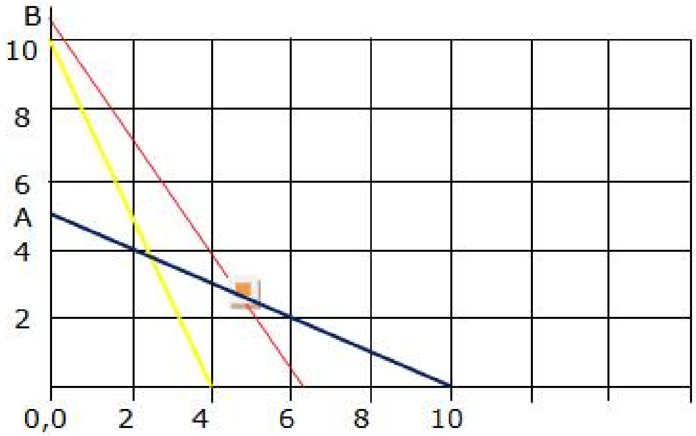
RD Sharma Solutions Class 12 Maths Chapter 30 Ex 30.3

Linear Programming Ex 30.3 Q1



Let x and y be the No. of 25 gm packets of foods F_1 and F_2

Minimum cost of diet $Z = 0.20x + 0.15y$

The constraints are

$0.25x + 0.1y \geq 1$; when $x=0$, $y=10$ & $y=0$, $x=4$ 10-4

$0.75x + 1.5y \geq 7.5$; when $x=0$, $y=5$ & $y=0$, $x=10$ A-10

$1.6x + 0.8y \geq 10$; when $x=0$, $y=25/2$ & $y=0$, $x=25/4$

The feasible region is the open region B-E-10

The minimum cost of the diet can be checked by finding the value of Z at corner points B, E & 10

Corner point	Value of $Z = 20x + 15y$
0, 12.5	187.5
10, 0	200
5, 2.5	137.5

Since the feasible region is an open region so we plot $20x + 15y < 137.5$, to check whether the resulting open half plane has any point common with the feasible region. Since it has common points $Z = 20x + 15y$

There is no optimal minimum value subject to the given constraints.

Linear Programming Ex 30.3 Q2

Let required quantity of food A and B be x and y units respectively.

Costs of one unit of food A and B are Rs 4 and Rs 3 per unit respectively, so, costs of x unit of food A and y unit of food B are $4x$ and $3y$ respectively. Let Z be minimum total cost, so

$$Z = 4x + 3y$$

Since one unit of food A and B contain 200 and 100 units of vitamin respectively. So, x units of food A and y units of food B contain $200x$ and $100y$ units of vitamin but minimum requirement of vitamin is 4000 units, so

$$200x + 100y \geq 4000$$

$$\Rightarrow \quad 2x + y \geq 40 \quad \text{(first constraint)}$$

Since one unit of food A and B contain 1 unit and 2 unit of minerals, so x units of food A and y units of food B contain x and $2y$ units of minerals respectively but minimum requirement of minerals is 50 units, so

$$x + 2y \geq 50 \quad \text{(second constraint)}$$

Since one unit of food A and B contain 40 calories each, so x units of food A and y units of food B contain $40x$ and $40y$ calories respectively but minimum requirement of calories is 1400, so

$$40x + 40y \geq 1400$$

$$\Rightarrow \quad 2x + 2y \geq 70$$

$$\Rightarrow \quad x + y \geq 35 \quad \text{(third constraint)}$$

So, mathematical formulation of LPP is find x and y which

$$\text{minimize} \quad Z = 4x + 3y$$

Subject to constraint,

$$2x + y \geq 40$$

$$x + 2y \geq 50$$

$$x + y \geq 35$$

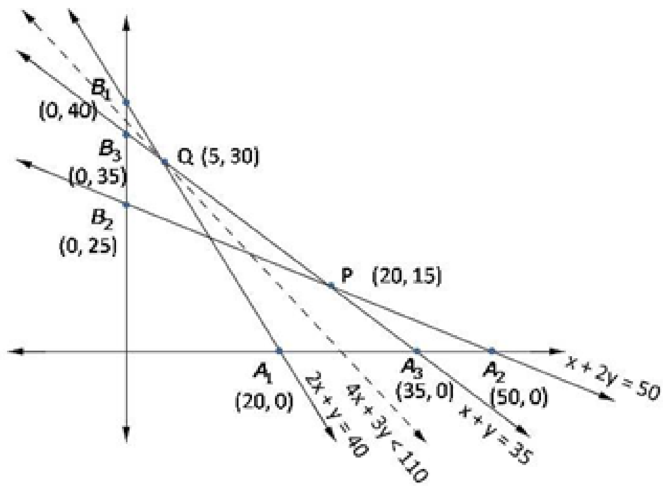
$$x, y \geq 0 \quad \text{[Since quantity of food can not be less than zero]}$$

Region $2x + y \geq 40$: Line $2x + y = 40$ meets axes at $A_1(20, 0)$, $B_1(0, 40)$ region not containing origin represents $2x + y \geq 40$ as $(0,0)$ does not satisfy $2x + y \geq 40$.

Region $x + 2y \geq 50$: Line $x + 2y = 50$ meets axes at $A_2(50, 0)$, $B_2(0, 25)$. Region not containing origin represents $x + 2y \geq 50$ as $(0,0)$ does not satisfy $x + 2y \geq 50$.

Region $x + y \geq 35$: Line $x + y = 35$ meets axes at $A_3(35,0)$, $B_3(0,35)$. Region not containing origin represents $x + y \geq 35$ as $(0,0)$ does not satisfy $x + y \geq 35$.

Region $x, y \geq 0$: It represent first quadrant in xy-plane.



Unbounded shaded region $A_2 P Q B_1$ represents feasible region with corner points $A_2(50,0)$, $P(20,15)$, $Q(5,30)$, $B_1(0,40)$

The value of $Z = 4x + 3y$ at

$A_2(50,0) \quad = 4(50) + 3(0) = 2000$

$P(20,15) \quad = 4(20) + 3(15) = 125$

$Q(5,30) \quad = 4(5) + 3(30) = 110$

$B_1(0,40) \quad = 4(0) + 3(40) = 110$

Smallest value of $Z = 110$

Open half plane $4x + 3y < 110$ has no point in common with feasible region, so, smallest value is the minimum value.

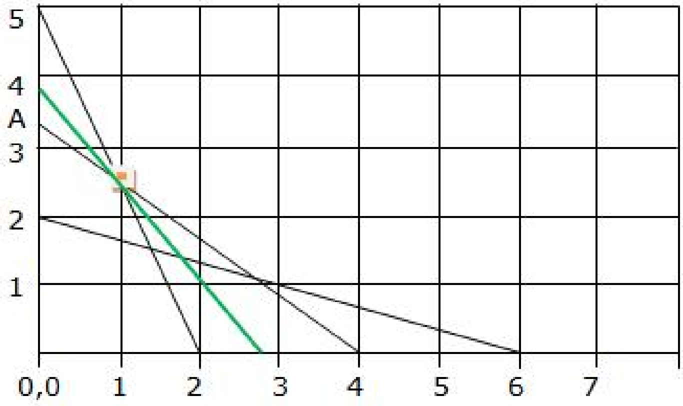
Hence,

quantity of food $A = x = 5$ unit

quantity of food $B = y = 30$ unit

minimum cost $=$ Rs 110

Linear Programming Ex 30.3 Q3



Let x & y be the units of Food I and Food II resptly.

