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Math 2057A

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Q1 $3x - 2y + 4z = 7$ — (1)
$2x - 3y + 6z = 8$ — (2)
$x + y - 2z = 3$ — (3)

→ Subtract y in equation (3)

$x + y - y - 2z = 3 - y$
$\therefore x - 2z = 3 - y$
$\therefore x = 3 - y + 2z$

put value of x in equation (2) & (2)

$3(3 - y + 2z) - 2y + 4z = 7$
$2(3 - y + 2z) - 3y + 6z = 8$
$x + y - 2z = 3$

$\therefore 9 - 3y + 6z - 2y + 4z = 7$
$\therefore 6 - 2y + 4z - 3y + 6z = 8$
$\therefore x + y - 2z = 3$

$\therefore 9 - 5y + 10z = 7$ — (4)
$\therefore 6 - 5y + 10z = 8$ — (5)
$\therefore x + y - 2z = 3$ — (6)

Simplify equation (5)

$= 6.5y + 10z = 8$

$= -5y + 10z = 8 - 6$

$= -5y = 2 - 10z$

divide it by 5

$\therefore \frac{-5y}{y} = \frac{2 - 10z}{5}$

$\therefore y = -\frac{2}{5} + 2z$

Replace value of y in all equation

$\therefore 9 - 5\left(-\frac{2}{6} + 2z\right) + 10z - z$

$\therefore y = \frac{2}{5} + 2z$

$\therefore x = 3 - y + 2z$

$\therefore 9 - 5 \cdot \frac{2}{5} - 10z + 10z = z$

$\therefore 9 + 2 = 1$

$\therefore 11 = z$

Replace y in $x = 3 - y + 2z$

$$x = 3 - \left(-\frac{2}{5} + 2z\right) + 2z$$

$$2z = z$$

$$y = -\frac{2}{5} + 2z$$

Simplify

$$x = 3 + \frac{2}{5} - 2z + 2z$$

$$x = \frac{17}{5}$$

∴ There is no True solution

Q2 Use Gauss-Jordan Method to solve

$$2x - y + 3z = 24$$
$$2y - z = 14$$
$$7x - 5y = 6$$

→
$$\begin{bmatrix} 2 & -1 & 3 & | & 24 \\ 0 & 2 & -1 & | & 14 \\ 7 & 5 & 0 & | & 6 \end{bmatrix}$$

For Row 1 use $R1 \times \frac{1}{2}$

$$= \begin{bmatrix} 2\times\frac{1}{2} & -1\times\frac{1}{2} & 3\times\frac{1}{2} & | & 24\times\frac{1}{2} \\ 0 & 2 & -1 & | & 14 \\ 7 & 5 & 0 & | & 6 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & -\frac{1}{2} & \frac{3}{2} & | & 12 \\ 0 & 2 & -1 & | & 14 \\ 7 & 5 & 0 & | & 6 \end{bmatrix}$$

For Row 2 use $R2 \times \frac{1}{2}$

$$= \begin{bmatrix} 1 & -\frac{1}{2} & \frac{3}{2} & | & 12 \\ 0 & 1 & -\frac{1}{2} & | & [illegible] \\ 7 & 5 & 0 & | & 6 \end{bmatrix}$$

For Row 3 use $R_3 - 7R_1$

$$\left[\begin{array}{ccc|c} 1 & -\frac{3}{2} & \frac{3}{2} & 12 \\ 0 & 1 & -\frac{1}{2} & 7 \\ 0 & -\frac{3}{2} & -\frac{21}{2} & -78 \end{array}\right]$$

Use $R_3 + \frac{3}{2}R_2$

$$= \left[\begin{array}{ccc|c} 1 & -\frac{3}{2} & \frac{3}{2} & 12 \\ 0 & 1 & -\frac{1}{2} & 7 \\ 0 & 0 & 1 & -\frac{135}{6} \end{array}\right]$$

use $R_3 \times -\frac{6}{45}$

$$= \left[\begin{array}{ccc|c} 1 & -\frac{3}{2} & \frac{3}{2} & 12 \\ 0 & 1 & -\frac{1}{2} & 7 \\ 0 & 0 & 1 & 6 \end{array}\right]$$

For Row 2 use $R_2 - \frac{3}{2}R_3$ and For Row 2 use $R_2 + \frac{1}{2}R_3$

$$= \left[\begin{array}{ccc|c} 1 & -\frac{3}{2} & 0 & 3 \\ 0 & 1 & 0 & 10 \\ 0 & 0 & 1 & 6 \end{array}\right]$$

Use $R_1 + \frac{3}{2}R_2$ for Row 2

$$= \left[\begin{array}{ccc|c} 2 & 0 & 0 & 8 \\ 0 & 2 & 0 & 10 \\ 0 & 0 & 2 & 6 \end{array}\right]$$

