LINEAR PROGRAMMING

Form 5
Vol 7

Part 1 – System of Inequalities (MC)

1. C	2. D	3. B	4. A	5. A	6. C	7. D
8. D	9. B	10. B	11. A	12. D		

1. The shaded regions in Figure 1.1 and Figure 1.2 represent the solutions of $4x+5y \le 30$ and $8x+5y \le 50$ respectively.

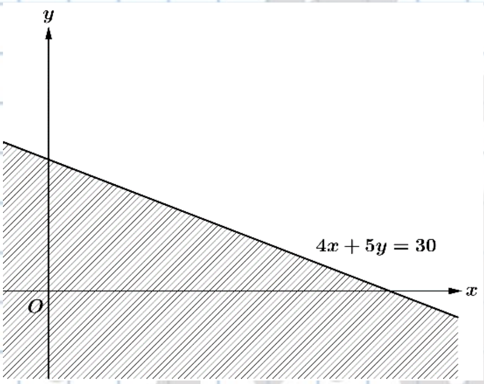


Figure 1.1

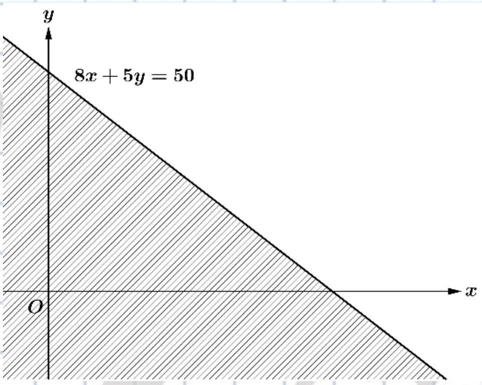


Figure 1.2

We can observe that the solution of $4x+5y \le 30$ is represented by Region II and Region III; while the solution of $8x+5y \le 50$ is represented by Region III and Region Iv.

Thus, the solution of $\begin{cases} 4x+5y \le 30 \\ 8x+5y \le 50 \end{cases}$ is represented by Region III.

2. The shaded region in Figure 1.3 represents the solution of $\begin{cases} 1 \le x+y \le 5 \\ 1 \le x \le 5 \\ 1 \le y \le 5 \end{cases}$.

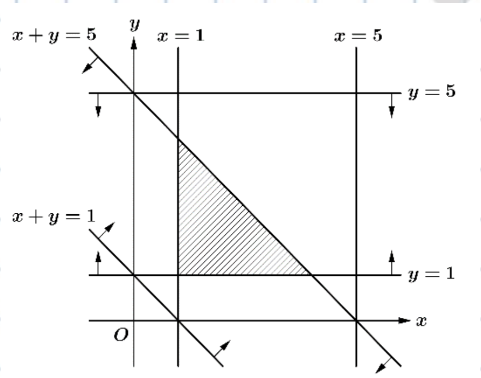


Figure 1.3

3. The shaded region in Figure 1.4 represents the solution of $\begin{cases} 3x+y+6\geq 0 \\ x-2y+8\geq 0 \\ x\leq 0 \end{cases}$.

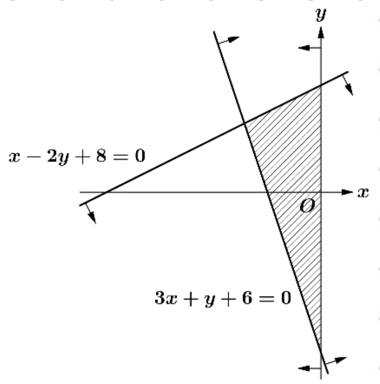


Figure 1.4

4. The shaded region in Figure 1.5 represents the solution of $\begin{cases} x-2y\geq 6 \\ x-y\leq 4 \\ x\geq 0 \\ y\leq 0 \end{cases}$.

