ME 1020 Engineering Programming with MATLAB

Open a new **Script File** for Problem 3.17:

17. Suppose it is known that the graph of the function $y = ax^3 + bx^2 + cx + d$ passes through four given points (x_i, y_i), $i = 1, 2, 3, 4$. Write a user-defined function that accepts these four points as input and computes the coefficients a, b, c, and d. The function should solve four linear equations in terms of the four unknowns a, b, c, and d. Test your function for the case where $(x_i, y_i) = (-2, -20)$, $(0, 4)$, $(2, 68)$, and $(4, 508)$, whose answer is $a = 7$, $b = 5$, $c = -6$, and $d = 4$.

Problem setup:

$$y_1 = ax_1^3 + bx_1^2 + cx_1 + d$$

$$y_2 = ax_2^3 + bx_2^2 + cx_2 + d$$

$$y_3 = ax_3^3 + bx_3^2 + cx_3 + d$$

$$y_4 = ax_4^3 + bx_4^2 + cx_4 + d$$

$$x = A^{-1}b$$

where

$$A = \begin{bmatrix} x_1^3 & x_1^2 & \cdots \\ x_2^3 & x_2^2 & \cdots \\ \vdots & \vdots & \ddots \end{bmatrix}$$

$$x = [a\ b\ c\ d]^T; \quad b = [y_1\ y_2\ y_3\ y_4]^T$$

```
% Problem 3.17
function [a,b,c,d] = abcd_points(x_1,y_1,x_2,y_2,x_3,y_3,x_4,y_4)

A = [x_1^3, x_1^2, x_1, 1;
     x_2^3, x_2^2, x_2, 1;
     x_3^3, x_3^2, x_3, 1;
     x_4^3, x_4^2, x_4, 1]
b = [y_1; y_2; y_3; y_4]
x=inv(A)*b
```

```
% Problem 3.17
clear
clc
disp('Problem 3.17: Scott Thomas')

abcd_points(-2,-20,0,4,2,68,4,508)
```

```
Problem 3.17: Scott Thomas

A =

    -8      4     -2      1
     0      0      0      1
     8      4      2      1
    64     16      4      1


b =

   -20
     4
    68
   508


x =

    7.0000
    5.0000
   -6.0000
    4.0000
```