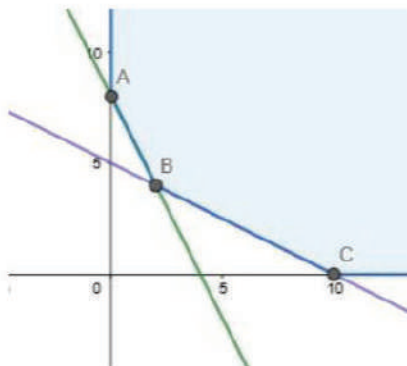


∴ According to the question,

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

$$\text{Minimize } Z = 5x + 7y$$

The feasible region determined  $2x + y \geq 8, x + 2y \geq 10, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,8), B(2,4), C(10,0)$ . The value of  $Z$  at corner points are

Corner Point	$Z = 5x + 7y$	
$A(0,8)$	56	
$B(2,4)$	38	Minimum
$C(10,0)$	50	



The minimum value of  $Z$  is 160 at point  $(4,2)$ .

Hence, the dietician should mix 2 units of  $X$  and 4 units of  $Y$  to meet the requirements at minimum cost of Rs.38.

### 30. Question

A dietician wishes to mix two types of food,  $X$  and  $Y$ , in such a way that the vitamin contents of the mixture contains at least 8 units of vitamin A and 10 units of vitamin C. Food  $X$  contains 2 units/kg of vitamin A and 1 unit /kg of vitamin C, while food  $Y$  contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs ₹5 per kg to purchase the food  $X$  and ₹7 per kg to purchase the food  $Y$ . Determine the minimum cost of such a mixture.

### Answer

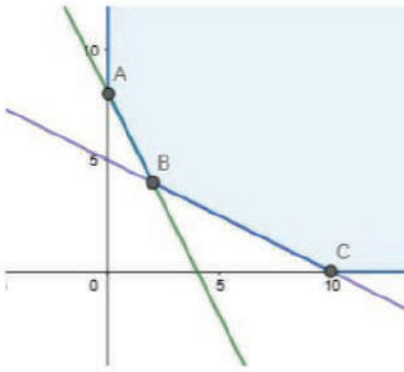
Let  $x$  and  $y$  be number of units of  $X$  and  $Y$ .

∴ According to the question,

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

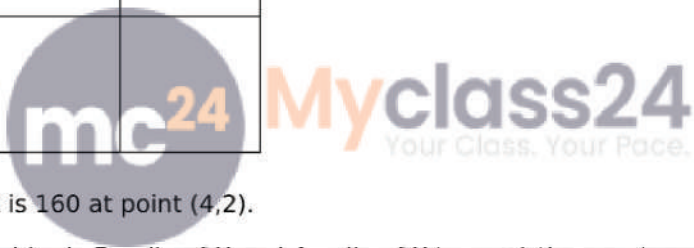
$$\text{Minimize } Z = 5x + 7y$$

The feasible region determined  $2x + y \geq 8, x + 2y \geq 10, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,8)$  ,  $B(2,4)$  ,  $C(10,0)$ .The value of  $Z$  at corner points are

Corner Point	$Z = 5x + 7y$	
$A(0,8)$	56	
$B(2,4)$	38	Minimum
$C(10,0)$	50	



The minimum value of  $Z$  is 160 at point  $(4,2)$ .

Hence, the dietician should mix 2 units of  $X$  and 4 units of  $Y$  to meet the requirements at minimum cost of Rs.38.

### 31. Question

A diet for a sick person must contain at least 4000 units of vitamins, 50 units of mineral and 1400 calories. Two food,  $A$  and  $B$ , are available at a cost of ₹4 and ₹3 per unit respectively. If one unit of  $A$  contains 200 units of vitamins, 1 unit of mineral and 40 calories, and 1 unit of  $B$  contains 100 units of vitamins, 2 units of mineral and 40 calories, find what combination of foods should be used to have the least cost.

### Answer

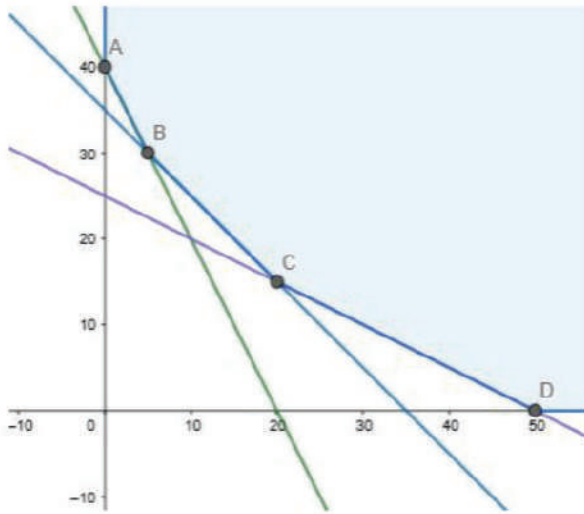
Let  $x$  and  $y$  be number of units of food  $A$  and  $B$ .

∴ According to the question,

$$200x + 100y \geq 4000, x + 2y \geq 50, 40x + 40y \geq 1400, x \geq 0, y \geq 0$$

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

The feasible region determined  $200x + 100y \geq 4000, x + 2y \geq 50, 40x + 40y \geq 1400, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are A(0,40) , B(5,30) , C(20,15) , D(50,0).The value of Z at corner points are

Corner Point	$Z = 4x + 3y$	
A(0,40)	120	
B(5,30)	110	Minimum
C(20,15)	125	
D(50,0)	200	



The minimum value of Z is 110 at point (5,30).

Hence, the diet should contain 5 units of food A and 30 units of food B for the least cost.

### 31. Question

A diet for a sick person must contain at least 4000 units of vitamins, 50 units of mineral and 1400 calories. Two food, A and B, are available at a cost of ₹4 and ₹3 per unit respectively. If one unit of A contains 200 units of vitamins, 1 unit of mineral and 40 calories, and 1 unit of B contains 100 units of vitamins, 2 units of mineral and 40 calories, find what combination of foods should be used to have the least cost.

