① $f_t(x) = 79x + 9000$

$f_m(x) = 71x + 9400$

a.) $f_t(600) = 79 \cdot 600 + 9000 = 56400$

$f_m(600) = 71 \cdot 600 + 9400 = 52000$

Cheaper to produce 600 tablets in Malaysia.

b.)

$$79x + 9000 = 71x + 9400$$
$$8x = 400$$
$$x = 50$$

The cost is equal for 50 tablets.

(2.) a.)

$$\left[\begin{array}{cccc|c} 3 & 2 & 1 & 20 & 6 \\ 1 & 2 & 1 & 10 & 0 \\ 1 & 1 & 1 & 6 & 2 \\ 2 & 2 & 1 & 15 & 3 \end{array}\right] \xrightarrow{\text{RREF}} \left[\begin{array}{cccc|c} 1 & 0 & 0 & 5 & 3 \\ 0 & 1 & 0 & 4 & -2 \\ 0 & 0 & 1 & -3 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right]$$

$$\begin{cases} x + 5w = 3 \\ y + 4w = -2 \\ z - 3w = 1 \end{cases}$$

b.) $x_2 = y = 6$

$$\begin{cases} 6 + 4w = -2 \\ x + 5w = 3 \\ z - 3w = 1 \end{cases} \qquad \begin{cases} w = -2 \\ x - 10 = 3 \\ z + 6 = 1 \end{cases} \qquad \begin{cases} w = -2 \\ x = 13 \\ z = -5 \end{cases}$$

c.)

$3 \cdot 13 + 2 \cdot 6 - 5 - 40 = 6$

$13 + 2 \cdot 6 - 5 - 20 = 0$

$13 + 6 - 5 - 12 = 2$

$2 \cdot 13 + 2 \cdot 6 - 5 - 30 = 3$ ✓

(3.) a.) $y = 2647.019x - 1286.154$

b.) $y = 2647.019 \cdot 2.9 - 1286.154$

$= 6390$

Orlando will have around 6390 sales.

c.)

$$20000 = 2647.019x - 1286.154$$

$$x = \frac{21286.154}{2647.019} = 8.04$$

To sell 20,000 units we need a market of 8 million.

④

$$\begin{pmatrix} 3 & 10 \\ 2 & 6 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 5 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & 10 \\ 2 & 6 \end{pmatrix}^{-1}\begin{pmatrix} 9 \\ 5 \end{pmatrix}$$

$$= \frac{1}{3\cdot 6 - 2\cdot 10}\begin{pmatrix} 6 & -10 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 9 \\ 5 \end{pmatrix}$$

$$= -\frac{1}{2}\begin{pmatrix} 6 & -10 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 9 \\ 5 \end{pmatrix}$$

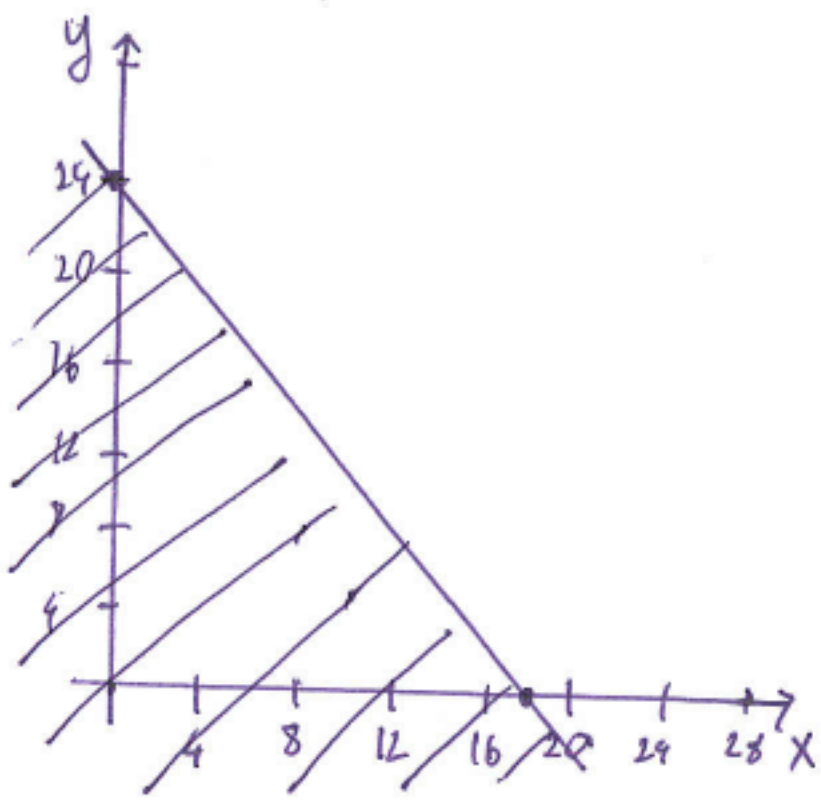
$$= \begin{pmatrix} -2 \\ 3/2 \end{pmatrix}$$