The objective function is to minimize the function
$Z = 0.6x + y$ such that
$10x + 4y \geq 20$ requirement of calcium, line 5-2
$5x + 6y \geq 20$ requirement of protein, line A-4
$2x + 6y \geq 12$ requirement of calories, line 2-6

These when plotted give 5-F-E-6 an open unbounded region.

The function $20x + 15y < 57.5$ needs to be plotted to check if there are any common points. The green line shows that there are no common points. So

Corner point	Value of $Z = 0.6x + y$
0, 5	5
F(1, 2.5)	3.1
E(2.67, 1.11)	2.71
6, 0	3.6

The minimum cost occurs when Food I is 1 unit and Food II is 2.5 units. Since it is an unbounded region plotting $Z<3.1$ gives the green line which has no common points, so (1, 2.5) can be said to be a minimum point.

Linear Programming Ex 30.3 Q4

Let required quantity of food A and food B be x and y units.

Given, costs of one unit of food A and B are 10 paise per unit each, so costs of x unit of food A and y unit of food B are $10x$ and $10y$ respectively, let Z be total cost of foods, so

$$Z = 10x + 10y$$

Since one unit of food A and B contain 0.12 mg and 0.10 mg of Thiamin respectively, so, x units of food A and y units of food B contain $0.12x$ mg and $0.10y$ mg of Thiamin respectively but minimum requirement of Thiamin is 0.4 mg, so

$$0.12x + 0.10y \geq 0.5$$

$\Rightarrow \quad 12x + 10y \geq 50$

$\Rightarrow \quad 6x + 5y \geq 25 \qquad$ (first constraint)

Since one unit of food A and B contain 100 and 150 Calories respectively, so x units of food A and y units of food B contain $100x$ and $150y$ units of Calories but minimum requirement of Calories is 600, so

$$100x + 150y \geq 600$$

$\Rightarrow \quad 2x + 3y \geq 12 \qquad$ (second constraint)

Hence, mathematical formulation of LPP is find x and y which

minimize $Z = 10x + 10y$

Subject to constraint,

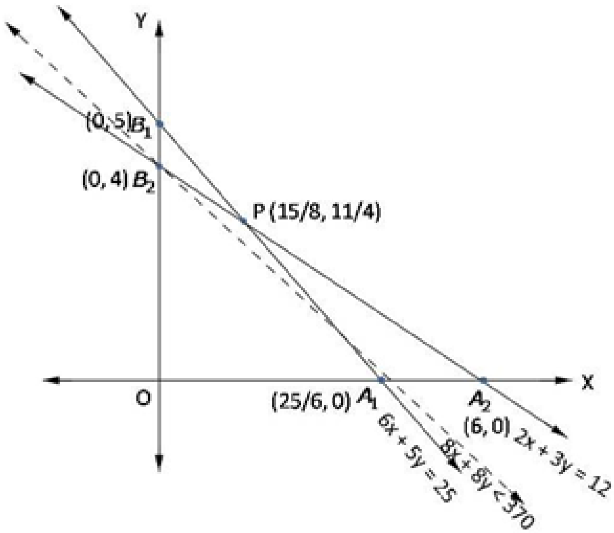
$$6x + 5y \geq 25$$
$$2x + 3y \geq 12$$
$$x, y \geq 0$$

[Since quantity of food A and B can not be less than zero]

Region $6x + 5y \geq 25$: $6x + 5y = 25$ meets axes at $A_1\left(\frac{25}{6}, 0\right)$, $B_1(0,5)$. Region not containing origin represents $6x + 5y \geq 25$ as $(0,0)$ does not satisfy $6x + 5y \geq 25$.

Region $2x + 3y \geq 12$: Line $2x + 3y = 12$ meets axes at $A_2(6,0)$, $B_2(0,4)$. Region not containing origin represents $2x + 3y \geq 12$ as $(0,0)$ does not satisfy $2x + 3y \geq 12$.

Region $x, y \geq 0$ represent first quadrant in xy-plane.



Unbounded shaded region $A_2 P B_1$ represents feasible region with corner points $A_2(6,0)$,
$P\left(\frac{15}{8},\frac{11}{4}\right)$, $B_1(0,5)$

The value of $Z = 10x + 10y$ at

$A_2(6,0) \quad = 10(6) + 10(0) = 60$

$P\left(\frac{15}{8},\frac{11}{4}\right) \quad = 10\left(\frac{15}{8}\right) + 10\left(\frac{11}{4}\right) = \frac{370}{8} = 46\frac{1}{4}$

$B_1(0,5) \quad = 10(0) + 10(5) = 50$

Smallest value of Z is $46\frac{1}{4}$.

Now open half plane $10x + 10y < \frac{370}{8}$

$\Rightarrow$ $8x + 8y < 370$ has no point in common with feasible region, so smallest value is the minimum value.

Hence,

Required quantity of food $A = \frac{15}{8}$ units, food $B = \frac{11}{4}$ units

minimum cost = Rs 46.25

Linear Programming Ex 30.3 Q5

Let required quantity of food X and food Y be x kg and y kg.

Since costs of food X and Y are Rs 5 and Rs 8 per kg., So, costs of food X and food Y are Rs. $5x$ and Rs. $8y$ respectively. Let Z be the total cost of food, then

$$Z = 5x + 8y$$

Since one kg of food X and Y contain 1 and 2 unit of vitamin A, so, x kg of food X and y kg of food Y contain x and $2y$ units of vitamin A respectively but minimum requirement of vitamin A is 6 units, so

$$x + 2y \geq 6 \qquad \text{(first constraint)}$$

Since one kg of food X and Y contain 1 unit of vitamin B each, so x kg of food X and y kg of food Y contain x and y units of vitamin B but minimum requirement of vitamin B is 7 units, so

$$x + y \geq 7 \qquad \text{(second constraint)}$$

Since one kg of food X and food Y contain 1 unit and 3 units of vitamin C respectively, so x kg of food X and y kg of food Y contain x and $3y$ units of vitamin C respectively but minimum requirement of vitamin C is 11 units, so

$$x + 3y \geq 11 \qquad \text{(third constraint)}$$

Since 1 kg of food X and food Y contain 2 units and 1 unit of vitamin D respectively, so, x kg of food X and y kg of food Y contain $2x$ and y units of vitamin D respectively but minimum requirement of vitamin D is 9 units, so

$$2x + y \geq 9 \qquad \text{(fourth constraint)}$$

Hence, mathematical formulation of LPP is find x and y which

minimize $Z = 5x + 8y$

Subject to constraints,

$$x + 2y \geq 6$$
$$x + y \geq 7$$
$$x + 3y \geq 11$$
$$2x + y \geq 9$$
$$x, y \geq 0 \qquad \text{[Since quantity of food } X \text{ and } Y \text{ can not be less than zero]}$$

Region $x + 2y \geq 6$: Line $x + 2y = 6$ meets axes at $A_1(6,0)$, $B_1(0,3)$. Region not containing origin represents $x + 2y \geq 6$ as $(0,0)$ does not satisfy $x + 2y \geq 6$.