### Answer

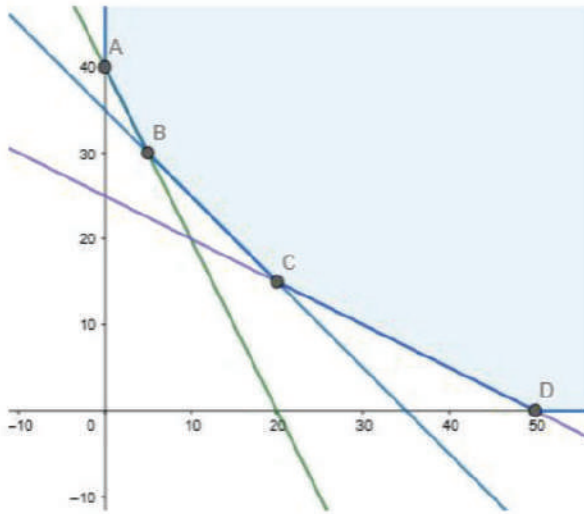
Let x and y be number of units of food A and B.

∴According to the question,

$$200x + 100y \geq 4000, x + 2y \geq 50, 40x + 40y \geq 1400, x \geq 0, y \geq 0$$

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

The feasible region determined  $200x + 100y \geq 4000, x + 2y \geq 50, 40x + 40y \geq 1400, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,40)$  ,  $B(5,30)$  ,  $C(20,15)$  ,  $D(50,0)$ .The value of  $Z$  at corner points are

Corner Point	$Z = 4x + 3y$	
$A(0,40)$	120	
$B(5,30)$	110	Minimum
$C(20,15)$	125	
$D(50,0)$	200	



The minimum value of  $Z$  is 110 at point  $(5,30)$ .

Hence, the diet should contain 5 units of food A and 30 units of food B for the least cost.

### 32. Question

A housewife wishes to mix together two kinds of food, X and Y, in such a way that the mixture contains at least 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C.

The vitamin contents of 1 kg of each food are given below.

	Vitamin A	Vitamin B	Vitamin C
Food X	1	2	3
Food Y	2	2	1

If 1 kg of food X cost ₹6 and 1 kg of food Y costs ₹10, find the minimum cost of the mixture which will produce the diet.

### Answer

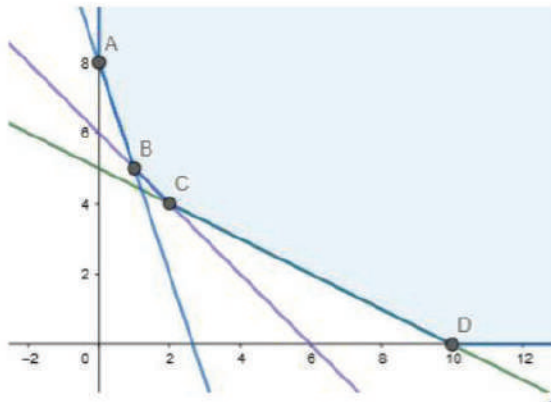
Let  $x$  and  $y$  be number of kilograms of food X and Y.

∴ According to the question,

$$x + 2y \geq 10, 2x + 2y \geq 12, 3x + y \geq 8, x \geq 0, y \geq 0$$

$$\text{Minimize } Z = 6x + 10y$$

The feasible region determined  $x + 2y \geq 10, 2x + 2y \geq 12, 3x + y \geq 8, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are A(0,8), B(1,5), C(2,4), D(10,0). The value of Z at corner points are

Corner Point	$Z = 6x + 10y$	
A(0,8)	80	
B(1,5)	56	
C(2,4)	52	Minimum
D(10,0)	60	

The minimum value of Z is 52 at point (2,4).

Hence, the diet should contain 2 kgs of food X and 4 kgs of food Y for the least cost of Rs. 52.

### 32. Question

A housewife wishes to mix together two kinds of food, X and Y, in such a way that the mixture contains at least 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C.

The vitamin contents of 1 kg of each food are given below.

	Vitamin A	Vitamin B	Vitamin C
Food X	1	2	3
Food Y	2	2	1

If 1 kg of food X cost ₹6 and 1 kg of food Y costs ₹10, find the minimum cost of the mixture which will produce the diet.

### Answer

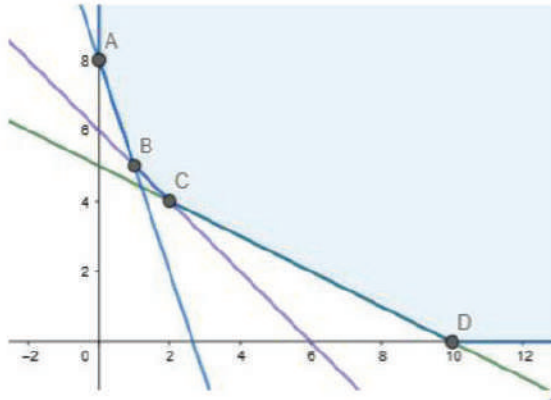
Let  $x$  and  $y$  be number of kilograms of food X and Y.

∴ According to the question,

$$x + 2y \geq 10, 2x + 2y \geq 12, 3x + y \geq 8, x \geq 0, y \geq 0$$

$$\text{Minimize } Z = 6x + 10y$$

The feasible region determined  $x + 2y \geq 10, 2x + 2y \geq 12, 3x + y \geq 8, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,8)$ ,  $B(1,5)$ ,  $C(2,4)$ ,  $D(10,0)$ . The value of  $Z$  at corner points are

Corner Point	$Z = 6x + 10y$	
$A(0,8)$	80	
$B(1,5)$	56	
$C(2,4)$	52	Minimum
$D(10,0)$	60	

The minimum value of  $Z$  is 52 at point  $(2,4)$ .

Hence, the diet should contain 2 kgs of food X and 4 kgs of food Y for the least cost of Rs. 52.

