Solutions to “More Optimization Problems”

1. Let x = #chickens
Let y = #quails

$x \geq 0$

$y \geq 0$

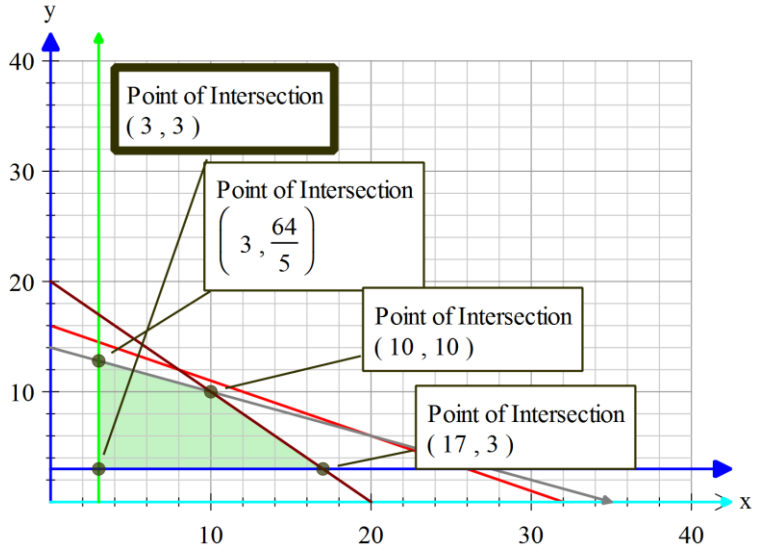
$2x + 5y \leq 70$

$x \geq 3$

$y \geq 3$

$x + y \leq 20$

Objective function: Maximize P = 2x + 4y



(x,y)	P = 2x + 4y
(3,3)	18
(3,12.8)	57.2
(10,10)	60 ← Max
(17,3)	46

Solution : 10 chickens and 10 quails will give him a maximum profit of $60.

2. Let x = #females
Let y = #males

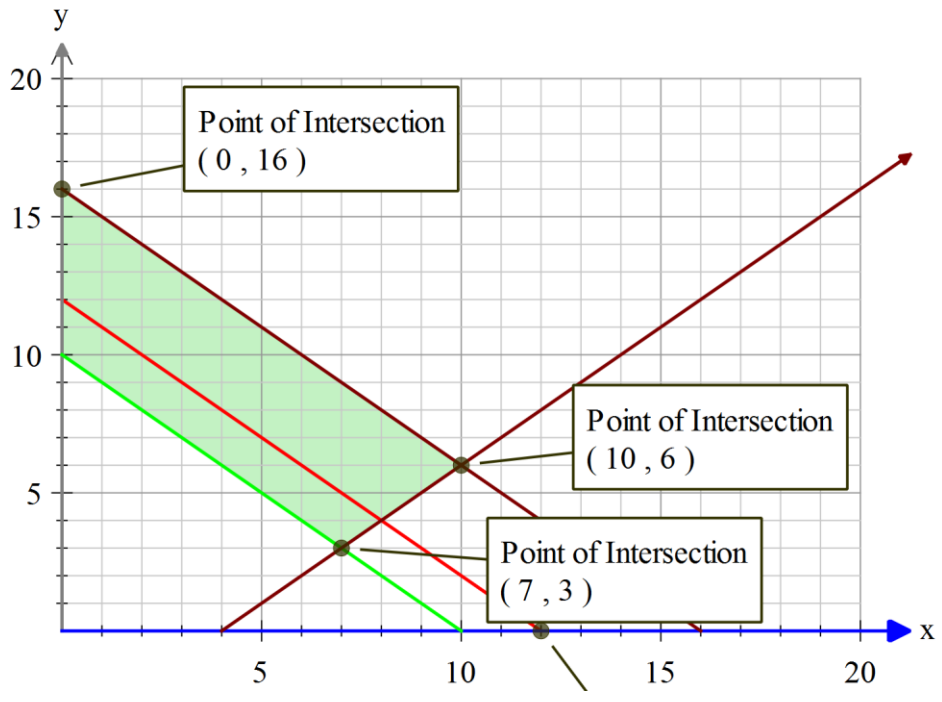
$x \geq 0$

$y \geq 0$

$x + y \geq 10$

$x + y \leq 16$ Objective: Minimize x + y

$x \leq y + 4$



(x,y)	S = x + y
(7,3)	10← Min
(10,6)	16
(0,16)	16
(0,10)	10← Min

Since both (7,3) and (0,10) minimize the objective function, then all of the integral points in between also do so. The possible solutions, therefore, are:

7 females and 3 males
6 females and 4 males
5 females and 5 males
4 females and 6 males
3 females and 7 males
2 females and 8 males
1 female and 9 males
0 females and 10 males

3. Let x = # litres of oil
Let y = # litres of gas

$x \geq 0$

$y \geq 0$

$x + y \leq 30$

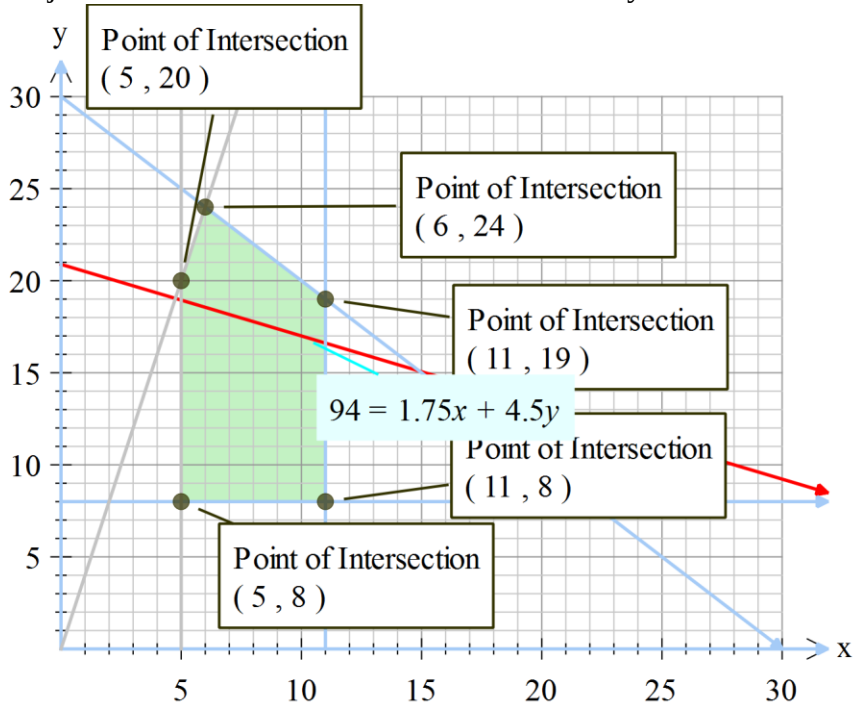
$y \geq 8$

$x \geq 5$

$x \leq 11$

$y \leq 4x$

Objective function: Maximize T = 1.75x + 4.5y



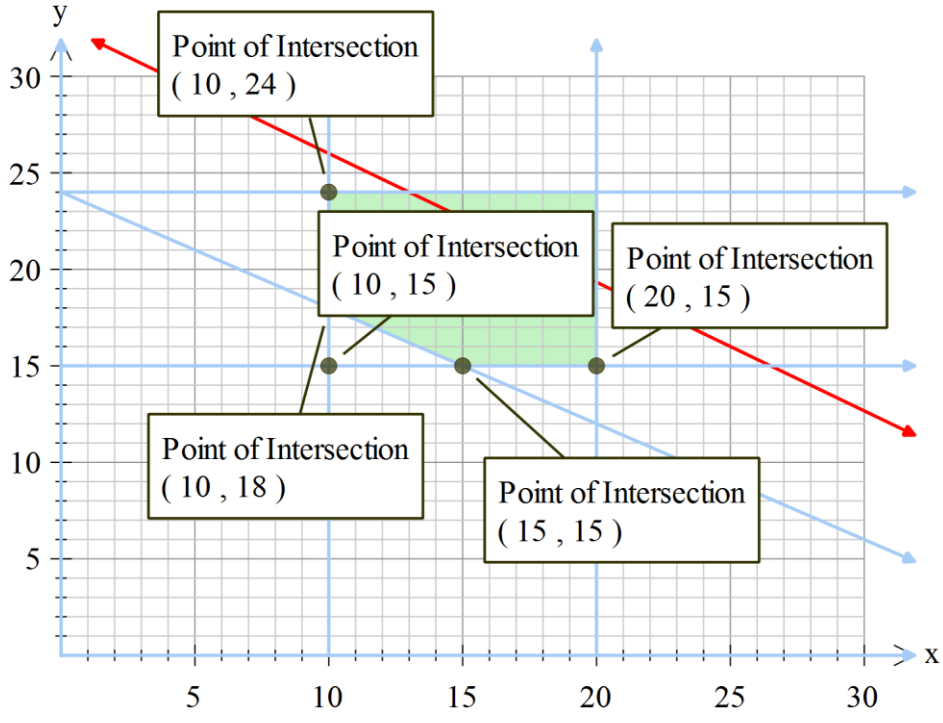
(x,y)	T = 1.75x + 4.5y
(5,20)	98.75
(6,24)	118.50← Max
(11,19)	104.75
(11,8)	55.25
(5,8)	44.75

