P 3.1

25g fat 32g protein.

$x = $ 1g fat + 2g protein

$y = $ 5g fat + 1g protein.

$$\left(\begin{array}{cc|c} 1 & 5 & 25 \\ 2 & 1 & 32 \end{array}\right).$$

$$\begin{array}{cc} x & y \end{array}.$$

$$R_2 \to R_2 - 2R_1 \sim \left(\begin{array}{cc|c} 1 & 5 & 25 \\ 0 & -9 & -18 \end{array}\right).$$

$$R_2 \to -\tfrac{1}{9}R_2 \sim \left(\begin{array}{cc|c} 1 & 5 & 25 \\ 0 & 1 & 2 \end{array}\right).$$

$$R_1 \to R_1 - 5R_2 \sim \left(\begin{array}{cc|c} 1 & 0 & 15 \\ 0 & 1 & 2 \end{array}\right).$$

$$\begin{array}{cc} x & y \end{array}.$$

should eat 15 units of x and 2 units of y.

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P3.3) a) $\left(\begin{array}{cc|c} -1 & -2 & -2 \\ 3 & 3 & 0 \end{array}\right).$

$R_2 \to \frac{1}{3}R_2$

$\sim \left(\begin{array}{cc|c} -1 & -2 & -2 \\ 1 & 1 & 0 \end{array}\right)$

$R_1 \leftrightarrow R_2$

$\sim \left(\begin{array}{cc|c} 1 & 1 & 0 \\ -1 & -2 & -2 \end{array}\right).$

$R_2 \to R_2 + R_1$

$\sim \left(\begin{array}{cc|c} 1 & 1 & 0 \\ 0 & -1 & -2 \end{array}\right).$

$R_2 \to -R_2$

$\sim \left(\begin{array}{cc|c} 1 & 1 & 0 \\ 0 & 1 & 2 \end{array}\right) \sim \left(\begin{array}{cc|c} 1 & 0 & -2 \\ 0 & 1 & 2 \end{array}\right).$

$\underline{\underline{(-2, 2)}}$

P3.3b).

$$\left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ -2 & 3 & 3 & -1 \\ -1 & 0 & 1 & 2 \end{array}\right).$$

$$R_2 \to R_2 + 2R_1 \quad \sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ -1 & 0 & 1 & 2 \end{array}\right).$$

$$R_3 \to R_3 + R_1 \quad \sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ 0 & -1 & -1 & 3 \end{array}\right).$$

$$R_3 \to R_3 + R_2 \quad \sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ 0 & 0 & -2 & 4 \end{array}\right).$$

$$R_3 \to -\tfrac{1}{2} R_3 \quad \sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ 0 & 0 & 1 & -2 \end{array}\right).$$

$R_2 \to R_2 + R_3$

$$\sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -2 \end{array}\right).$$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & -2 & 0 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -2 \end{array}\right).$$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & 0 & -4 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -2 \end{array}\right).$$

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c) $\left(\begin{array}{ccc|c} 2 & -2 & 3 & 2 \\ 1 & -2 & -1 & 0 \\ -2 & 2 & 2 & 1 \end{array}\right)$

$R_1 \to R_1 - R_2$

$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 1 & -2 & -1 & 0 \\ -2 & 2 & 2 & 1 \end{array}\right).$

$R_2 \to R_2 - R_1$

$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 0 & -2 & -5 & -2 \\ -2 & 2 & 2 & 1 \end{array}\right).$

$R_3 \to R_3 + 2R_1$

$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 0 & -2 & -5 & -2. \\ 0 & 2 & 10 & 5 \end{array}\right).$

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$R_3 \to R_3 + R_2$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 0 & -2 & -5 & -2 \\ 0 & 0 & 5 & 3 \end{array}\right).$$

$R_3 \to \frac{1}{5}R_3$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 0 & -2 & -5 & -2 \\ 0 & 0 & 1 & \frac{3}{5} \end{array}\right).$$

$R_2 \to R_2 \times -\frac{1}{2}$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & 4 & 2 \\ 0 & 1 & \frac{5}{2} & 1 \\ 0 & 0 & 1 & \frac{3}{5} \end{array}\right)$$

$R_1 \to R_1 - 4R_3$

$$\sim \left(\begin{array}{ccc|c} 1 & 0 & 0 & -\frac{2}{5} \\ 0 & 1 & 0 & -\frac{1}{2}. \\ 0 & 0 & 1 & \frac{3}{5} \end{array}\right).$$

sln $= \underline{\underline{\left(-\frac{2}{5}, -\frac{1}{2}, \frac{3}{5}\right)}}$.