### 33. Question

A firm manufactures two types of product, A and B, and sells them at a profit of ₹5 per unit of type A and ₹3 per unit of type B. Each product is processed on two machines,  $M_1$  and  $M_2$ . one unit of type A requires one minute of processing time on  $M_1$  and two minutes of processing time on  $M_2$ ; whereas one unit of type B requires one minute of processing time on  $M_1$  and one minute on  $M_2$ . Machines  $M_1$  and  $M_2$  are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product the firm should produce a day in order to maximize the profit. Solve the problem graphically.

### Answer

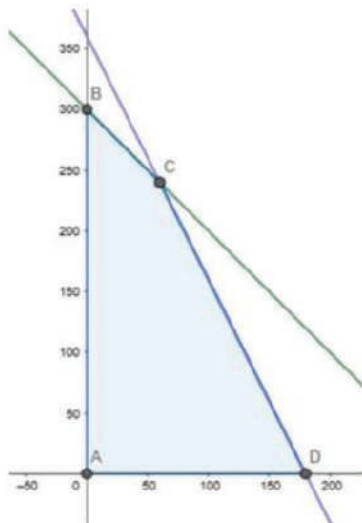
Let the firm manufacture  $x$  number of A and  $y$  number of B products.

∴ According to the question,

$$X + y \leq 300, 2x + y \leq 360, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 5x + 3y$$

The feasible region determined  $X + y \leq 300, 2x + y \leq 360, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$ ,  $B(0,300)$ ,  $C(60,240)$ ,  $D(180,0)$ . The value of  $Z$  at corner point is

Corner Point	$Z = 5x + 3y$	
$A(0,0)$	0	
$B(0,300)$	900	
$C(60,240)$	1020	Maximum
$D(180,0)$	900	



The maximum value of  $Z$  is 1020 and occurs at point  $(60,240)$ .

The firm should produce 60 A products and 240 B products to earn maximum profit of Rs.1020.

### 33. Question

A firm manufactures two types of product, A and B, and sells them at a profit of ₹5 per unit of type A and ₹3 per unit of type B. Each product is processed on two machines,  $M_1$  and  $M_2$ . one unit of type A requires one minute of processing time on  $M_1$  and two minutes of processing time on  $M_2$ ; whereas one unit of type B requires one minute of processing time on  $M_1$  and one minute on  $M_2$ . Machines  $M_1$  and  $M_2$  are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product the firm should produce a day in order to maximize the profit. Solve the problem graphically.

## Answer

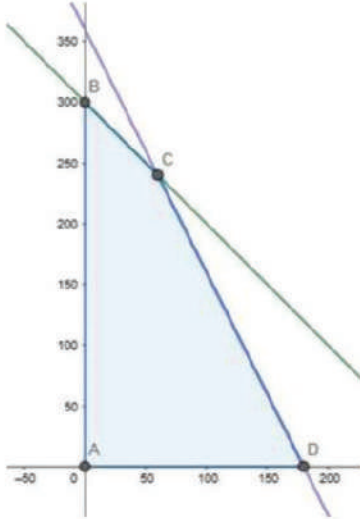
Let the firm manufacture  $x$  number of A and  $y$  number of B products.

∴ According to the question,

$$X + y \leq 300, 2x + y \leq 360, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 5x + 3y$$

The feasible region determined  $X + y \leq 300, 2x + y \leq 360, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$ ,  $B(0,300)$ ,  $C(60,240)$ ,  $D(180,0)$ . The value of  $Z$  at corner point is

Corner Point	$Z = 5x + 3y$	
$A(0,0)$	0	
$B(0,300)$	900	
$C(60,240)$	1020	Maximum
$D(180,0)$	900	

The maximum value of  $Z$  is 1020 and occurs at point  $(60,240)$ .

The firm should produce 60 A products and 240 B products to earn maximum profit of Rs.1020.

## 34. Question

A small firm manufactures items A and B. The total number of items that it can manufacture in a day is at most 24. Item A takes one hour to make while item B takes only half an hour. The maximum time available per day is 16 hours. If the profit on one unit item A be ₹300 and that on one unit of item B be ₹160, how many of each type of item should be produced to maximize the profit? Solve the problem graphically.

Ans. Z is maximum at (8, 16) and its maximum value is ₹4960

**Answer**

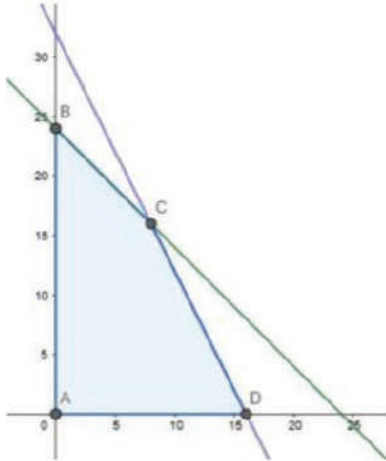
Let the firm manufacture x number of A and y number of B products.

∴ According to the question,

$$X + y \leq 24, x + 0.5y \leq 16, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 300x + 160y$$

The feasible region determined  $X + y \leq 24, x + 0.5y \leq 16, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are A(0,0) , B(0,24) , C(8,16) , D(16,0).The value of Z at corner point is

Corner Point	$Z = 300x + 160y$	
A(0,0)	0	
B(0,24)	3840	
C(8,16)	4960	Maximum
D(16,0)	4800	

The maximum value of Z is 4960 and occurs at point (8,16).

The firm should produce 8 A products and 16 B products to earn maximum profit of Rs.4960.

**34. Question**

A small firm manufactures items A and B. The total number of items that it can manufacture in a day is at most 24. Item A takes one hour to make while item B take only half an hour. The maximum time available per day is 16 hours. If the profit on one unit item A be ₹300 and that on one unit of item B be ₹160, how many of each type of item should be produced to maximize the profit? Solve the problem graphically.