Solution: A maximum running time of 118.5 mininutes will be obtained by adding 6 L of oil and 24 L of gas.

4. Let x = # units of nitrogen
Let y = # units of phosphorous

$$x \geq 10$$
$$x \leq 20$$
$$x \geq 0 \qquad y \geq 15$$
$$y \geq 0 \qquad y \leq 24$$
$$3x + 5y \geq 120$$

Objective function: Minimize C = 4x + 6y



(x,y)	C = 4x + 6y
(10,18)	148← Min
(10,24)	184
(15,15)	150
(20,24)	224
(20,15)	170

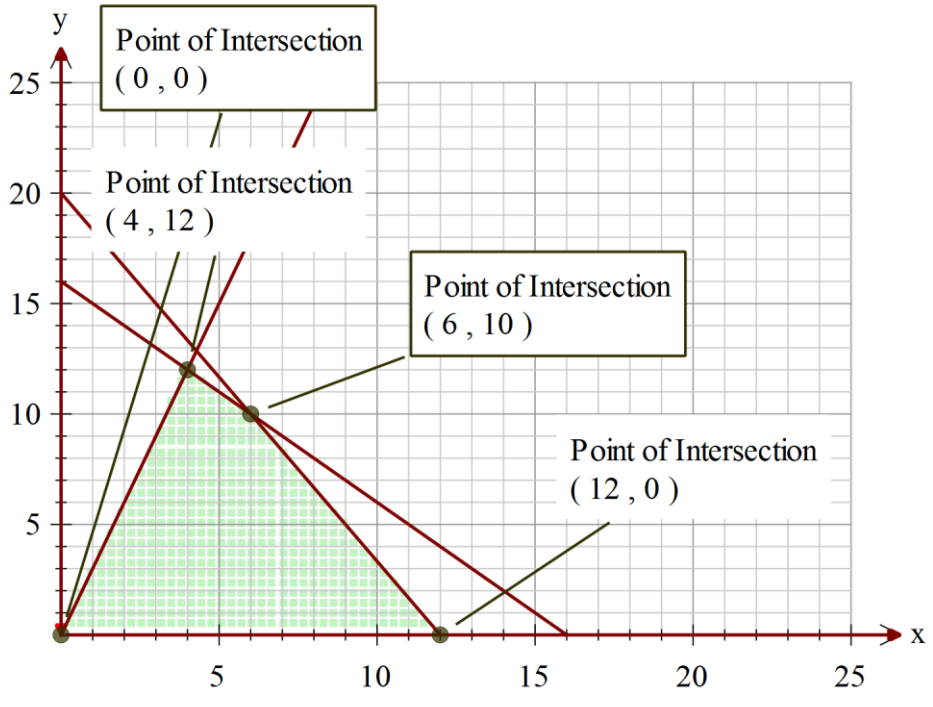
Solution : 10 units of nitrogen and 18 units of phosphorous will result in a minimum cost of $148