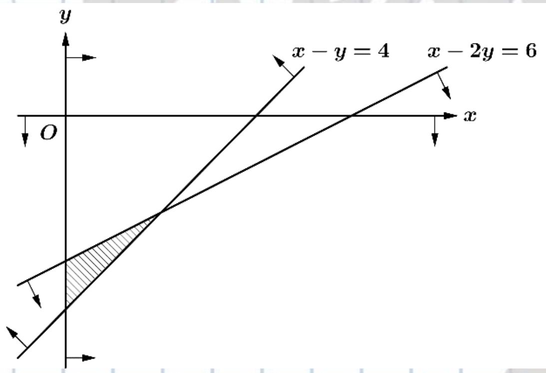


Figure 1.5

5. The shaded region in Figure 1.6 represents the solution of $\begin{cases} 2x+18\geq 3y \\ x-3y\leq -9 \\ -3\leq x\leq 0 \end{cases}$.

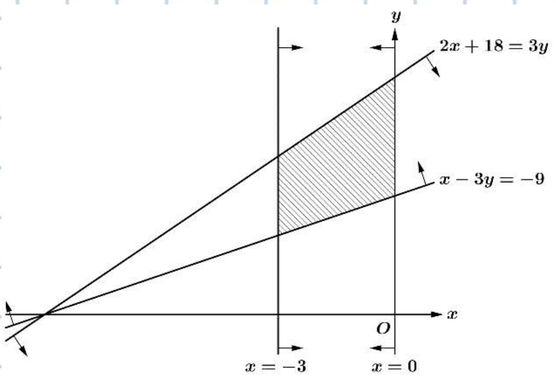


Figure 1.6

6. Observe that the point (–1, 1) lies in the shaded region (including the boundary).
So, we must have $x \le 0$, $y \ge 0$ and $y \le x+3$.

Thus, the constraints are $\begin{cases} y \le x+3 \\ x \le 0 \\ y \ge 0 \end{cases}$.

7. Observe that the point (4, 4) lies in the shaded region (including the boundary).
So, we must have $y-x \le 2$ and $x+y \le 10$.
Thus, II and IV are the appropriate choices.

8. Note that the figure shows the graph of $-3x+4y-24=0$.
Since the point (0, 0) does not lie in the shaded region (including the boundary), we must have $-3x+4y-24 \ge 0$.
Thus, we have $4y-3x \ge 24$.

9. From the graph, we have
$L_1 : y=-2x+6$
$L_2 : x+2y-3=0$
$L_3 : y=x+6$
Since the point (0, 2) lies in the shaded region (including the boundary), we must have $y \le -2x+6$, $x+2y-3 \ge 0$ and $y \le x+6$.

Thus, we have $\begin{cases} y \le x+6 \\ y \le -2x+6 \\ x+2y \ge 3 \end{cases}$.

10. Observe that the point (1, 0) lies in the shaded region (including the boundary).
So, we must have $x \le 6$, $2x \ge 3y$ and $2x-9y-12 \le 0$.

Thus, we have $\begin{cases} 2x-9y-12 \le 0 \\ 2x \ge 3y \\ x \le 6 \end{cases}$.

11. Observe that the point (0, 0) lies in the shaded region (including the boundary).
So, we must have $2x+3y-6 \le 0$, $2x+y+6 \ge 0$, $2x-y-6 \le 0$ and $2x-3y+6 \ge 0$.

Thus, we have $\begin{cases} 2x+3y-6 \le 0 \\ 2x-3y+6 \ge 0 \\ 2x+y+6 \ge 0 \\ 2x-y-6 \le 0 \end{cases}$.

12. From the shaded region (including the boundary), we have

$$\begin{cases} x \geq 2 \\ x + y \leq 10 \\ x \leq 6y - 4 \end{cases}$$

Since the point (h, k) lies in the shaded region, we must have $h \geq 2$, $h + k \leq 10$ and $h \leq 6k - 4$.
Hence, we have $6k - h \geq 4$.
Thus, I, II and III are all true.