Ans. Z is maximum at (8, 16) and its maximum value is ₹4960

**Answer**

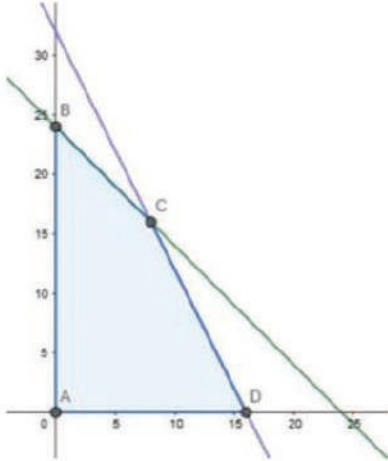
Let the firm manufacture  $x$  number of A and  $y$  number of B products.

∴ According to the question,

$$X + y \leq 24, x + 0.5y \leq 16, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 300x + 160y$$

The feasible region determined  $X + y \leq 24, x + 0.5y \leq 16, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$  ,  $B(0,24)$  ,  $C(8,16)$  ,  $D(16,0)$ .The value of  $Z$  at corner point is

Corner Point	$Z = 300x + 160y$	
$A(0,0)$	0	
$B(0,24)$	3840	
$C(8,16)$	4960	Maximum
$D(16,0)$	4800	



The maximum value of  $Z$  is 4960 and occurs at point  $(8,16)$ .

The firm should produce 8 A products and 16 B products to earn maximum profit of Rs.4960.

**35. Question**

A manufacture produces two types of steel trunks. He has two machines, A and B. The first type of trunk requires 3 hours on machine A and 3 hours on machine B. The second type required 3 hours on machine A and 2 hours on Machine A and 2 hours on machine B. Machine A and B can work at most for 18 hours and 15 hours per day respectively. He earns a profit of ₹30 and ₹25 per trunk of the first type and second type respectively. How may trunks of each type must he make each day to make the maximum profit?

**Answer**

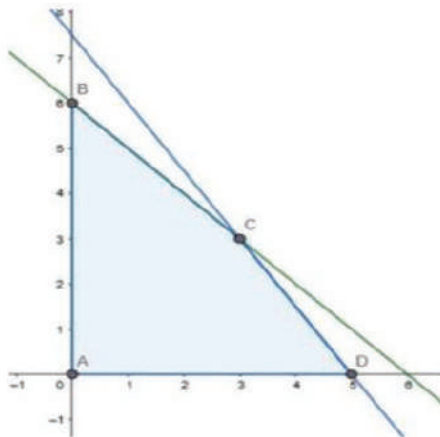
Let the manufacturer manufacture  $x$  and  $y$  numbers of type 1 and type 2 trunks.

∴ According to the question,

$$3x + 3y \leq 18, 3x + 2y \leq 15, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 30x + 25y$$

The feasible region determined  $3x + 3y \leq 18, 3x + 2y \leq 15, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$ ,  $B(0,6)$ ,  $C(3,3)$ ,  $D(5,0)$ . The value of  $Z$  at corner point is

Corner Point	$Z = 30x + 25y$	
$A(0,0)$	0	
$B(0,6)$	150	
$C(3,3)$	165	Maximum
$D(5,0)$	150	

The maximum value of  $Z$  is 165 and occurs at point  $(3,3)$ .

The manufacturer should manufacture 3 trunks of each type to earn maximum profit of Rs.165.

### 35. Question

A manufacturer produces two types of steel trunks. He has two machines, A and B. The first type of trunk requires 3 hours on machine A and 3 hours on machine B. The second type required 3 hours on machine A and 2 hours on machine B. Machine A and B can work at most for 18 hours and 15 hours per day respectively. He earns a profit of ₹30 and ₹25 per trunk of the first type and second type respectively. How many trunks of each type must he make each day to make the maximum profit?

### Answer

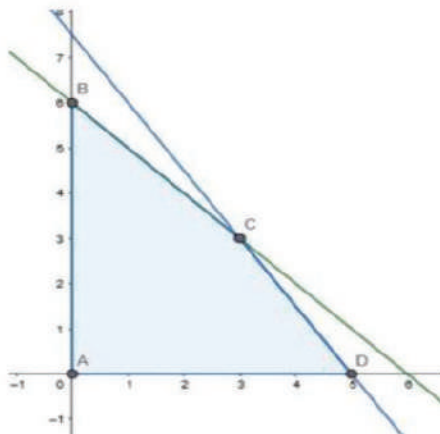
Let the manufacturer manufacture  $x$  and  $y$  numbers of type 1 and type 2 trunks.

∴ According to the question,

$$3x + 3y \leq 18, 3x + 2y \leq 15, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 30x + 25y$$

The feasible region determined  $3x + 3y \leq 18, 3x + 2y \leq 15, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$ ,  $B(0,6)$ ,  $C(3,3)$ ,  $D(5,0)$ . The value of  $Z$  at corner point is

Corner Point	$Z = 30x + 25y$	
$A(0,0)$	0	
$B(0,6)$	150	
$C(3,3)$	165	Maximum
$D(5,0)$	150	

The maximum value of  $Z$  is 165 and occurs at point  $(3,3)$ .

The manufacturer should manufacture 3 trunks of each type to earn maximum profit of Rs.165.

### 36. Question

A company manufactures two types of toys, A and B. Type A requires 5 minutes each for cutting and 10 minutes each for assembling. Type B required 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. The profit is ₹50 each on type A and ₹60 each on type B. how many toys of each types should the company manufactures in a day to maximize the profit?

### Answer

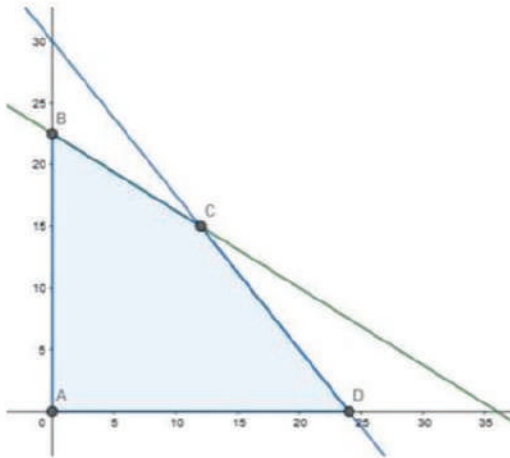
Let the company manufacture  $x$  and  $y$  numbers of toys A and B.