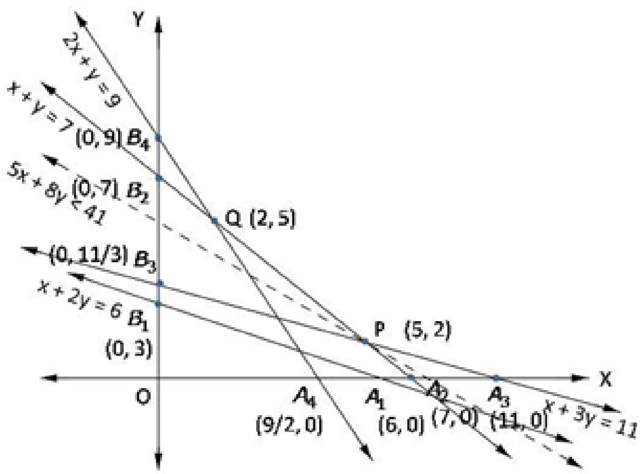
Region $x + y \geq 7$: Line $x + y = 7$ meets axes at $A_2(7,0)$, $B_2(0,7)$ respectively. Region not containing origin represents $x + y \geq 7$ as $(0,0)$ does not satisfy $x + y \geq 7$.

Region $x+3y \geq 11$: Line $x+3y=11$ meets axes at $A_3(11,0)$, $B_3\left(0,\frac{11}{3}\right)$ respectively.

Region not containing origin represents $x+3y \geq 11$ as $(0,0)$ does not satisfy $x+3y \geq 11$.

Region $2x+y \geq 9$: Line $2x+y=9$ meets axes at $A_4\left(\frac{9}{2},0\right)$, $B_4(0,9)$ respectively. Region not containing origin represents $2x+y \geq 9$ as $(0,0)$ does not satisfy $2x+y \geq 9$.

Region $x, y \geq 0$ it represent first quadrant.



Unbounded shaded region $A_2PQ\ B_4$ is the feasible region with corner points $A_3(11,0)$, $P(5,2)$, $Q(2,5)$, $B_4(0,9)$

The value of $Z=5x+8y$ at

$A_3(11,0) \quad = 5(11)+8(0) = 55$

$P(5,2) \quad = 5(5)+8(2) = 41$

$Q(2,5) \quad = 5(2)+8(5) = 50$

$B_4(0,9) \quad = 5(0)+8(9) = 72$

Smallest value of Z is 41.

Now open half plane $5x+8y<41$ has no point is common with feasible region, os, smallest value of is the minimum value.
hence

last cost of mixture= Rs 41

Linear Programming Ex 30.3 Q6

Let quantity of food F_1 and F_2 be x and y units.
respectively.
Given, costs of one unit of food F_1 and F_2 be Rs 4 and Rs 6 per unit, So, costs of X unit of food $F_1$and Y units of food F_2 be $4x$ and $6y$ respectively,
Let Z be the total cost , so

$$Z = 4x + 8y$$

Since one unit of food F_1 and F_2 contain 3 and 6 unit of vitamin A respectively, so,
x units of food F_1 and y units of food F_2 contain $3x$ and $6y$ units of vitamin A respectively, but minimum requirement
of vitamin A is 80 units, so

$$3x + 6y \geq 80 \qquad \text{(first constraint)}$$

Since one unit of food F_1 and F_2 contain 4 unit and 3 unit of mineral,
so x unit of food F_1 and y unit of food F_2 contain $4x$ and $3y$ units of mineral respectively but minimum requirement of minerals be 100 units, so

$$4x + 3y \geq 100$$

$$\Rightarrow \quad 4x + 3y \geq 100 \qquad \text{(second constraint)}$$

mathematical formulation of LPP is, Find x and y which minimum

$$Z = 4x + 6y$$

Subject to constraints,

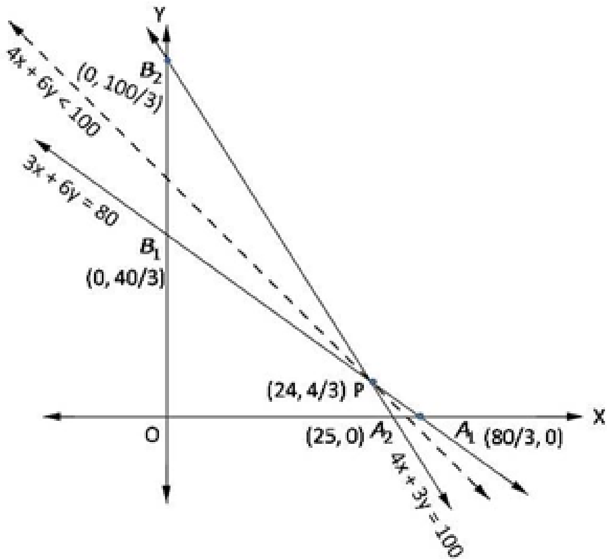
$$3x + 6y \geq 80$$
$$4x + 3y \geq 100$$
$$x, y \geq 0$$

[since quantity of food can not be less than zero]

Region $3x + 6y \geq 80$: line $3x + 6y = 80$ meets axes at $A_1\left(\frac{80}{3}, 0\right), B_1\left(0, \frac{40}{3}\right)$ respectively. Region not containing origin represents $3x + 6y \geq 80$ as $(0,0)$ does not satisfy $3x + 6y \geq 80$.

Region $4x + 3y \geq 100$ line $3x + 6y = 100$ meets axes at $A_2(25, 0), B_2\left(0, \frac{100}{3}\right)$ respectively. Region not containing origin represents $4x + 3y \geq 100$ as $(0,0)$ does not satisfy $4x + 3y \geq 100$.

Region $x, y \geq 0$ represents first quadrant



Unbounded shaded region $A_1 P B_2$ represents feasible region with corner points $A_1\left(\frac{80}{3}, 0\right)$, $P\left(24, \frac{4}{3}\right)$, $B_2\left(0, \frac{100}{3}\right)$.

The value of $Z = 4x + 6y$ at

$$A_1\left(\frac{80}{3}, 0\right) \quad = 4\left(\frac{80}{3}\right) + 6(0) = \frac{320}{3}$$

$$P\left(24, \frac{4}{3}\right) \quad = 4(24) + 6\left(\frac{4}{3}\right) = 104$$

$$B_2\left(0, \frac{100}{3}\right) \quad = 4(0) + 6\left(\frac{100}{3}\right) = 200$$

Smallest value of Z is 104 .Now open half plane $4x + 6y < 104$ has no point in common with feasible region so, smallest value is minimum value.

Hence,

Minimum cost of mixture = Rs 104

Linear Programming Ex 30.3 Q7

Let required quantity of bran and rice be x kg and y kg.
Given, costs of one kg of bran and rice are Rs 5 and Rs 4 per kg, So, costs of X unit of bran and Y kg of rice are $5x$ and Rs $4y$ respectively,
Let total cost of bran and rice be Z, so,

$$Z = 5x + 4y$$

Since one kg of bran and rice contain 80 and 100 mg of protien, so,
x kg of bran and y kg of rice contain $80x$ and $100y$ grms of protien respectively, but minimum requirement of protien for kelloggs is 88 gms, so

$$80x + 100y \geq 88$$

$$\Rightarrow \quad 20x + 25y \geq 22 \qquad \text{(first constraint)}$$

Since one kg of bran and rice contain 40 mg and 30 mg of iron, so,
x kg of bran and y kg of rice contain $40x$ and $30y$ mg of iron respectively, but minimum requirement of iron is 36 mg for kelloggs, so