5. Let x = #hectares of cherries
Let y = #hectares of raspberries

$x \geq 0$
$y \geq 0$

$x + y \leq 16$
$5x + 3y \leq 60$
$y \leq 3x$

Objective Max R = 3000x + 2500y



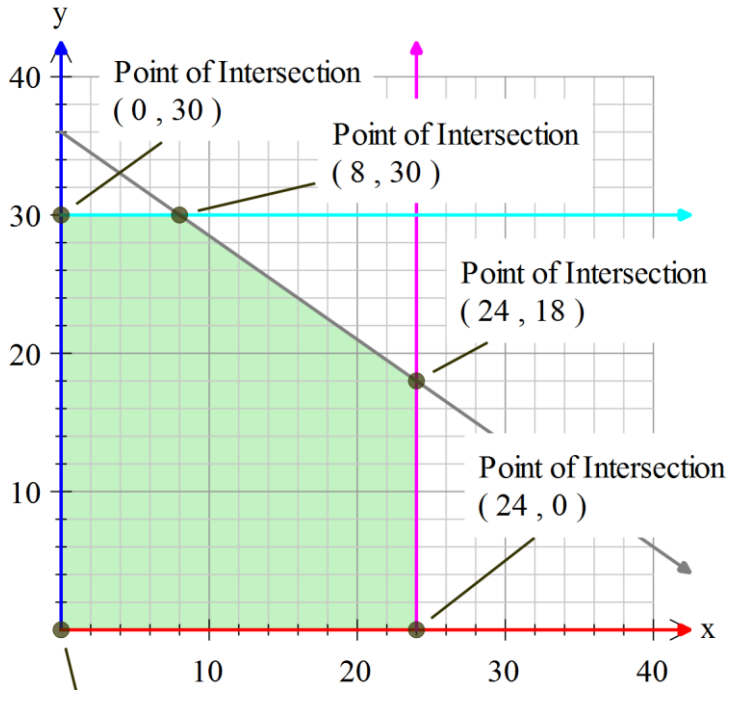
(x,y)	R = 3000x + 2500y
(0,0)	0
(4,12)	42 000
(6,10)	43 000 ← Max
(12,0)	36 000

Solution: The farmer should plant 6 hectares of cherries and 10 hectares of raspberries for a maximum revenue of $43 000.

6. Let x = # cords of birch
Let y = # cords of maple

$$x \geq 0 \qquad x \leq 24$$
$$y \geq 0 \qquad y \leq 30$$
$$\frac{x}{4} + \frac{y}{3} \leq 12$$

Objective: Max R = 100x + 150y



(x,y)	R = 100x + 150y
(0,0)	0
(0,30)	4500
(8,30)	5300← Max
(24,0)	2400
(24,18)	5100

Solution: 8 cords of birch and 30 cords of maple will result in a maximum revenue of $5300

7. Let x = # of enriched loaves
Let y = # of whole wheat loaves

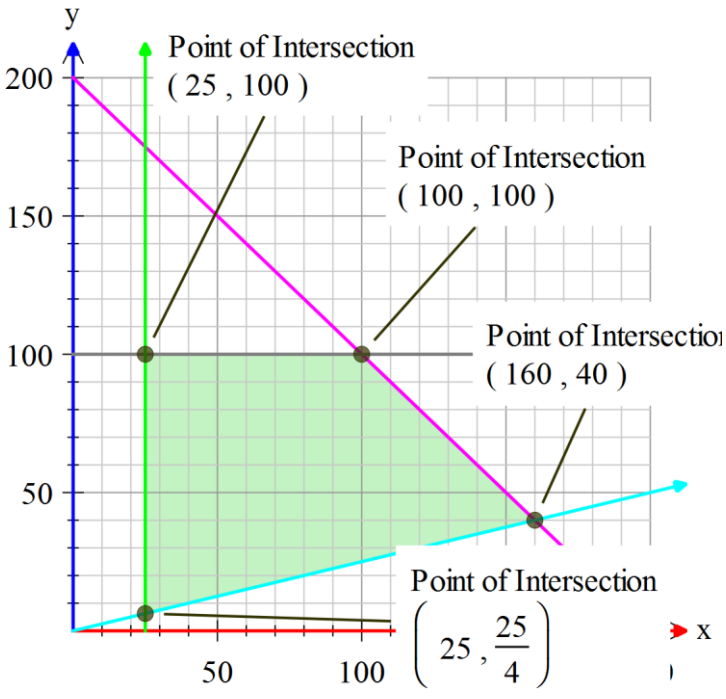
$$x + y \le 200$$

$$x \ge 0 \qquad y \ge \frac{1}{4}x$$

$$y \ge 0 \qquad y \le 100$$

$$x \ge 25$$

Max P = 0.35x + 0.28y



(x,y)	P = 0.35x + 0.28y
(25,100)	36.75
(100,100)	63
(160,40)	67.20← Max
(25,6.25)	10.50