∴ According to the question,

$$5x + 8y \leq 180, 10x + 8y \leq 240, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 50x + 60y$$

The feasible region determined  $5X + 8y \leq 180$ ,  $10x + 8y \leq 240$ ,  $x \geq 0$ ,  $y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$ ,  $B(0,22.5)$ ,  $C(12,15)$ ,  $D(24,0)$ . The value of  $Z$  at corner point is

Corner Point	$Z = 50x + 60y$	
$A(0,0)$	0	
$B(0,22.5)$	1350	
$C(12,15)$	1500	Maximum
$D(24,0)$	1200	



The maximum value of  $Z$  is 1500 and occurs at point  $(12,15)$ .

The company should manufacture 12 A toys and 15 B toys to earn profit of rupees 1500.

### 36. Question

A company manufactures two types of toys, A and B. Type A requires 5 minutes each for cutting and 10 minutes each for assembling. Type B required 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. The profit is ₹50 each on type A and ₹60 each on type B. how many toys of each types should the company manufactures in a day to maximize the profit?

### Answer

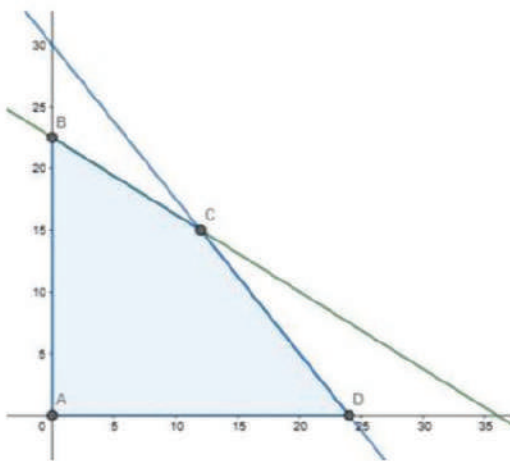
Let the company manufacture  $x$  and  $y$  numbers of toys A and B.

∴ According to the question,

$$5X + 8y \leq 180, 10x + 8y \leq 240, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 50x + 60y$$

The feasible region determined  $5X + 8y \leq 180$ ,  $10x + 8y \leq 240$ ,  $x \geq 0$ ,  $y \geq 0$  is given by



The corner points of feasible region are  $A(0,0)$  ,  $B(0,22.5)$  ,  $C(12,15)$  ,  $D(24,0)$ .The value of  $Z$  at corner point is

Corner Point	$Z = 50x + 60y$	
$A(0,0)$	0	
$B(0,22.5)$	1350	
$C(12,15)$	1500	Maximum
$D(24,0)$	1200	

The maximum value of  $Z$  is 1500 and occurs at point  $(12,15)$ .

The company should manufacture 12 A toys and 15 B toys to earn profit of rupees 1500.

### 37. Question

Kellogg is a new cereal formed of a mixture of bran and rice, that contains at least 88 grams of protein and at least 36 milligrams of iron. Knowing that bran contains 80 grams of protein and 40 milligrams of iron per kilograms, and that rice contains 100 grams of protein and 30 milligrams of iron per kilogram, find the minimum cost producing this new cereal if bran costs ₹5 per kilogram and rice costs ₹4 per kilogram.

### Answer

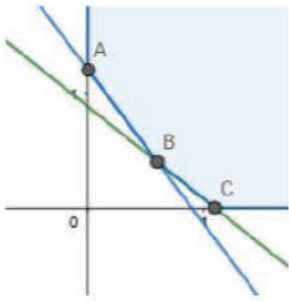
Let  $x$  and  $y$  be number of kilograms of bran and rice.

∴ According to the question,

$$80x + 100y \geq 88, 40x + 30y \geq 36, x \geq 0, y \geq 0$$

$$\text{Minimize } Z = 5x + 4y$$

The feasible region determined  $80x + 100y \geq 88, 40x + 30y \geq 36, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,1.2)$  ,  $B(0.6,0.4)$  ,  $C(1.1,0)$ .The value of  $Z$  at corner points are

Corner Point	$Z = 5x + 4y$	
$A(0,1.2)$	4.8	
$B(0.6,0.4)$	4.6	Minimum
$C(1.1,0)$	5.5	

The minimum value of  $Z$  is 4.6 at point  $(0.6,0.4)$ .

Hence, the diet should contain 0.6 kgs of bran and 0.4 kgs of rice for achieving minimum cost of Rs.4.6.

### 37. Question

Kellogg is a new cereal formed of a mixture of bran and rice, that contains at least 88 grams of protein and at least 36 milligrams of iron. Knowing that bran contains 80 grams of protein and 40 milligrams of iron per kilograms, and that rice contains 100 grams of protein and 30 milligrams of iron per kilogram, find the minimum cost producing this new cereal if bran costs ₹5 per kilogram and rice costs ₹4 per kilogram.

### Answer

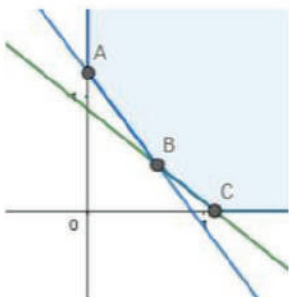
Let  $x$  and  $y$  be number of kilograms of bran and rice.