$$\begin{cases} x = -2 \\ y = 3/2 \end{cases}$$

(5.) $8x + 6y \geq 144$

$y \geq -\frac{4}{3}x + 24$

$(0, 24)$, $(18, 0)$



$0 = -\frac{4}{3}x + 24$

$\frac{4}{3}x = 24$

$x = 18$

$0 + 0 \geq 144$ x

(6.)

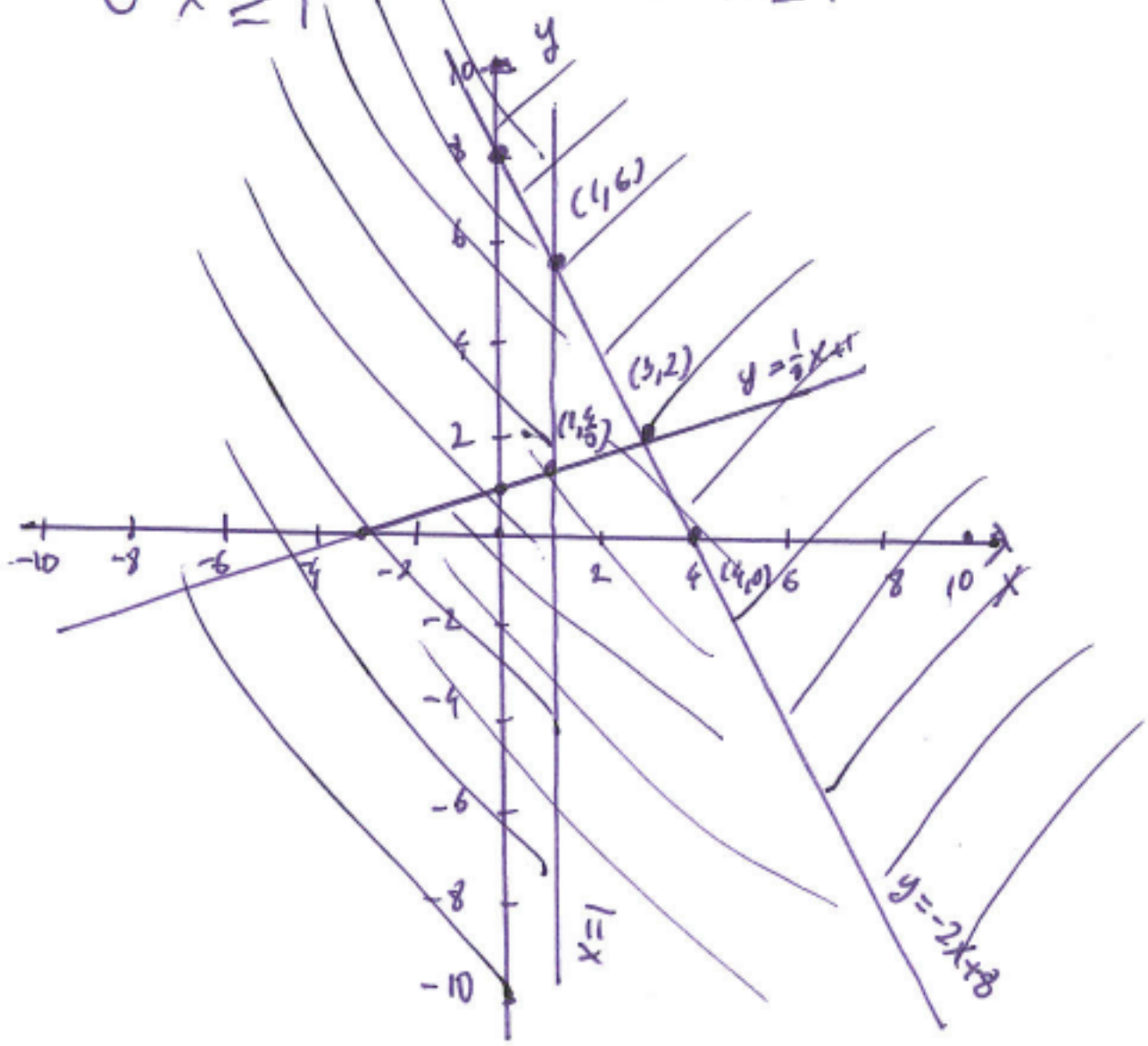
x - oz of Type I

y - oz of Type II

minimize $0.24x + 0.18y$

subject to $\begin{cases} 200x + 120y \geq 800 \\ 100x + 300y \geq 1200 \\ x \geq 0, y \geq 0 \end{cases}$

7. $\begin{cases} 2x+y \le 8 \\ -2x+6y \ge 6 \\ x \ge 1 \end{cases}$ $\begin{cases} y \le -2x+8 \\ y \ge \frac{1}{3}x+1 \\ x \ge 1 \end{cases}$ $(0,8), (4,0)$ $(0,1), (-3,0)$



$-2x+8 = \frac{1}{3}x+1$

$-6x+24 = x+3$

$-7x = -21$

$x = 3$

$y = 2$

$x = 1$

$-2+8 = 6 = y$

$x = 1$

$y = \frac{1}{3}+1 = \frac{4}{3}$

8.

a.) $\left[\begin{array}{ccc|c} -2 & -3 & 2 & -2 \\ 1 & 1 & 0 & 3 \\ -1 & -3 & 5 & 8 \end{array}\right] \xrightarrow{\text{RREF}} \left[\begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 3 \end{array}\right]$ $\begin{cases} x=1 \\ y=2 \\ z=3 \end{cases}$