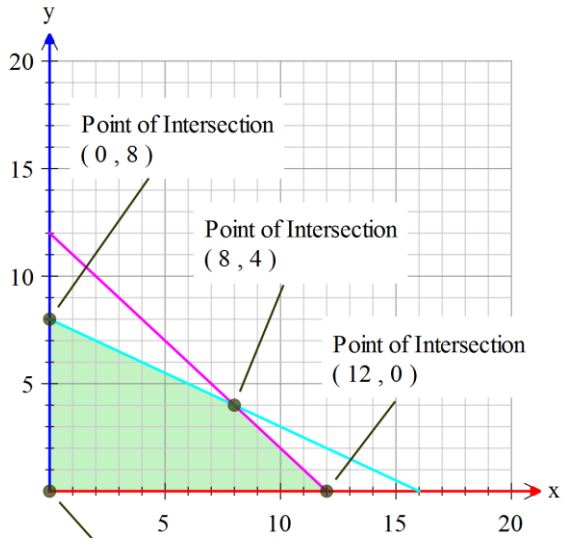
Solution: 8 enriched loaves and 30 whole wheat loaves will result in a maximum profit of $67.20

8. Let x = #children
Let y = #adults

$x \geq 0$ $\quad$ $x + y \leq 12$

$y \geq 0$ $\quad$ $\frac{1}{2}x + y \leq 8$

Objective: Max 12x + 20y



(x,y)	12x + 20y
(0,8)	160
(12,0)	144
(8,4)	176← Max
(0,0)	0

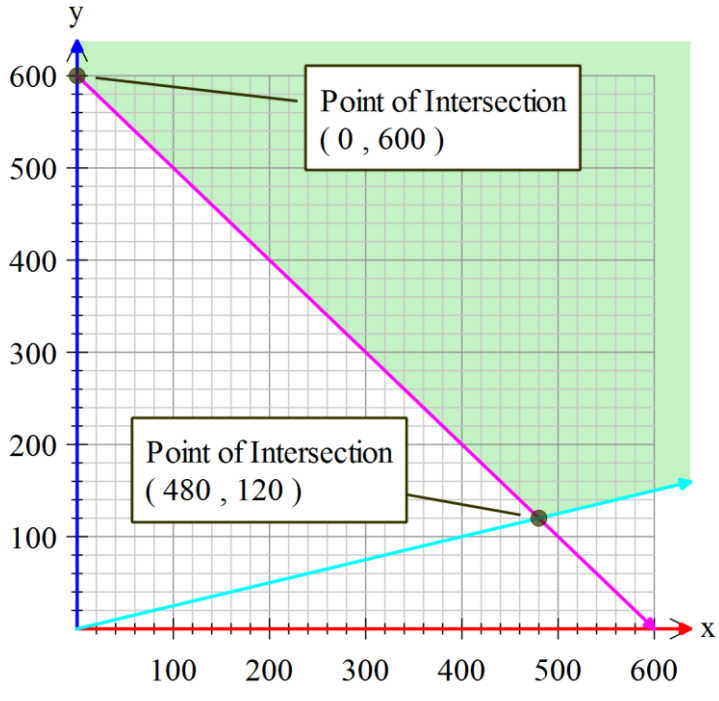
Solution: 8 child lessons and 4 adult lessons will result in a maximum revenue of $176

9. Let x = # kg of sand
Let y = # kg of cement

$x \geq 0$ $\quad$ $x + y \geq 600$

$y \geq 0$ $\quad$ $y \geq \frac{1}{4}x$

Min 0.01x + 1y



(x,y)	0.01x + 1y
(0,600)	600
(480,120)	124.80← Min

Solution: 480 kg of sand and 120 kg of cement will result in a minimum cost of $124.80

