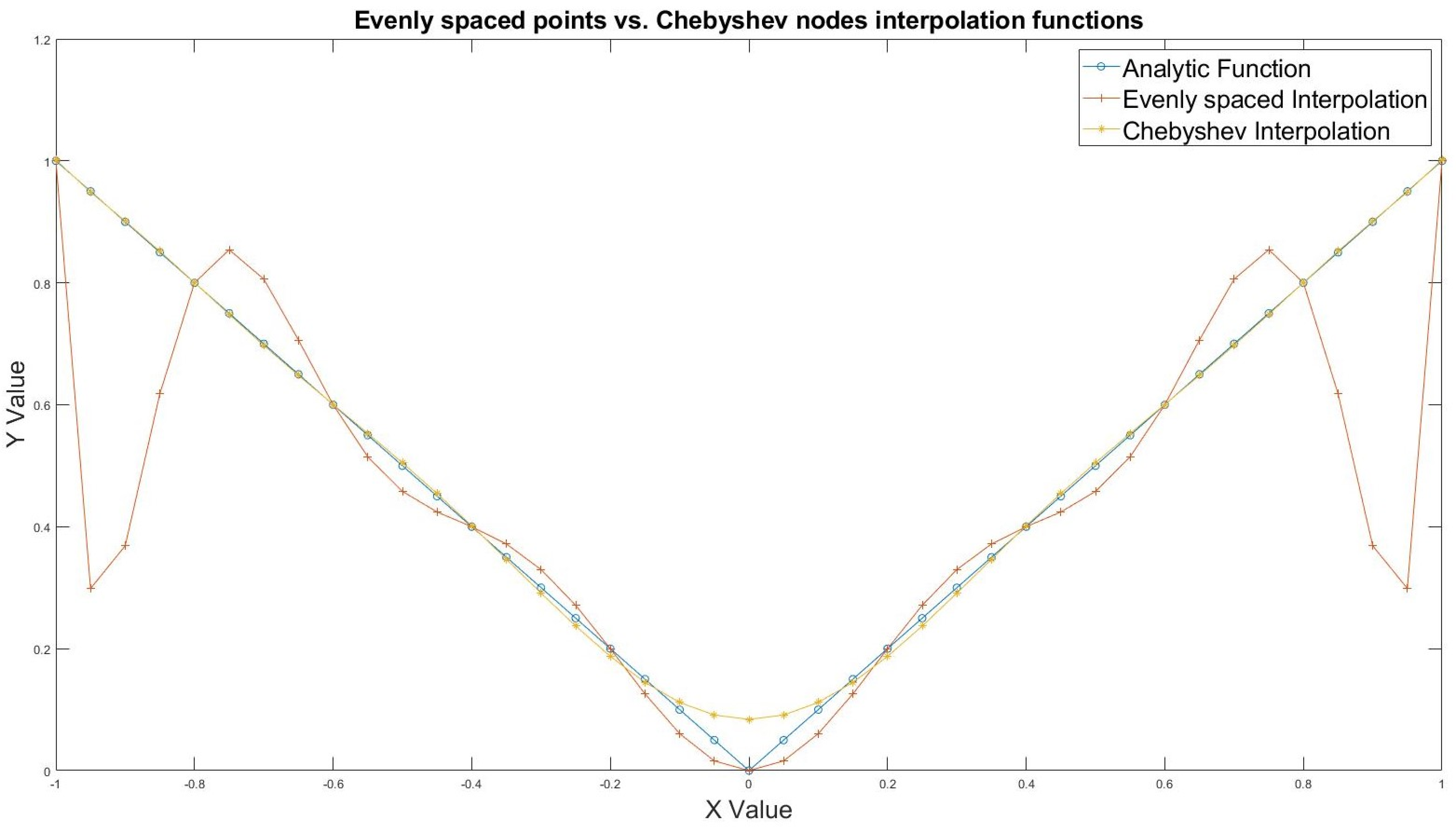
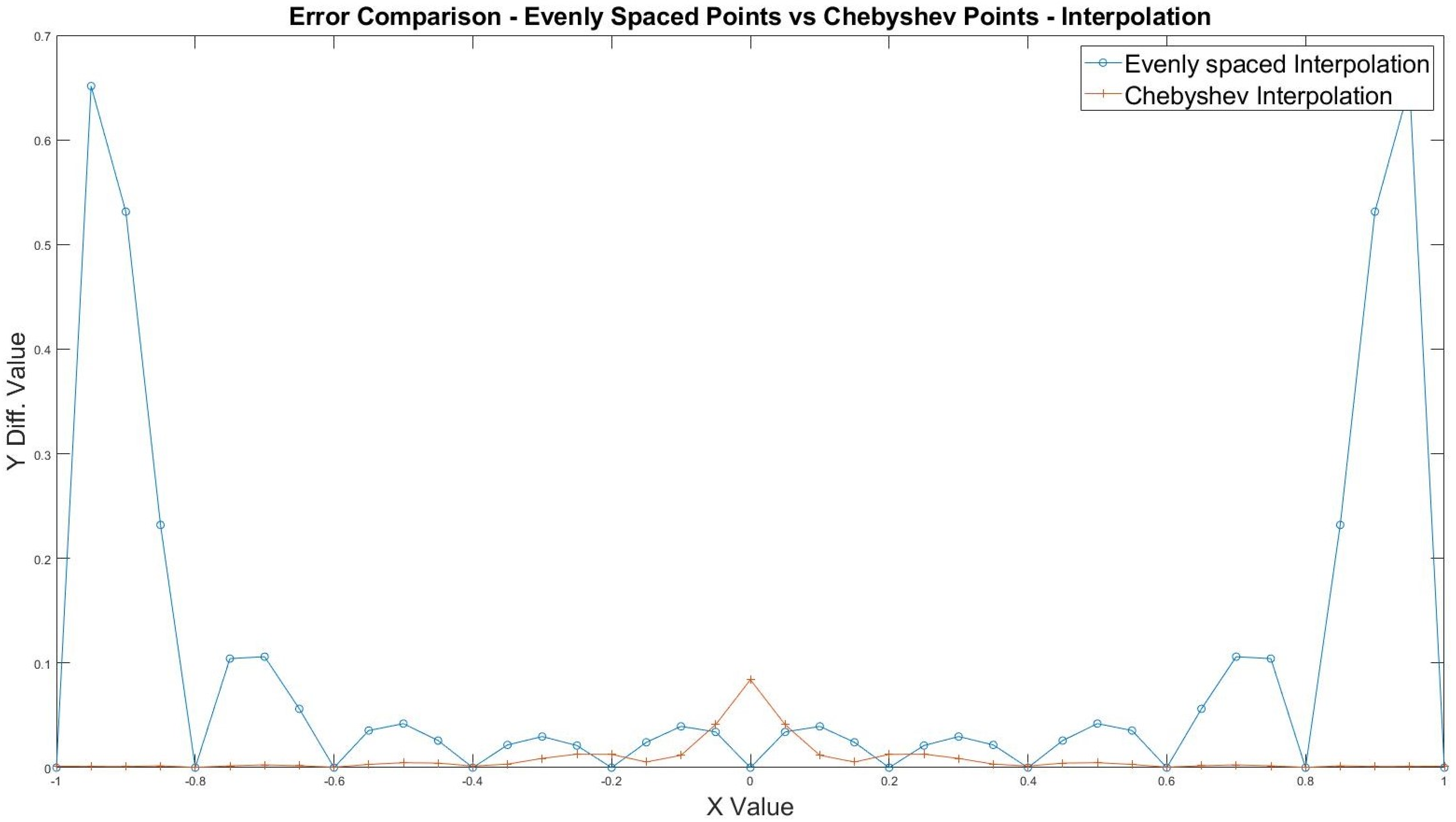