∴According to the question,

$$80x + 100y \geq 88, 40x + 30y \geq 36, x \geq 0, y \geq 0$$

$$\text{Minimize } Z = 5x + 4y$$

The feasible region determined  $80x + 100y \geq 88, 40x + 30y \geq 36, x \geq 0, y \geq 0$  is given by



The feasible region is unbounded. The corner points of feasible region are  $A(0,1.2)$  ,  $B(0.6,0.4)$  ,  $C(1.1,0)$ .The

value of Z at corner points are

Corner Point	$Z = 5x + 4y$	
A(0,1.2)	4.8	
B(0.6,0.4)	4.6	Minimum
C(1.1,0)	5.5	

The minimum value of Z is 4.6 at point (0.6,0.4).

Hence, the diet should contain 0.6 kgs of bran and 0.4 kgs of rice for achieving minimum cost of Rs.4.6.

### 38. Question

A dealer wishes to purchase a number of fans and sewing machines. He has only ₹5760 to invest and has space for at most 20 items. A fan costs him ₹360 and a sewing machine ₹240. He expects to sell a fan at a profit of ₹22 and a sewing machine at a profit of ₹18. Assuming that he can sell all the items that he buys, how should he invest his money to maximize the profit? Solve the graphically and find the maximum profit.

### Answer

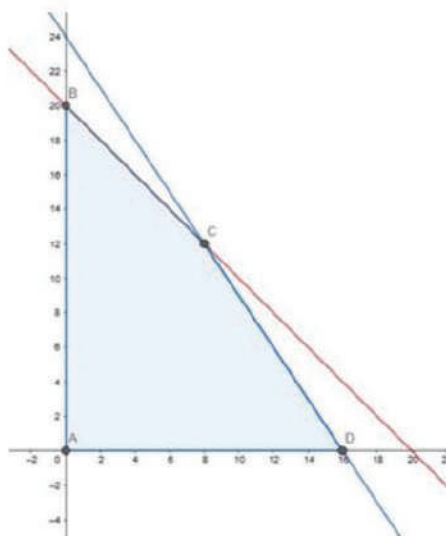
Let the number of fans bought be  $x$  and sewing machines bought be  $y$ .

∴ According to the question,

$$360x + 240y \leq 5760, x + y \leq 20, x \geq 0, y \geq 0$$

Maximize  $Z = 22x + 18y$

The feasible region determined by  $360x + 240y \leq 5760, x + y \leq 20, x \geq 0, y \geq 0$  is given by



The corner points of the feasible region are A(0,0), B(0,20), C(8,12), D(16,0). The value of Z at corner points is

Corner Point	$Z = 22x + 18y$	
A(0,0)	0	
B(0,20)	360	
C(8,12)	392	Maximum
D(16,0)	352	

The maximum value of  $Z$  is 392 at point (8,12).

The dealer must buy 8 fans and 12 sewing machines to make the maximum profit.

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### Answer

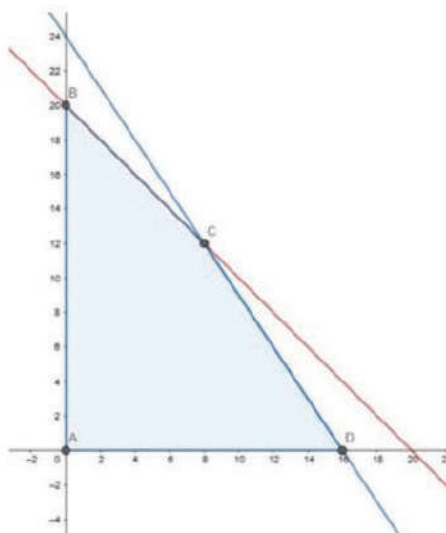
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### 39. Question

Anil wants to invest at the most ₹12000 in bonds A and B. According to rules, he has to invest at least ₹2000 in bond A and at least ₹4000 in bond B. If the rate of interest of bond A is 8% per annum and on bond B, it is 10% per annum, how should he invest his money for maximum interest? Solve the problem graphically.

### Answer

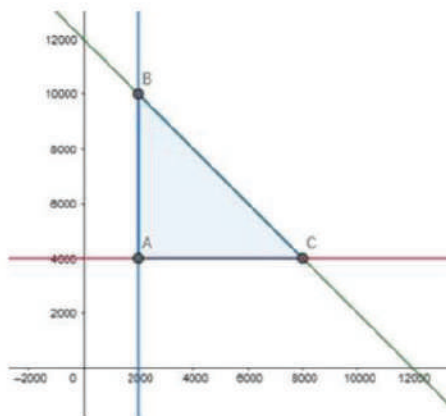
Let the invested money in bond A be  $x$  and in bond B be  $y$ .

∴ According to the question,

$$X + y \leq 12000, x \geq 2000, y \geq 4000$$

$$\text{Maximize } Z = 0.08x + 0.10y$$

The feasible region determined by  $X + y \leq 12000, x \geq 2000, y \geq 4000$  is given by



The corner points of the feasible region are A(2000,4000) , B(2000,10000) and C(8000,4000) . The value of  $Z$  at the corner point are

Corner Point	$Z = 0.08x + 0.10y$	
A(2000,4000)	560	
B(2000,10000)	1160	Maximum
C(8000,4000)	1040	

The maximum value of Z is 116770 at point (2000,10000)

So, he must invest Rs.2000 in bond A and Rs.10000 in bond B.

The maximum annual income is Rs.1160 .

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### Answer

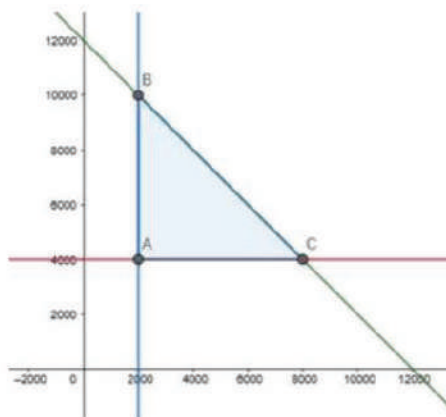
Let the invested money in bond A be x and in bond B be y.

