

## MATLAB Section

This section will provide the code and results for all relevant MATLAB problems for the midterm.

### Code

The relevant code used to solve each problem is shown here. Note that the code is broken up and labeled by applicable problem.

```
%%  
% File: midterm.m  
%  
% Author: Thomas Kost  
%  
% Date: 06 February 2021  
%  
% @brief MATLAB solution to relevant midterm problems  
%  
clc, close all, clear;  
  
%% Problem 4:  
  
t= linspace(-0.75,0.25,7);  
y1 = 0;  
y2 = -0.1;  
y3 = 0.5;  
y5 = 1;  
y6 = 0.8;  
y7 = 0.5;  
  
b = [y1,y2,y3,y5,y6,y7,0,0]';  
vand_p = fliplr(vander(t(1:4)));  
vand_q = fliplr(vander(t(4:7)));  
vand_t4 = vand_p(4,:);  
vand_p = vand_p(1:3,:);  
vand_q = vand_q(2:4,:);  
t4 = t(4);  
t4_prime_vand = [0,1,2*t4, 3*(t4^2)];  
A = [vand_p, zeros(3,4);zeros(3,4), vand_q; vand_t4, -vand_t4;...  
      t4_prime_vand, -t4_prime_vand];  
x = A\b;  
  
%% plot results  
x_axis = linspace(-0.75,0.25,1000);  
p = zeros(1,length(x_axis));
```

```

q = zeros(1,length(x_axis));

for m= 1:4
    p = p + (x_axis.^(m-1))*x(m);
    q = q + (x_axis.^(m-1))*x(m+4);
end
fig1 =figure;
hold on;
plot(x_axis, p);
plot(x_axis, q);
legend("p(t)", "q(t)");
title("Plotting p(t) and q(t)");
xlabel("t");
ylabel("p(t), q(t)");
saveas(fig1, "polynomial_plot.jpg");

```

### Results

### 4B: The resulting plot shows the graphs generated from solving the system of linear equations derived in the problem. We can see the two polynomials resulting plotted in the graph below:

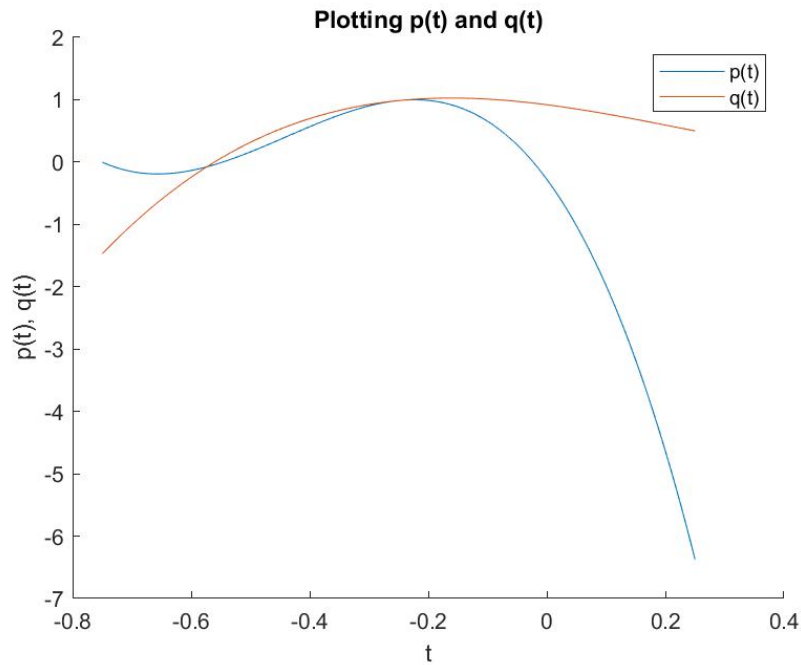


Figure 1: Figure 1

Our results make sense as at time step  $t_4$  we can see that the graphs are tangent and coincident.