Evenly spaced points vs. Chebyshev nodes interpolation functions
Analytic Function
Evenly spaced Interpolation
Chebyshev Interpolation
Y Value
X Value
1.2
1
0.8
0.6
0.4
0.2
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1


Error Comparison - Evenly Spaced Points vs Chebyshev Points - Interpolation
Evenly spaced Interpolation
Chebyshev Interpolation
Y Diff. Value
X Value
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

Section 4.2 Problem 9 Discussion:

Chebyshev nodes led to better approximation away from zero while evenly spaced points have worse accuracy away from zero. Chebyshev only has error near zero but quickly drops while evenly spaced points get worse error as we go near the end points.

```matlab
% Javier Salazar 1001144647
clc
clear all
%------------parameters-------------
a = -1;
b = 1;
n = 11;
fun = @(x) abs(x);
%------main function---------------
%-----------equally spaced points----------
x_points = linspace(a, b, n);
y_points = fun(x_points);
a_coeff = coefficients(n, x_points, y_points);
t = linspace(a, b, 41);
interpValues = evaluate(n, x_points, a_coeff, t);
y_new = abs(t);
%------------chevyshev-----------------
x_points_cheby = cheby(a, b, n);
y_points_cheby = fun(x_points_cheby);
a_coeff_cheby = coefficients(n, x_points_cheby, y_points_cheby);
interpValues_cheby = evaluate(n, x_points_cheby, a_coeff_cheby, t);
y_new_cheby = abs(t);
%---------------plotting---------------------
figure
plot(t, y_new, 'Marker', 'o');
hold on
plot(t, interpValues, 'Marker', '+');
hold on
plot(t, interpValues_cheby, 'Marker', '*');
hold off
title('Evenly spaced points vs. Chebyshev nodes interpolation functions', 'FontSize', 20);
xlabel('X Value', 'FontSize', 20);
ylabel('Y Value', 'FontSize', 20);
legend({'Analytic Function', 'Evenly spaced Interpolation', 'Chebyshev Interpolation'}, 'FontSize',20);

figure
plot(t, abs(y_new-interpValues), 'Marker', 'o');
hold on
plot(t, abs(y_new-interpValues_cheby), 'Marker', '+');
hold off
legend({'Evenly spaced Interpolation', 'Chebyshev Interpolation'}, 'FontSize',20);
title('Error Comparison - Evenly Spaced Points vs Chebyshev Points - Interpolation', 'FontSize', 20);
xlabel('X Value', 'FontSize', 20);
ylabel('Y Diff. Value', 'FontSize', 20);
%----------cheby points--------------------
function points = cheby(a, b, n)
points = zeros(1,n);
for i = 0:n-1
```

```
    points(i+1) = 0.5*(a+b) + 0.5*(b-a)*cos(pi*((2*i+1)/(2*n+2)));
end
end
%------------a vector function------------------
function a = coefficients(n, x, y)
a = y;
for j = 1:n
    for i = n:-1:j+1
        a(i) = (a(i)-a(i-1))/(x(i)-x(i-j));
    end
end
end
%---------------evaluate p(x) function--------------
function values = evaluate(n, x, a, t)
numberPoints = length(t);
values = ones(1, numberPoints)*a(n);
for k = 1:numberPoints
    for i = n-1:-1:1
        values(k) = values(k)*(t(k)-x(i))+a(i);
    end
end
end

```