b.) $\left[\begin{array}{ccc|c} 1 & 1 & 4 & 3 \\ 4 & 1 & -2 & -6 \\ -3 & 0 & 2 & 1 \end{array}\right] \xrightarrow{\text{RREF}} \left[\begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -6 \\ 0 & 0 & 1 & 2 \end{array}\right]$ $\begin{cases} x=1 \\ y=-6 \\ z=2 \end{cases}$

9.

$$\begin{pmatrix} 3 & -3 & -7 & 6 \\ -4 & 2 & 6 & -8 \\ -2 & 5 & 1 & -4 \end{pmatrix} \xrightarrow{\frac{1}{2}R_2} \begin{pmatrix} 3 & -3 & -7 & 6 \\ -2 & 1 & 3 & -4 \\ -2 & 5 & 1 & -4 \end{pmatrix} \xrightarrow[R_3 - 5R_2]{R_1 + 3R_2} \begin{pmatrix} -3 & 0 & 2 & -6 \\ -2 & 1 & 3 & -4 \\ 8 & 0 & -14 & 16 \end{pmatrix}$$

(10.)

$$\left(\begin{array}{cccc|c} 0 & 2 & 1 & -1 & 1 \\ 1 & -1 & 1 & 1 & 14 \\ -1 & -9 & -1 & 4 & 11 \\ 1 & 1 & 1 & 0 & 9 \end{array}\right) \xrightarrow{\text{RREF}} \left(\begin{array}{cccc|c} 1 & 0 & 0 & 1/2 & 11/2 \\ 0 & 1 & 0 & -1/2 & -5/2 \\ 0 & 0 & 1 & 0 & 6 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)$$

infinitely many solutions

$$\begin{cases} x + \frac{1}{2}w = \frac{11}{2} \\ y - \frac{1}{2}w = -\frac{5}{2} \\ z = 6 \\ w = \text{any number} \end{cases}$$

$$\begin{cases} x = -\frac{1}{2}w + \frac{11}{2} \\ y = \frac{1}{2}w - \frac{5}{2} \\ z = 6 \\ w = \text{any number} \end{cases}$$

