GRAPHICS ASSIG

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$$\begin{bmatrix} u^3 & u^2 & u & 1 \end{bmatrix} \begin{bmatrix} ax & ay & az \\ bx & by & bz \\ cx & cy & cz \\ dx & dy & dz \end{bmatrix}$$

function would be $au^3 + bu^2 + cu + d$.

Let the roots of the function be $\alpha, \beta, \gamma, \theta$

and it is given that the values of the 'u' vary by $1/3$ and $0 \le u \le 1$

which implies that the function value would be

$a(0) + b(0) + c(0) + d$ at $u = 0$

$a(1/3)^3 + b(1/3)^2 + c(1/3) + d$ at $u = 1/3$

$a(2/3)^3 + b(2/3)^2 + c(2/3) + d$ at $u = 2/3$

$a + b + c + d$ at $u = 1$

Now we can write this one in matrix form as follows

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 1/27 & 1/9 & 1/3 & 1 \\ 8/27 & 4/9 & 2/3 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

we have to get the values of a, b, c, d to compute function.

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1/27 & 1/9 & 1/3 & 1 \\ 8/27 & 4/9 & 2/3 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1/27 & 1/9 & 1/3 & 1 \\ 8/27 & 4/9 & 2/3 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

$\Rightarrow$ solving the inverse we get

$$a = -\frac{9}{2} x_1 + \frac{27}{2} x_2 - \frac{27}{2} x_3 + \frac{9}{2} x_4$$

$$b = 9x_1 - 45/2\, x_2 + 18 x_3 - \frac{9}{2} x_4$$

$$c = -11/2\, x_1 + 9 x_2 - 9/2\, x_3 + x_4$$

$$d = x_1$$

$\therefore$ The answer is

$$\begin{bmatrix} u^3 & u^2 & u & 1 \end{bmatrix} \begin{bmatrix} -9/2 & +27/2 & -27/2 & +9/2 \\ 9 & -45/2 & 18 & -9/2 \\ -\frac{11}{2} & 9 & -9/2 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$