$$40x + 30y \geq 36 \qquad \text{(second constraint)}$$

Hence, mathematical formulation of LPP is, Find x and y which minimize

$$Z = 5x + 4y$$

subject to constraints,

$$20x + 25y \geq 22$$

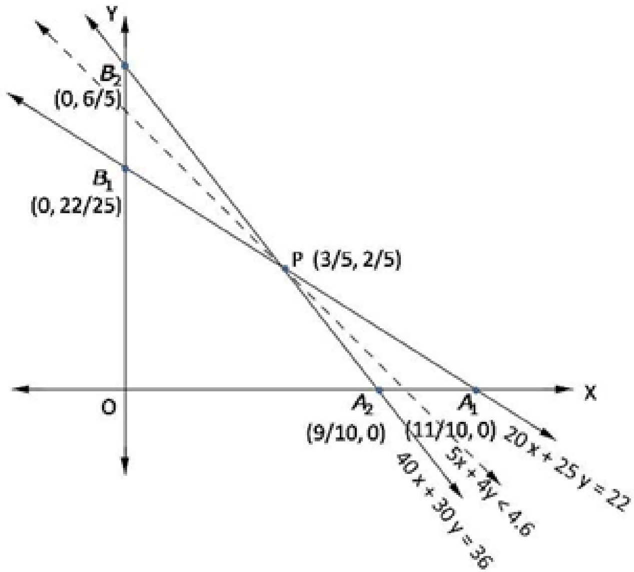
$$40x + 30y \geq 36$$

$$x, y \geq 0$$

[Since quantity of bran and rice can not be less than zero]

Region $20x + 25y \geq 22$: line $20x + 25y = 22$ meets axes at $A_1\left(\frac{11}{10}, 0\right), B_1\left(0, \frac{22}{25}\right)$ respectively. Region not containing origin represents $20x + 25y \geq 22$ as $(0,0)$ does not satisfy $20x + 25y \geq 22$.

Region $40x + 30y \geq 36$ line $40x + 30y = 36$ meets axes at $A_2\left(\frac{9}{10}, 0\right), B_2\left(0, \frac{6}{5}\right)$. Region not containing origin represents $40x + 30y \geq 36$ as $(0,0)$ does not satisfy $40x + 30y \geq 36$.



The value of $Z = 5x + 4y$ at

$$A_1\left(\frac{11}{10}, 0\right) = 5\left(\frac{11}{10}\right) + 4(0) = 5.5$$

$$P\left(\frac{3}{5}, \frac{2}{5}\right) = 5\left(\frac{3}{5}\right) + 4\left(\frac{2}{5}\right) = 4.6$$

$$B_2\left(0, \frac{6}{5}\right) = 5(0) + 4\left(\frac{6}{5}\right) = 4.8$$

Smallest value of Z is 4.6. Now open half plane $5x + 4y < 4.6$ has no point in common with feasible region so, smallest value z is the minimum value.

Hence

Minimum cost of mixture = Rs 4.6

Linear Programming Ex 30.3 Q8

Let required number of bag A and bag B be x and y respectively.

Since, costs of each bag A and bag B are Rs 8 and Rs 12 per kg., So,
cost of x number of bag A and y number of bag B are Rs $8x$ and Rs $12y$ respectively,
Let Z be total cost of bags, so,

$$Z = 8x + 12y$$

Since, each bag A and B contain 60 and 30 gms. of almonds respectively. so,
x bags of A and y bags of B contain $60x$ and $30y$ gms. of almonds respectively but,
mixtures should contain at least 240 gms almonds, so,

$$60x + 30y \geq 240$$

$$\Rightarrow \quad 2x + y \geq 8 \qquad \text{(first constraint)}$$

Since, each bag A and B contain 30 and 60 gms. of cashew nuts respectively. so,
x bags of A and y bags of B contain $30x$ and $60y$ gms. of cashew nuts respectively but,
mixtures should contain at least 300 gms of cashew nuts, so,

$$30x + 60y \geq 300$$

$$\Rightarrow \quad x + 2y \geq 10 \qquad \text{(second constraint)}$$

Since, each bag A and B contain 30 and 180 gms. of hazel nuts respectively. so,
x bags of A and y bags of B contain $30x$ and $180y$ gms. of hazel nuts respectively but,
mixtures should contain at least 540 gms of hazel nuts, so,

$$30x + 180y \geq 540$$

$$\Rightarrow \quad x + 6y \geq 18 \qquad \text{(third constraint)}$$

Hence, mathematical formulation of LPP is, Find x and y which maximize

$$Z = 8x + 12y$$

subject to constraints,

$$2x + y \geq 8$$
$$x + 2y \geq 10$$
$$x + 6y \geq 18$$
$$x, y \geq 0$$

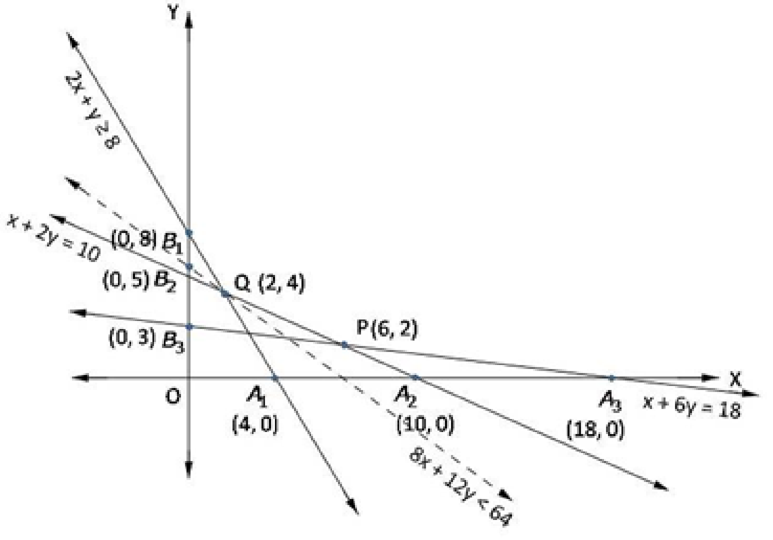
[Since quantity of bags can not be less than zero]

Region $2x + y \geq 8$: line $2x + y = 8$ meets axes at $A_1(4,0)$, $B_1(0,8)$ respectively. Region not containing origin represents $2x + y \geq 8$ as $(0,0)$ does not satisfy $2x + y \geq 8$.

Region $x + 2y \geq 10$: line $x + 2y = 10$ meets axes at $A_2(10,0)$, $B_2(0,5)$ respectively. Region not containing origin represents $2x + y \geq 10$ as $(0,0)$ does not satisfy $x + 2y \geq 10$

Region $x + 6y \geq 18$: line $x + 6y = 18$ meets axes at $A_3(18, 0)$, $B_3(0,3)$ respectively. Region not containing origin represents $x + 6y \geq 8$ as $(0,0)$ does not satisfy $x + 6y \geq 8$

Region $x, y \geq 0$: it represents first quadrant.



Unbouded shaded region A_3PQB_1 is feasible region with corner point $A_3(18,0)$, $P(6,2)$ $Q(2,4)$, $B_1(0,8)$. P is obtained by solving $x + 6y = 18$ and $x + 2y = 10$, Q is obtained by solving $2x + y = 8$ and $x + 2y = 10$

The value of $z = 8x + 12y$ at

$A_3(18,0) \quad = 8(18) + 12(0) = 144$

$P(6,2) \quad = 8(6) + 12(2) = 72$

$Q(2,4) \quad = 8(2) + 12(4) = 64$

$B_1(0,8) \quad = 8(0) + 12(8) = 96$

Smallest value of Z is 64, open half plane $8x + 12y \geq 64$ has no point is common with feasible region, so, smallest value is the minimum value

Minimum cost = Rs64
quantity of mixture A = 2 kg.
quantity of mixture B = 4kg

Linear Programming Ex 30.3 Q9

Let required number of cakes of type A and B are x and y respectively.