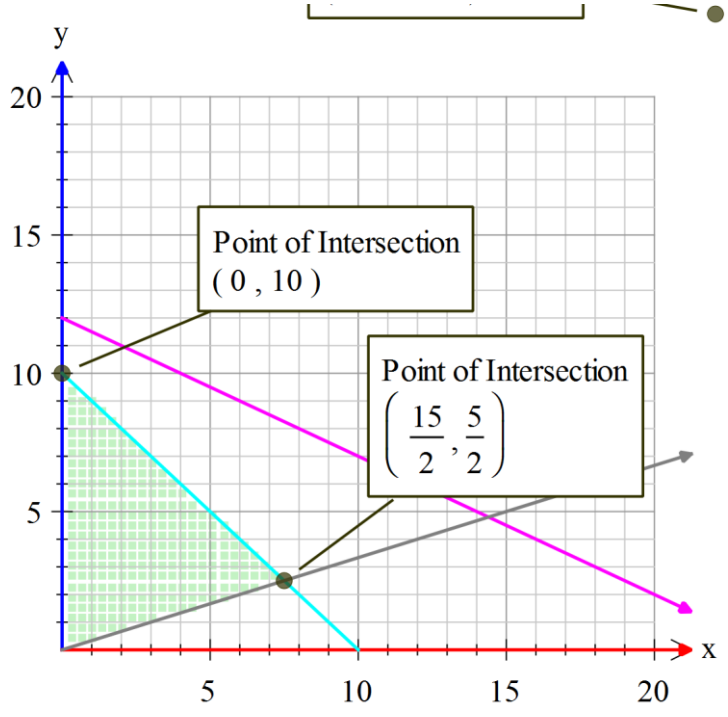
10. Let x = # pages of text
Let y = # pages of graphics

$x \geq 0$ $\quad$ $0.5x + y \leq 12$

$y \geq 0$ $\quad$ $x + y \leq 10$

$x \leq 3y$

Max 2.50x + 4y



(x,y)	2.50x + 4y
(0,0)	0
(0,10)	40← Max
(7.5,2.5)	28.75

Solution: she should prepare 0 pages of text and 10 pages of graphics to make $40

11. Let x = # days in France
Let y = # days in Italy

$x \geq 0$

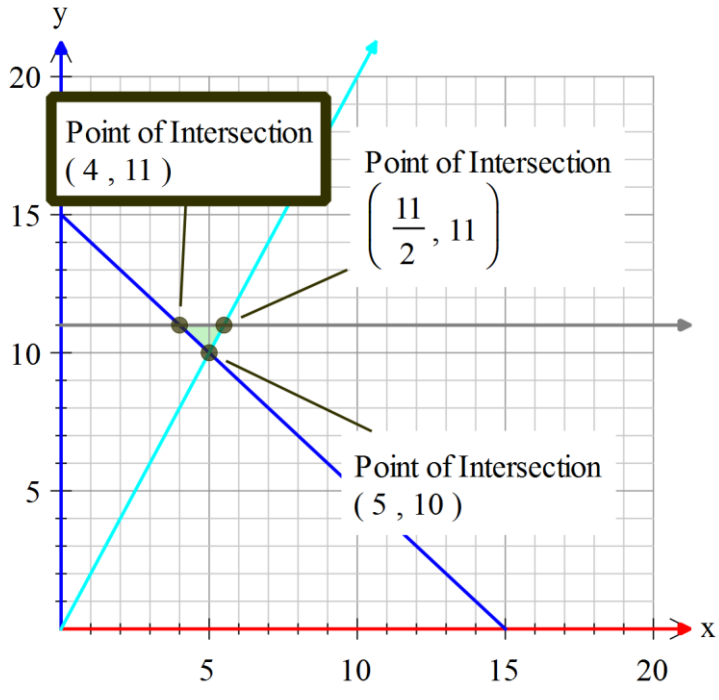
$y \geq 0$

$x + y \geq 15$

$y \geq 2x$

$y \leq 11$

(x,y)	Min 80x + 150y
(5,10)	1900← Min
(4,11)	1970
(5.5,11)	2090



Solution: They should spend 5 days in France and 10 days in Italy to spend as little money as possible ($1900)