∴ According to the question,

$$X + y \leq 12000, x \geq 2000, y \geq 4000$$

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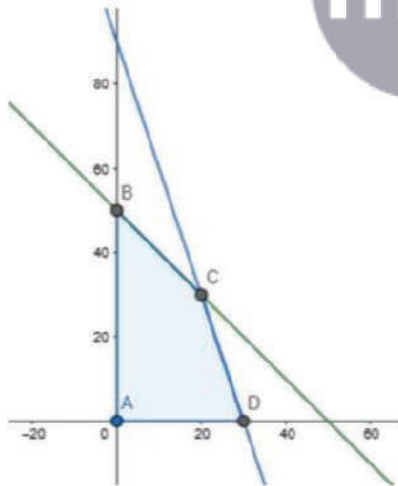
#### 40. Question

Maximize =  $60x + 15y$ , subject to the constraints

$x + y \leq 50$ ,  $3x + y \leq 90$ ,  $x, y \geq 0$ .

#### Answer

The feasible region determined by the constraints  $x + y \leq 50$ ,  $3x + y \leq 90$ ,  $x, y \geq 0$ . is given by



The corner points of feasible region are A(0,0) ,B(0,50) ,C(20,30), D(30,0) . The values of Z at the following points is

Corner Point	$Z = 60x + 15y$	
A(0,0)	0	
B(0,50)	750	
C(20,30)	1650	
D(30,0)	1800	Maximum

The maximum value of  $Z$  is 1800 at point A(30,0) .

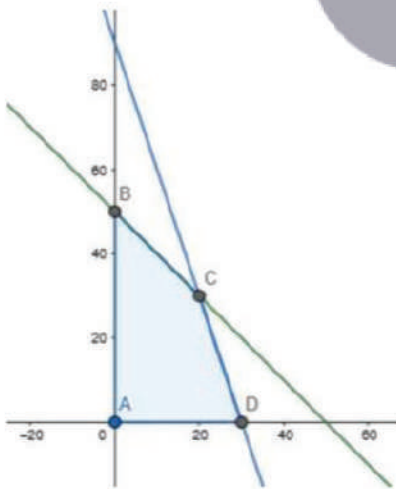
#### 40. Question

Maximize  $Z = 60x + 15y$ , subject to the constraints

$$x + y \leq 50, 3x + y \leq 90, x, y \geq 0.$$

#### Answer

The feasible region determined by the constraints  $x + y \leq 50, 3x + y \leq 90, x, y \geq 0$  is given by



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Corner Point	$Z = 60x + 15y$	
A(0,0)	0	
B(0,50)	750	
C(20,30)	1650	
D(30,0)	1800	Maximum

The maximum value of  $Z$  is 1800 at point A(30,0) .

#### 41. Question

A company manufacture two types of toys A and B. type A requires 5 minutes each for cutting and 10 minutes for each assembling. Type B requires 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. He earns a profit of ₹50 each on type A and ₹60 each on type B. How many toys of each type should the company manufacture in a day to maximize the profit?

#### Answer

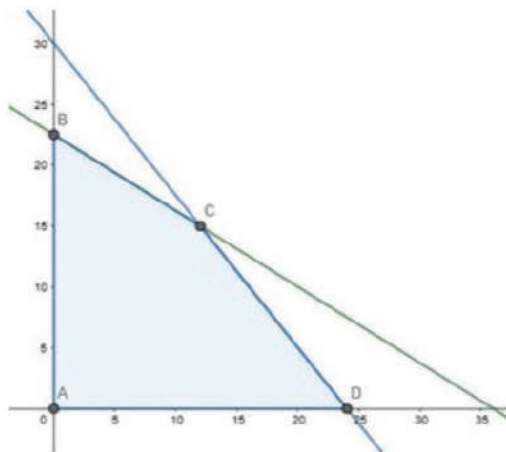
Let the company manufacture  $x$  and  $y$  numbers of toys A and B.

∴ According to the question,

$$5X + 8y \leq 180, 10x + 8y \leq 240, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 50x + 60y$$

The feasible region determined  $5X + 8y \leq 180, 10x + 8y \leq 240, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are A(0,0) , B(0,22.5) , C(12,15) , D(24,0).The value of  $Z$  at corner point is

Corner Point	$Z = 50x + 60y$	
A(0,0)	0	
B(0,22.5)	1350	
C(12,15)	1500	Maximum
D(24,0)	1200	

The maximum value of  $Z$  is 1500 and occurs at point (12,15).

The company should manufacture 12 A toys and 15 B toys to earn profit of rupees 1500.

#### 41. Question

A company manufacture two types of toys A and B. type A requires 5 minutes each for cutting and 10 minutes for each assembling. Type B requires 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. He earns a profit of ₹50 each on type A and ₹60 each on type B. How many toys of each type should the company manufacture in a day to maximize the profit?

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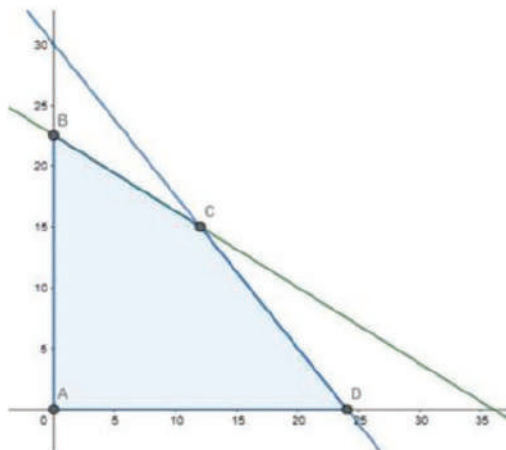
Let the company manufacture  $x$  and  $y$  numbers of toys A and B.

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Corner Point	$Z = 50x + 60y$	
A(0,0)	0	
B(0,22.5)	1350	
C(12,15)	1500	Maximum
D(24,0)	1200	

The maximum value of  $Z$  is 1500 and occurs at point (12,15).

The company should manufacture 12 A toys and 15 B toys to earn profit of rupees 1500.