Let Z be total number of cakes ,so,

$$Z = x + y$$

Since one unit of cake of type A and B contain 300 gm and 150 gm flour respectively, so, x unit of cake of type A and y units of cake of type B require $300x$ and $150y$ gms of flour respectivley, but maximum flour available is $7.5 \times 1000 = 7500$ gm ,so

$$300x + 150y \le 7500$$

$$\Rightarrow \quad 2x + y \le 50 \qquad \text{(first constraint)}$$

Since one unit of cake of type A and B contain 15 and 30 gm fat respectively, so, x unit of cake of type A and y units of cake of type B contain $15x$ and $30y$ gms of fat respectivley, but maximum fat available is 600 gm ,so

$$15x + 30y \le 600$$

$$\Rightarrow \quad x + 2y \le 40 \qquad \text{(second constraint)}$$

Hence, mathematical formulation of LPP is find x and y which

$$\text{maximize } Z = x + y$$

Subject to constriants,

$$2x + y \le 50$$

$$x + 2y \le 40$$

$$x, y \ge 0 \qquad \text{[Since number of cakes can not be less than zero]}$$

Region $2x + y \le 50$: line $2x + y = 50$ meets axes at $A_1(25,0)$, $B_1(0,50)$ respectively.

Region containing origin represents $2x + y \le 50$ as $(0,0)$ satisfies $2x + y \le 50$.

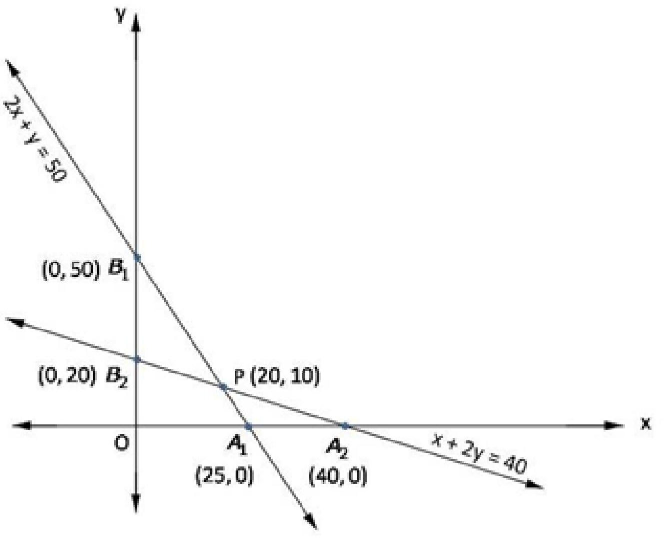
Region $x + 2y \le 40$: line $x + 2y = 40$ meets axes at $A_2(40,0)$, $B_2(0,20)$ respectively.

Region containing origin represents $x + 2y \le 40$ as $(0,0)$ satisfies $x + 2y \le 40$.

Region $x, y \ge 0$: it represent first quandrant

Shaded region OA_1PB_2 represents feasible region.

Point $P(20, 10)$ is obtained by solving $x + 2y = 40$ and $2x + y = 50$



The value of $Z = x + y$ at

$O(0,0) = 0 + 0 = 0$

$A_1(25,0) = 25 + 0 = 25$

$P(20,10) = 20 + 10 = 30$

$B_2(0,20) = 0 + 20 = 20$

maximum $Z = 30$ at $x = 20$, $y = 10$

Number of books of type $A = 20$, type $B = 10$

Linear Programming Ex 30.3 Q10

Let x kg of food P and y kg of food Q are mixed together to make the mixture.

Then the mathematical model of the LPP is as follows:

Minimize $Z = 60x + 80y$

Subject to $3x + 4y \geq 8$,

$5x + 2y \geq 11$

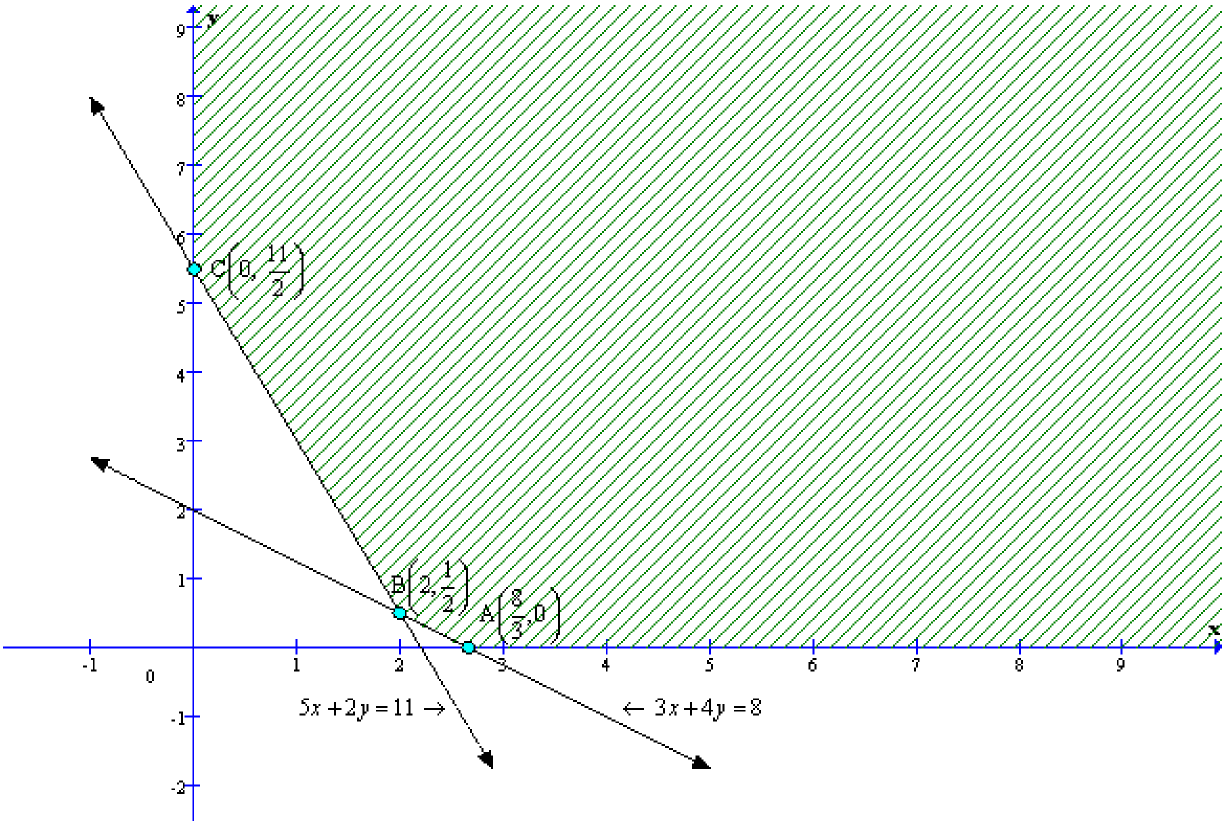
and $x \geq 0$, $y \geq 0$

To solve the LPP we draw the lines,

$3x + 4y = 8$,

$5x + 2y = 11$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABC are $A\left(\frac{8}{3}, 0\right)$, $B\left(2, \frac{1}{2}\right)$ and $C\left(0, \frac{11}{2}\right)$.