11.

a.)

$$\begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix} \xrightarrow{R_2 \leftrightarrow R_4} \begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 7 & -3 & 2 & 9 & -1 \\ -4 & 2 & -6 & -14 & 8 \\ 0 & 3 & -5 & 8 & -6 \end{pmatrix}$$

b.)

$$\begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix} \xrightarrow{-4R_3 \to R_3} \begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ 16 & -8 & 24 & 56 & -32 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix}$$

c.)

$$\begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix} \xrightarrow{3R_2 + R_1 \to R_1} \begin{pmatrix} -10 & 1 & -17 & -30 & 20 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix}$$

d.)

$$\begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{pmatrix} \xrightarrow{R_3 + R_4 \to R_4} \begin{pmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & 0 & -3 & 17 & -7 \end{pmatrix}$$

12.

a.)

$$\left(\begin{array}{cccc|c} -1 & 2 & 1 & -10 & 8 \\ -2 & 3 & 1 & -19 & 14 \\ 2 & -4 & -3 & 17 & -10 \\ -1 & 1 & 0 & -9 & 6 \end{array}\right) \xrightarrow{\text{RREF}} \left(\begin{array}{cccc|c} 1 & 0 & 0 & 5 & 2 \\ 0 & 1 & 0 & -4 & 8 \\ 0 & 0 & 1 & 3 & -6 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)$$

$$\begin{cases} x+5w=2 \\ y-4w=8 \\ z+3w=-6 \\ w = \text{any number} \end{cases} \qquad \begin{cases} x=-5w+2 \\ y=4w+8 \\ z=-3w-6 \\ w = \text{any number} \end{cases}$$

b.)

$$\begin{cases} x=-20+2 \\ y=16+8 \\ z=-30-6 \\ w=4 \end{cases} \qquad \begin{cases} x=-18 \\ y=24 \\ z=-18 \\ w=4 \end{cases}$$

c.)

$4 = 4w + 8$

$4w = -4$

$w = -1$

$$\begin{cases} x=5+2 \\ y=4 \\ z=3-6 \\ w=-1 \end{cases} \qquad \begin{cases} x=7 \\ y=4 \\ z=-3 \\ w=-1 \end{cases}$$

(13)

a.)

$$A = \begin{array}{c} \\ \text{reqs. PB} \\ \text{from } y \end{array} \begin{array}{c} \begin{array}{cc} \text{requirements of} & \\ \text{PB} & y \end{array} \\ \begin{pmatrix} 0.12 & 0.18 \\ 0.05 & 0.14 \end{pmatrix} \end{array}$$

input-output matrix

$$D = \begin{array}{c} \\ PB \\ y \end{array} \begin{pmatrix} 4000 \\ 2800 \end{pmatrix}$$

demand matrix

X production

b.)