Part 2 - System of Inequalities (SQ)

1. (a) Slope of $L_1 = \dfrac{0+2}{6-0} = \dfrac{1}{3}$

The equation of L_1 is

$$y = \frac{1}{3}x - 2$$

$$x - 3y - 6 = 0$$

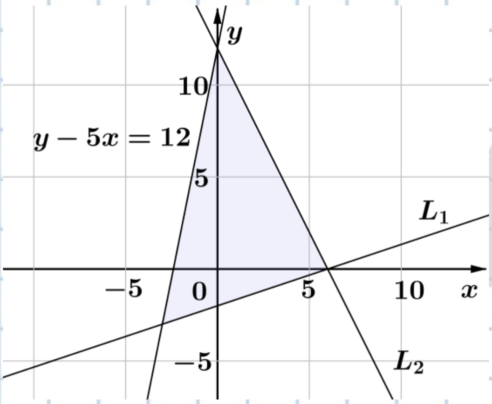
The equation of L_2 is

$$\frac{y-0}{x-6} = -2$$

$$y = -2x + 12$$

$$2x + y - 12 = 0$$

(b)



(c) $(6,0)$, $(-3,-3)$, $(0,12)$

2. (a) The y-intercept of L_2 is 4.

The equation of L_2 is

$y = 2x + 4$

$2x - y + 4 = 0$

The x-intercept of L_3 is 6.

The equation of L_3 is

$$\frac{y-0}{x-6} = \frac{2}{5}$$

$$y = \frac{2}{5}x - \frac{12}{5}$$

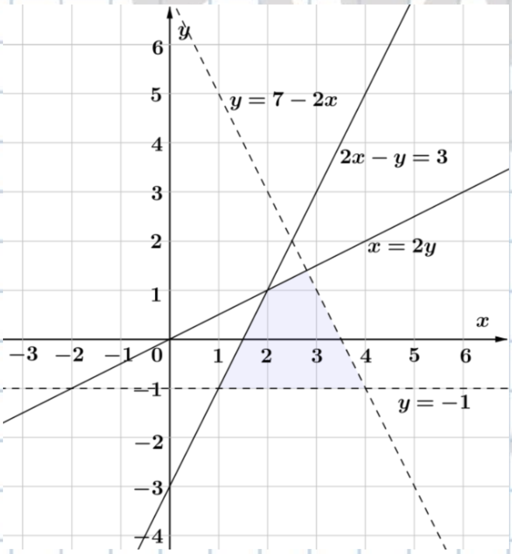
$2x - 5y - 12 = 0$

(b) $\begin{cases} 2x + 3y \le 12 \\ 2x - y + 4 \ge 0 \\ 2x - 5y - 12 \le 0 \end{cases}$

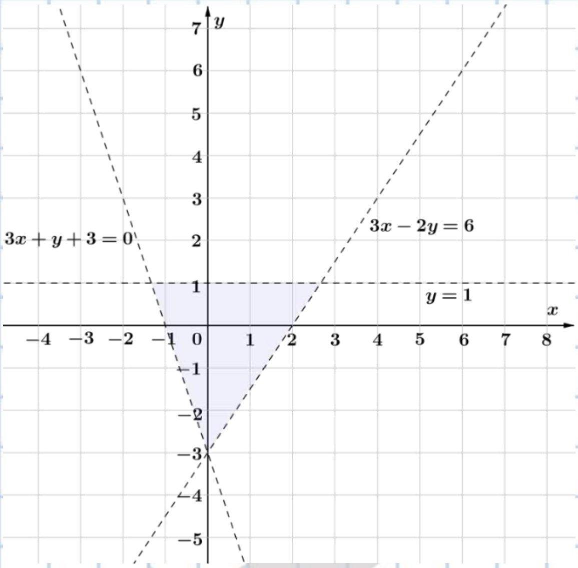
(or equivalent)

(c) $(0, 4)$, $(6, 0)$, $(-4, -4)$

3.



4. (a)



(b) $(0,0)$, $(1,0)$, $(1,-1)$, $(0,-1)$, $(0,-2)$