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = 60x + 80y$
$A\left(\frac{8}{3}, 0\right)$	$Z = 160$
$B\left(2, \frac{1}{2}\right)$	$Z = 160$
$C\left(0, \frac{11}{2}\right)$	$Z = 440$

The minimum value of the mixture is Rs. 160 at all points on the line segment joining points $\left(\frac{8}{3}, 0\right)$ and $\left(2,\right.$

Linear Programming Ex 30.3 Q11

Let x be the number of one kind of cake and
y be the number of second kind of cakes that are made.

Then the mathematical model of the LPP is as follows:

Maximize $Z = x + y$

Subject to $200x + 100y \le 5000$,

$25x + 50y \le 1000$

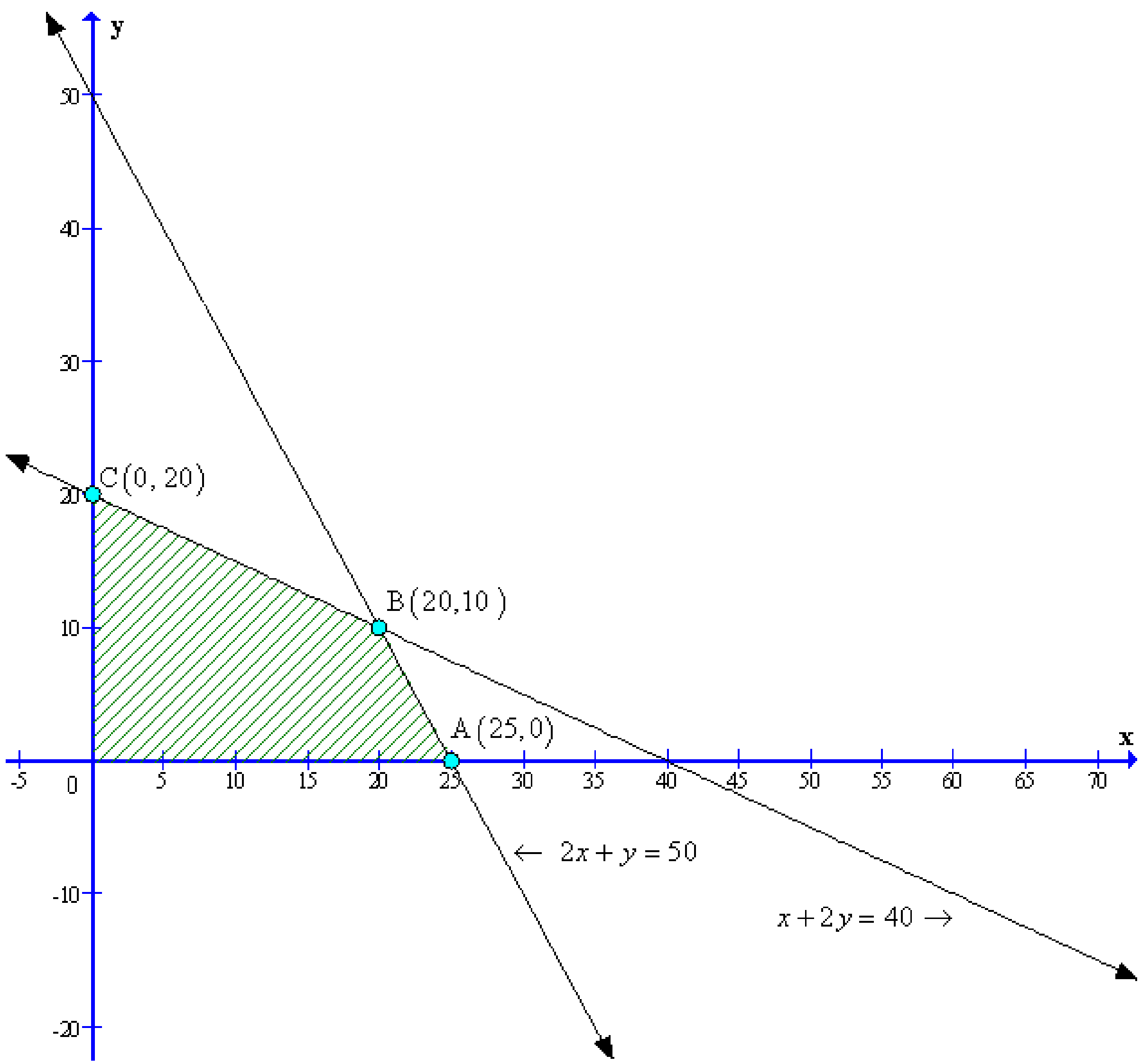
and $x \ge 0$, $y \ge 0$

To solve the LPP we draw the lines,

$2x + y = 50$,

$x + 2y = 40$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABC are A(25, 0), B(20,10) and C(0,20).

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = x + y$
A(25, 0)	Z = 25
B(20, 10)	Z = 30
C(0, 20)	Z = 20

The maximum of 30 cakes can be made.

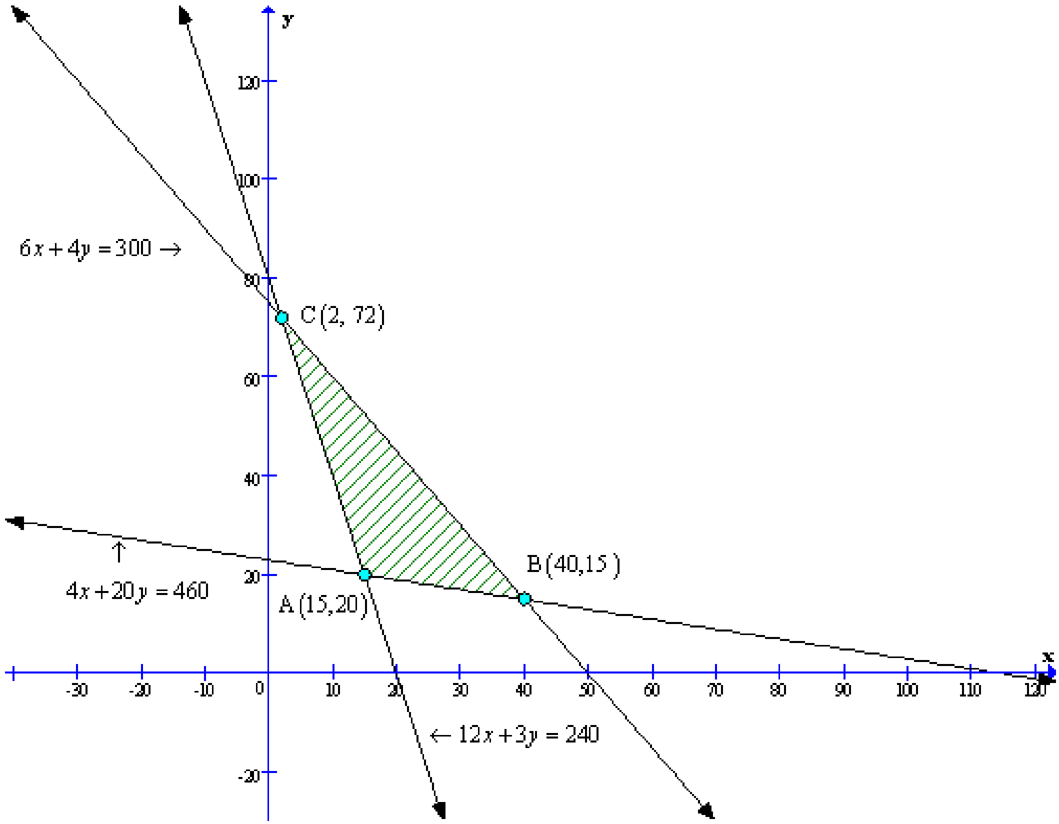
Linear Programming Ex 30.3 Q12

Let x be the number of packets of food P
y be the number of packets of food Q used to minimize vitamin A.