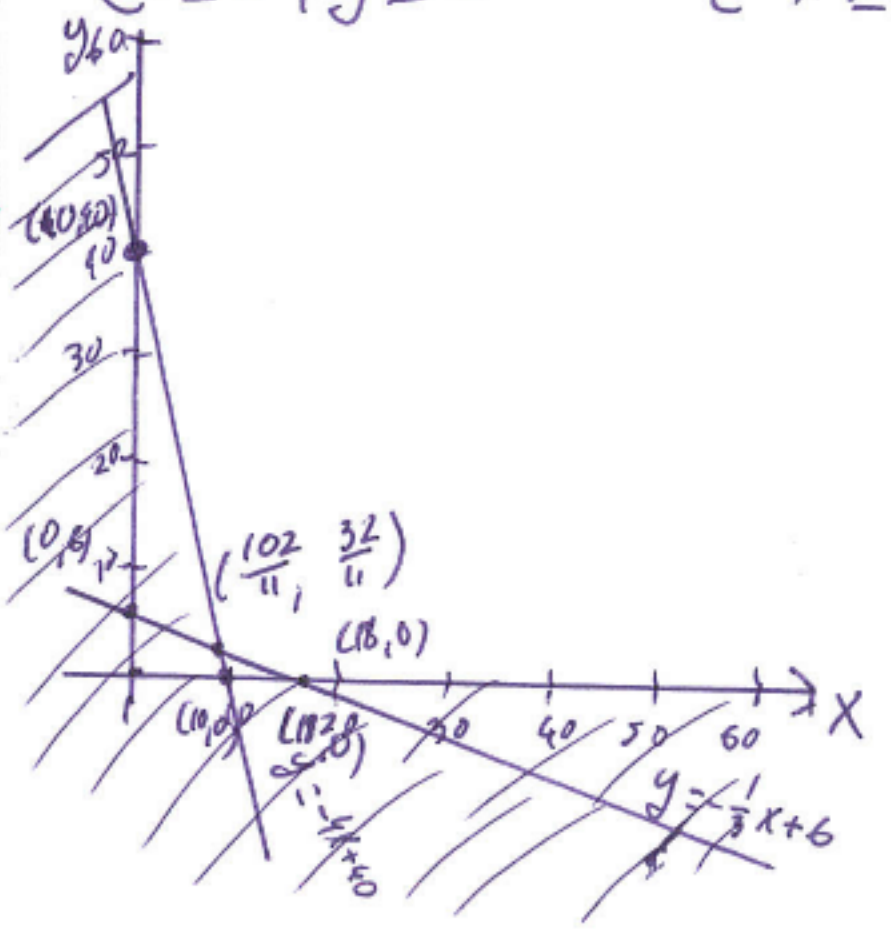
$$X = (I - A)^{-1} D = \begin{pmatrix} 4867 \\ 3539 \end{pmatrix}$$

(14)

$$\begin{pmatrix} -4 & Q \\ 2 & 0 \end{pmatrix}^{-1} = \frac{1}{-2Q}\begin{pmatrix} 0 & -Q \\ -2 & -4 \end{pmatrix} = \begin{pmatrix} 0 & 1/2 \\ 1/Q & 2/Q \end{pmatrix}$$

15.

$$\begin{cases} 4x+y \geq 40 \\ 2x+6y \geq 36 \\ x \geq 0,\ y \geq 0 \end{cases} \qquad \begin{cases} y \geq -4x+40 \\ y \geq -\frac{1}{3}x+6 \\ x \geq 0,\ y \geq 0 \end{cases} \qquad \begin{matrix} (0,40),(10,0) \\ (0,6),(18,0) \end{matrix}$$



$$-4x+40 = -\frac{1}{3}x+6$$

$$-12x+120 = -x+18$$

$$11x = 102$$

$$x = \frac{102}{11}$$

$$y = \frac{32}{11}$$

16.

x	y
0	23.2
5	23.8
10	24.7
18	25.8
24	26.7
29	26.9
34	27.1
36	27.5
39	28.1

a.)

$$y = 0.12x + 23.38$$

b.) year 2013 $\Rightarrow x = 43$

$$y = 0.12 \cdot 43 + 23.38 = 28.54$$

Average age at marriage in 2013 is expected to be 28.54.

c.)

$$0.12x + 23.38 = 38$$

$$x = \frac{38 - 23.38}{0.12}$$

$$= 121.83$$

Average age at marriage is expected to be 38 in 2092.

$$122 + 1970 = 2092$$

(17.) a.)

$$A = \begin{array}{c} \\ \text{req. from} \\ \\ \end{array} \begin{array}{c} \begin{array}{ccc} M & P & W \end{array} \\ \begin{pmatrix} .08 & 0 & .05 \\ .03 & .11 & .04 \\ .07 & .02 & .10 \end{pmatrix} \end{array} \begin{array}{l} M \\ P \\ W \end{array}$$

requirements of

input-output matrix

$$D = \begin{array}{c} M \\ P \\ W \end{array} \begin{pmatrix} 32 \\ 25 \\ 40 \end{pmatrix}$$

demand matrix

X production

b.)

$$X = (I - A)^{-1} D = \begin{pmatrix} 37.4 \\ 31.5 \\ 48.1 \end{pmatrix}$$

(18.)

x - # of type A packages
y - # of type B packages

$$\text{maximize } 175x + 240y$$

$$\text{subject to } \begin{cases} 140x + 185y \leq 6000 \\ 3x + 5y \leq 300 \\ x \geq 0, y \geq 0 \end{cases}$$