#### 42. Question

One kind of cake requires 200 g of flour and 25 g of fat, another kind of cake requires 100 g of flour and 50 g of fat. Find the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat, assuming that there is no shortage of the other ingredients used in making the cakes. Make it an LPP and solve it graphically.

#### Answer

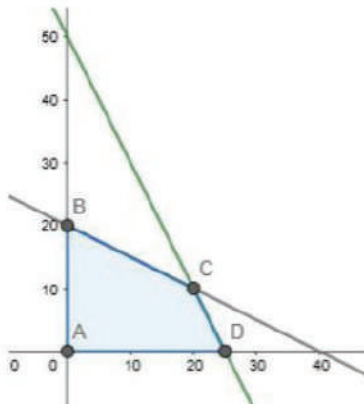
Let the company make  $x$  no of 1<sup>st</sup> kind and  $y$  no of 2<sup>nd</sup> cakes.

∴ According to the question,

$$200x + 100y \leq 5000, 25x + 50y \leq 1000, x \geq 0, y \geq 0$$

Maximize  $Z = x + y$

The feasible region determined by  $200x + 100y \leq 5000, 25x + 50y \leq 1000, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are A(0,0), B(0,20), C(20,10), D(25,0). The value of  $Z$  at corner point is

Corner Point	$Z = x + y$	
A(0,0)	0	
B(0,20)	20	
C(20,10)	30	Maximum
D(25,0)	25	

The maximum value of  $Z$  is 30 and occurs at point (20,10).

The company should make 20 of 1<sup>st</sup> type and 10 of 2<sup>nd</sup> type.

#### 42. Question

One kind of cake requires 200 g of flour and 25 g of fat, another kind of cake requires 100 g of flour and 50 g of fat. Find the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat, assuming that there is no shortage of the other ingredients used in making the cakes. Make it an LPP and solve it graphically.

#### Answer

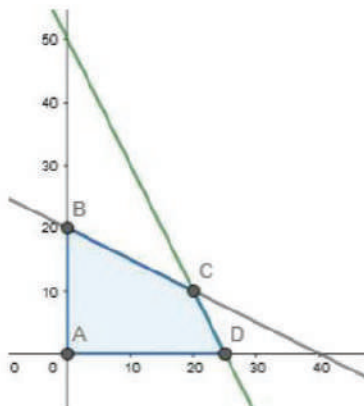
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Corner Point	$Z = x + y$	
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B(0,20)	20	
C(20,10)	30	Maximum
D(25,0)	25	

The maximum value of  $Z$  is 30 and occurs at point (20,10).

The company should make 20 of 1<sup>st</sup> type and 10 of 2<sup>nd</sup> type.

#### 43. Question

A manufacturing company makes two types of teaching aids A and B of mathematics for class XII. Each type of A requires 9 labor hours of fabricating and 1 labor hour for finishing. Each type of B requires 12 labor hours for fabricating and 3 labor hours for finishing. For fabricating and finishing, the maximum labor hours available per week are 180 and 30 respectively. The company makes a profit of ₹80 on each piece of type A and ₹120 on each piece of type B. How many pieces of type A and type B should be manufactured per week to get a maximum profit? Make it as an LLP and solve graphically. What is the maximum profit per week?

#### Answer

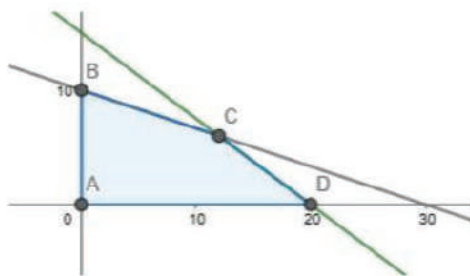
Let the company make  $x$  no of 1<sup>st</sup> type of teaching aid and  $y$  no of 2<sup>nd</sup> type of teaching aid.

∴ According to the question,

$$9x + 12y \leq 180, x + 3y \leq 30, x \geq 0, y \geq 0$$

$$\text{Maximize } Z = 80x + 120y$$

The feasible region determined by  $9x + 12y \leq 180, x + 3y \leq 30, x \geq 0, y \geq 0$  is given by



The corner points of feasible region are A(0,0) , B(0,10) , C(12,6) , D(20,0).The value of  $Z$  at corner point is

Corner Point	$Z = 80x + 120y$	
A(0,0)	0	
B(0,10)	1200	
C(12,6)	1680	Maximum
D(20,0)	1600	

The maximum value of  $Z$  is 1680 and occurs at point (12,6).

The company should make 12 of 1<sup>st</sup> type and 6 of 2<sup>nd</sup> type of teaching aid. Maximum profit is Rs.1680.

#### 43. Question

A manufacturing company makes two types of teaching aids A and B of mathematics for class XII. Each type of A requires 9 labor hours of fabricating and 1 labor hour for finishing. Each type of B requires 12 labor hours for fabricating and 3 labor hours for finishing. For fabricating and finishing, the maximum labor hours available per week are 180 and 30 respectively. The company makes a profit of ₹80 on each piece of type A and ₹120 on each piece of type B. How many pieces of type A and type B should be manufactured per week to get a maximum profit? Make it as an LLP and solve graphically. What is the maximum profit per week?

#### Answer

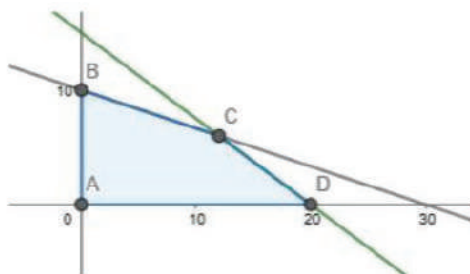
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Corner Point	$Z = 80x + 120y$	
A(0,0)	0	
B(0,10)	1200	
C(12,6)	1680	Maximum
D(20,0)	1600	

The maximum value of  $Z$  is 1680 and occurs at point (12,6).

The company should make 12 of 1<sup>st</sup> type and 6 of 2<sup>nd</sup> type of teaching aid. Maximum profit is Rs.1680.