Then the mathematical model of the LPP is as follows:
Minimize $Z = 6x + 3y$
Subject to $12x + 3y \geq 240$,
$4x + 20y \geq 460$
$6x + 4y \leq 300$
and $x \geq 0,\ y \geq 0$

To solve the LPP we draw the lines,
$12x + 3y = 240$,
$4x + 20y = 460$,
$6x + 4y = 300$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABC are A(15, 20), B(40, 15) and C(2, 72).

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = 6x + 3y$
A(15, 20)	Z = 150
B(40, 15)	Z = 285
C(2, 72)	Z = 228

15 packets of food P and 20 packets of food Q should be used to minimise the amount of vitamin
The minimum amount of vitamin A is 150 units.

Linear Programming Ex 30.3 Q13

Let x be the number of bags of brand P
y be the number of bags of brand Q.

Then the mathematical model of the LPP is as follows:

Minimize $Z = 250x + 200y$

Subject to $3x + 1.5y \geq 18$,

$2.5x + 11.25y \geq 45$

$2x + 3y \geq 24$

and $x \geq 0$, $y \geq 0$

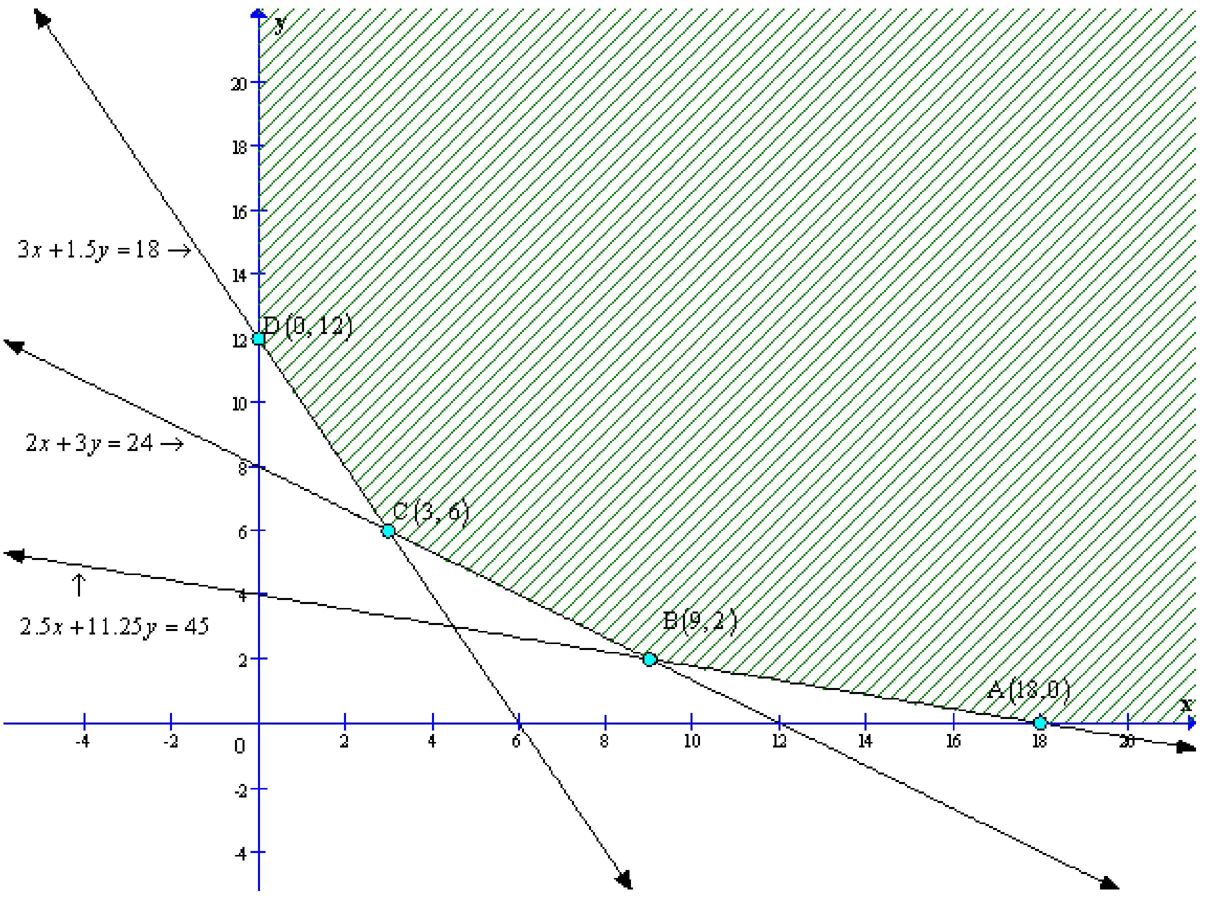
To solve the LPP we draw the lines,

$3x + 1.5y = 18$,

$2.5x + 11.25y = 45$

$2x + 3y = 24$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABCD are A(18, 0), B(9,2), C(3, 6) and D(0, 12).

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = 250x + 200y$
A(18, 0)	Z = 4500
B(9, 2)	Z = 2650
C(3, 6)	Z = 1950
D(0,12)	Z = 2400

3 bags of brand P and 6 bags of brand Q should be mixed in order to prepare the mixture having a minumum cost per bag.

Mimum cost of the mixture per bag is $= \frac{1950}{9}$ = Rs. 216.67.

Note: Answer given in the book is incorrect.

Linear Programming Ex 30.3 Q14

Let x be the amount of food X and y be the amount of food Y that is to be mixed which will produce the required diet.

Then the mathematical model of the LPP is as follows:

Minimize $Z = 16x + 20y$

Subject to $x + 2y \geq 10$,

$2x + 2y \geq 12$

$3x + y \geq 8$

and $x \geq 0,\ y \geq 0$

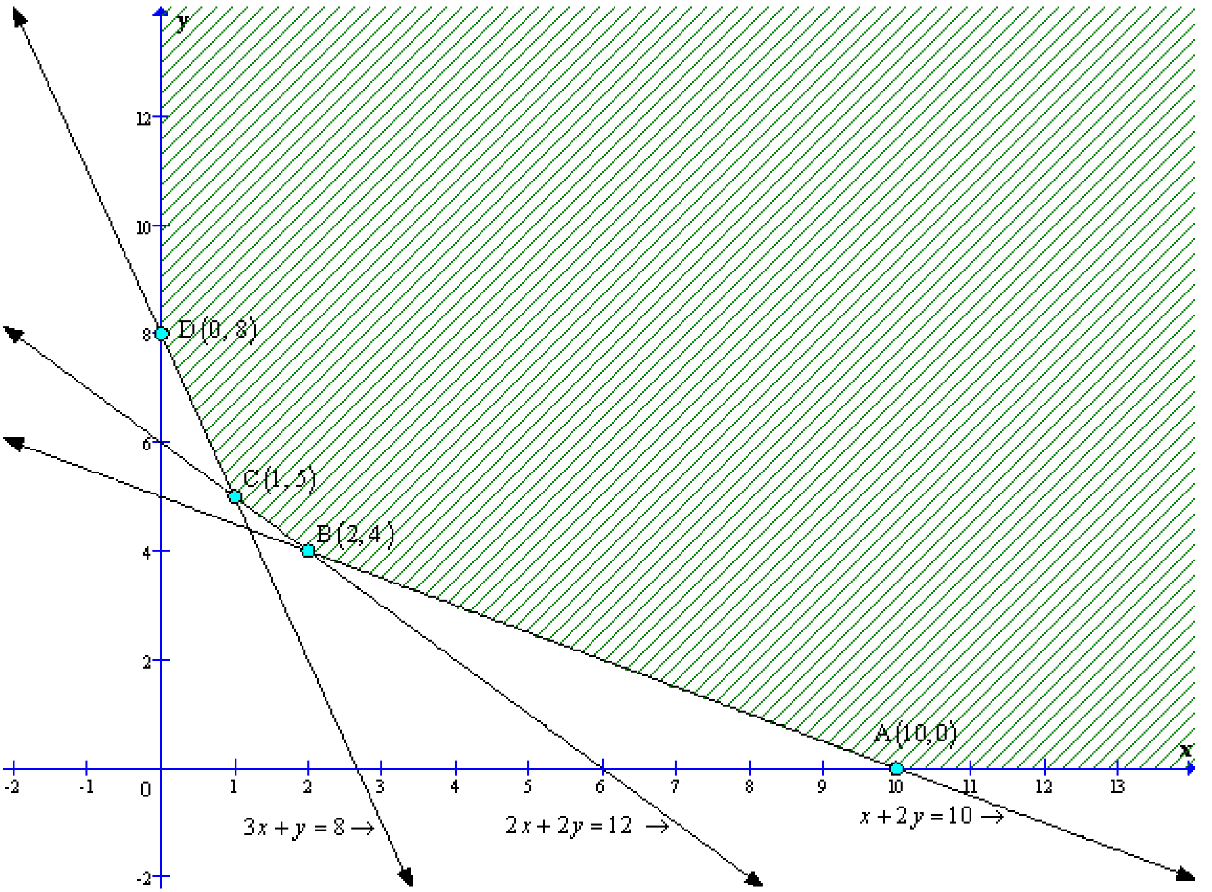
To solve the LPP we draw the lines,

$x + 2y = 10$,

$2x + 2y = 12$

$3x + y = 8$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABCD are A(10, 0), B(2, 4), C(1, 5) and D(0, 8).

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = 16x + 20y$
A(10, 0)	Z = 160
B(2, 4)	Z = 112
C(1, 5)	Z = 116
D(0, 8)	Z = 160

2 kg of food X and 4 kg of food y will be required to mimimize the cost of the diet.
The least cost of the mixture is Rs. 112.

Linear Programming Ex 30.3 Q15

Let x bags of fertilizer P and y bags of fertilizer Q used in the garden to minimize the usage of nitroge

Then the mathematical model of the LPP is as follows:

Minimize $Z = 3x + 3.5y$

Subject to $x + 2y \geq 240$,

$3x + 1.5y \geq 270$

$1.5x + 2y \leq 310$

and $x \geq 0$, $y \geq 0$

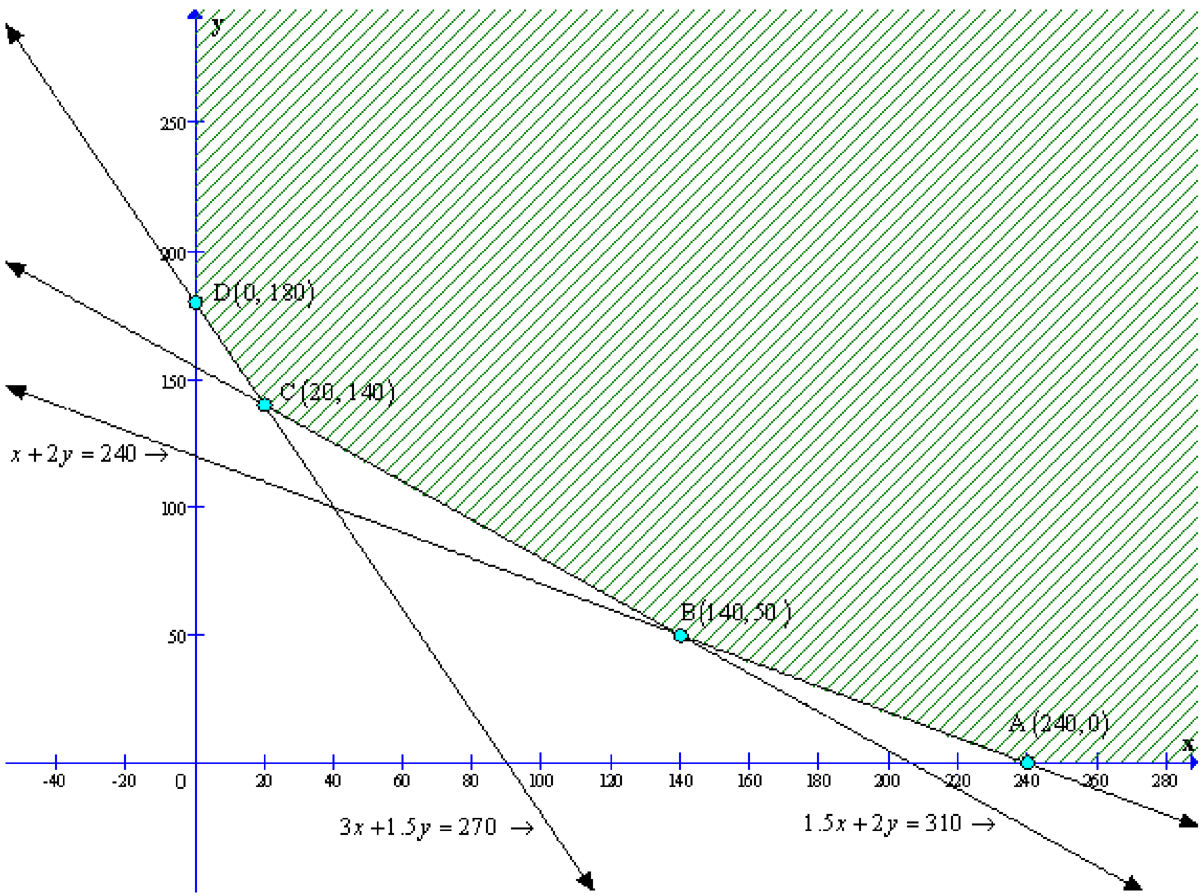
To solve the LPP we draw the lines,

$x + 2y = 240$,

$3x + 1.5y = 270$

$1.5x + 2y = 310$

The feasible region of the LPP is shaded in graph.



The coordinates of the vertices (Corner - points) of shaded feasible region ABC are A(40, 100), B(140, 50) and C(20, 140).

The values of the objective of function at these points are given in the following table:

Point (x_1, x_2)	Value of objective function $Z = 3x + 3.5y$
A(40, 100)	$Z = 470$
B(140, 50)	$Z = 595$
C(20, 140)	$Z = 550$

40 bags of brand P and 100 bags of brand Q should be used to minimize the amount of nitrogen added to the garden.
The minimum amount of nitrogen added in the garden is 470kg.