12. Let x = # pages in black & white
Let y = # pages in colour

$x \geq 0$

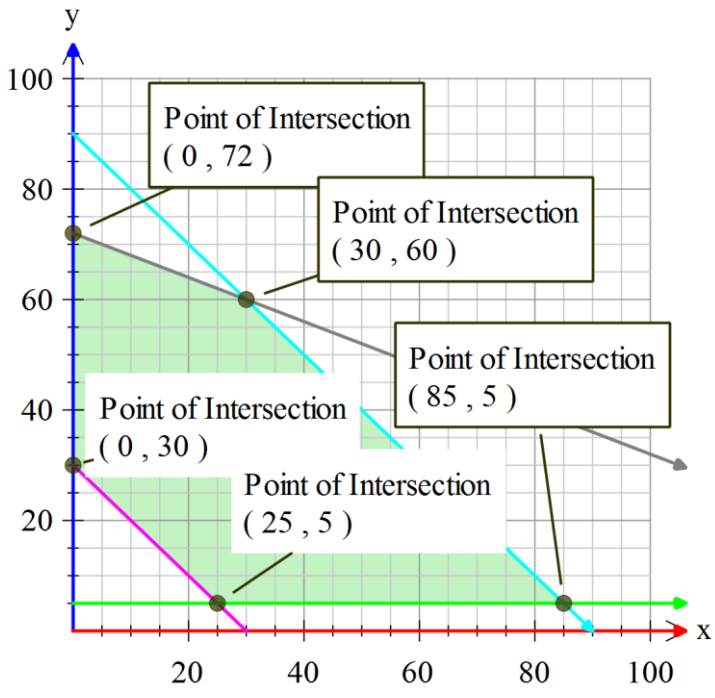
$y \geq 0$

$x + y \geq 30$

$x + y \leq 90$

$2x + 5y \leq 360$

$y \geq 5$



(x,y)	Min 0.10x + 0.25y + 3
(0,72)	21.00
(30,60)	21.00
(85,5)	12.75
(25,5)	6.75← Min
(0,30)	10.50

There should be 25 black and white pages and 2 colour pages so the cost of the book is a minimum ($6.75)

13. Let x = # round pills
Let y = # oval pills

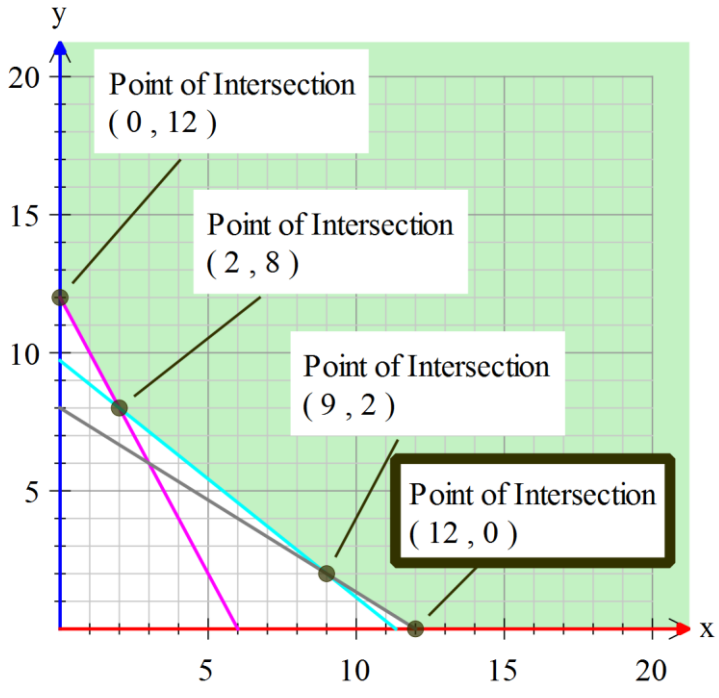
$x \geq 0$

$y \geq 0$

$2x + y \geq 12$

$6x + 7y \geq 68$

$2x + 3y \geq 24$



(x,y)	Min x + y
(0,12)	12
(2,8)	10← Min
(9,2)	11
(12,0)	12

The minimum number of round pills is 2 and oval pills is 8