P 3.4 a).
$$\left(\begin{array}{cc|c} -1 & -2 & -2 \\ 3 & 6 & 6 \end{array}\right)$$

$R_2 \to R_2 + 3R_1$
$$\sim \left(\begin{array}{cc|c} -1 & -2 & -2 \\ 0 & 0 & 0 \end{array}\right).$$

since we are solving 2 var with 1 eqn,
there are ∞ slns.

basic var = x_1.
free: x_2.

$$x_1 + 2x_2 = 2.$$

Let $x_2 = t$.

$$x_1 = 2 - 2t.$$

a sln x,
$$x = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 2-2t \\ t \end{pmatrix}.$$
$$= \begin{pmatrix} 2 \\ 0 \end{pmatrix} + t\begin{pmatrix} -2 \\ 1 \end{pmatrix}.$$

for $\forall t \in \mathbb{R}$

b) $\left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ -2 & 3 & 3 & -1 \\ -1 & 2 & 1 & 0 \end{array}\right)$

$R_2 \to R_2 + 2R_1$
$\sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ -1 & 2 & 1 & 0 \end{array}\right).$

$R_3 \to R_3 + R_1$
$\sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ 0 & 1 & -1 & 1 \end{array}\right).$

R_3 & R_2 the same
$\sim \left(\begin{array}{ccc|c} 1 & -1 & -2 & 1 \\ 0 & 1 & -1 & 1 \\ 0 & 0 & 0 & 0 \end{array}\right).$

basic var: x_1, x_2.

free var: x_3.

sln is a line ∵ since there is 1 free var.

Let $x_3 = t$

$\therefore x_1 - x_2 - x_3 = 1.$

$x_2 - x_3 = 1$

$\cancel{x_3 = t}$

$\underline{\underline{x_2 = 1 + t}}$

$x_1 = x_2 + x_3 + 1$

$= 1 + t + t + 1$

$= \underline{\underline{2 + 2t}}.$

$\therefore \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix} + t \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} \right.$.

XD copy

wry?

c) $\left(\begin{array}{ccc|c} 2 & -2 & 3 & 2 \\ 0 & 0 & 5 & 3 \\ -2 & 2 & 2 & 1 \end{array}\right).$

$R_1 \to R_1 \times \frac{1}{2}$

$\sim \left(\begin{array}{ccc|c} 1 & -1 & \frac{3}{2} & 1 \\ 0 & 0 & 5 & 3 \\ -2 & 2 & 2 & 1 \end{array}\right).$

$R_3 \to R_3 + 2R_1$

$\sim \left(\begin{array}{ccc|c} 1 & -1 & \frac{3}{2} & 1 \\ 0 & 0 & 5 & 3 \\ 0 & 0 & 5 & 3 \end{array}\right).$

$\sim \left(\begin{array}{ccc|c} 1 & -1 & \frac{3}{2} & 1 \\ 0 & 0 & 5 & 3 \\ 0 & 0 & 0 & 0 \end{array}\right).$

x_1, x_3 are basic vars.

free: x_2. Let $x_2 = t$.

$x_1 = 1 + x_2 - \frac{3}{2} x_3.$

$x_2 = t.$

$x_3 = \frac{3}{5}.$

$\left\{ \begin{pmatrix} \frac{1}{10} \\ 0 \\ \frac{3}{5} \end{pmatrix} + t \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}, \; t \in \mathbb{R} \right\}.$