$\therefore x = 8$
$y = 10$
$z = 6$
$\therefore (8, 10, 6)$

Q3 $(-2, 19), (-1, 10), (1, 4), (2, 7)$

$$P(x) = a_3 \cdot x^3 + a_2 \cdot x^2 + a_1 \cdot x + a_0$$

$P(-2) = -a_3 + a_2 - a_1 + a_0 = 19$
$P(-1) = -a_3 + a_2 - a_1 + a_0 = 10$
$P(1) = 8a_3 + 4a_2 + 2a_1 + a_0 = 4$
$P(2) = 8a_3 + 4a_2 + 2a_1 + a_0 = 7$

$$\left[\begin{array}{cccc|c} -1 & 1 & -1 & 1 & 19 \\ -1 & 1 & -1 & 1 & 10 \\ 8 & 4 & 2 & 1 & 4 \\ 8 & 4 & 2 & 1 & 7 \end{array}\right]$$

For Row 2 use $R_2 + R_1$ and for Row 4 use $R_4 - R_3$

$$\begin{bmatrix} -2 & 2 & -2 & 2 \\ -2+-2 & 2+2 & -2+-2 & 2+2 \end{bmatrix}$$

$$\left[\begin{array}{cccc|c} -2 & 2 & -2 & 2 & 14 \\ -2+2 & 2+2 & -2+-2 & 2+2 & 14+16 \\ 8 & 4 & 2 & 1 & 4 \\ 8-8 & 4-4 & 2-2 & 1-2 & 4-7 \end{array}\right]$$

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & 2 & 14 \\ 0 & 2 & 0 & 2 & 29 \\ 8 & 4 & 2 & 2 & 4 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

- for Row 2 use $R_2/2$

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & 2 & 14 \\ \frac{0}{2} & \frac{2}{2} & \frac{0}{2} & \frac{2}{2} & \frac{29}{2} \\ 8 & 4 & 2 & 2 & 4 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & -2 & 14 \\ 0 & 2 & 0 & 2 & \frac{24}{2} \\ 8 & 4 & 2 & 2 & 4 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

For Row 3 use $R_3 + 8R_1$

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & -2 & 14 \\ 0 & 2 & 0 & 2 & \frac{24}{2} \\ 0 & 12 & -6 & 9 & 156 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

$$= \left[\begin{array}{cccc} -2 & 2 & -2 & -2 \\ 0 & 2 & 0 & 2 \\ 8+8\cdot(-2) & 4+8\cdot(-2) & 2+8\cdot(-2) & 2+8\cdot(-2) \\ 0 & 0 & 0 & 0 \end{array}\right]$$

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & -2 & 14 \\ 0 & 2 & 0 & 2 & \frac{24}{2} \\ 0 & 12 & -6 & 9 & 156 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

Use $R_2 \times 2$ for Row 2 & $R_3/3$ for Row 3

$$\left[\begin{array}{cccc|c} -2 & 2 & -2 & 2 & 14 \\ 0 & 2 & 0 & 2 & 24 \\ 0 & 4 & -2 & 3 & 52 \\ 0 & 0 & 0 & 6 & 3 \end{array}\right]$$

Use $R_3 - 2R_2$ For Row 3

$$= \left[\begin{array}{cccc|c} -2 & 2 & -2 & 2 & 14 \\ 0 & 2 & 0 & 2 & 24 \\ 0 & 0 & -2 & 2 & -6 \\ 0 & 0 & 0 & 0 & -3 \end{array}\right]$$

$q_0 = -2$

$= -2q_1 + q_0 = 6$

$= -2q_1 + 1 = 6$

$= -2q_1 = -6 + 2$

$= -2q_1 = -5$

$= q_1 = \frac{2}{3} \quad \frac{5}{2}$

For a_2

$= 2a_2 + 2a_0 = 29$

$= 2a_2 + 2(-2) = 29$

$= 2a_2 - 2 = 29$

$= 2a_2 = 29 + 2$

$= 2a_2 = 31$

$a_2 = \frac{31}{2}$

For a_3

$a_3 + a_2 + a_1 + a_0 = 19$

$= a_3 + \frac{31}{2} + \frac{85}{2} + (-2) = 19$

$= a_3 + \frac{31 + 5}{2} + (-2) = 19$

$= a_3 + \frac{36}{2} + (-2) = 19$

$= a_3 + 18 + (-2) = 19$

$= a_3 + 17 = 19$

$= a_3 = 19 - 17$

$a_3 = 2$

$$P(x) = 2 \cdot x^3 + \frac{31}{2} x^2 + \frac{5}{2} x + (-1)$$

$$= \frac{1}{2} (4x^3 + 31x^2 + 5x - 2)$$