LINEAR PROGRAMMING

Form 5
Vol 7

Part 4 – Application Problem

1.	C	2.	B	3.	B

1. Number of passengers ≥ 400.
   So, we have $50x+24y\geq 400$.
   Thus, we have $25x+12y\geq 200$.

2. Note that x and y must be non-negative integers.
   Based on the condition (1), we have $x<2y$.
   Based on the condition (2), we have $24x+40y\geq 320$.
   Thus, the constraints on x and y are:

$$\begin{cases} x<2y \\ 3x+5y\geq 40 \\ x \text{ and } y \text{ are non-negative integers} \end{cases}$$

3. Note that $x\geq 0$ and $y\geq 0$.
   Based on the daily production capacities, we have
   $150x+180y\geq 1200$, $200x+150y\geq 1500$ and $120x+160y\geq 1000$.
   Thus, the constraints on x and y are:

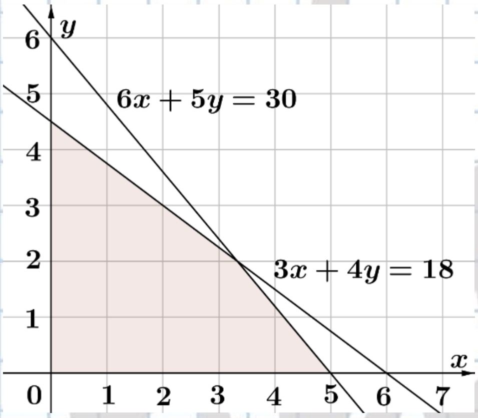
$$\begin{cases} 5x+6y\geq 40 \\ 4x+3y\geq 30 \\ 3x+4y\geq 25 \\ x\geq 0 \\ y\geq 0 \end{cases}$$

4. (a) $\begin{cases} 150x + 200y \le 900 \\ 30x + 25y \le 150 \\ x \text{ and } y \text{ are non-negative integers} \end{cases}$

$\begin{cases} 3x + 4y \le 18 \\ 6x + 5y \le 30 \\ x \text{ and } y \text{ are non-negative integers} \end{cases}$

(or equivalent)

(b)

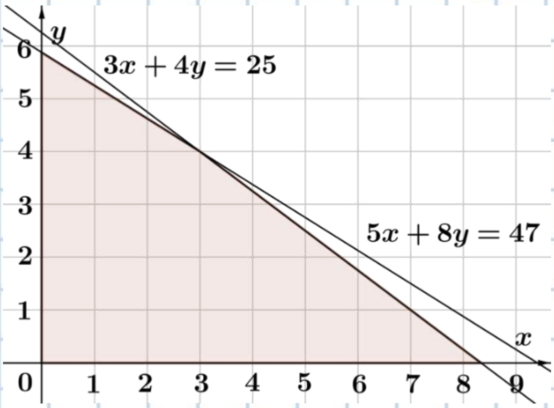


5. (a) $\begin{cases} 12x + 16y \le 100 \\ 5x + 8y \le 47 \\ x \text{ and } y \text{ are non-negative integers} \end{cases}$

$\begin{cases} 3x + 4y \le 25 \\ 5x + 8y \le 47 \\ x \text{ and } y \text{ are non-negative integers} \end{cases}$

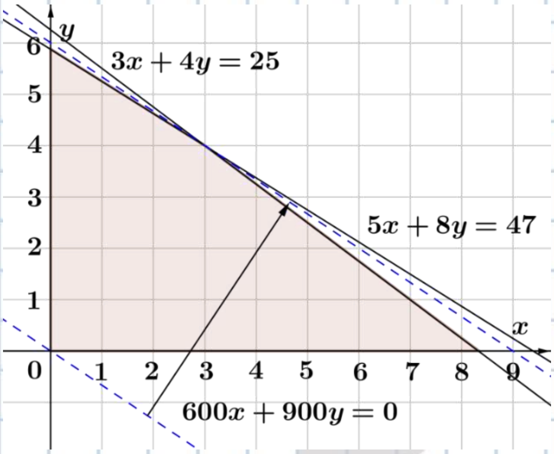
(or equivalent)

(b)



(c) Let the profit be $P = 600x + 900y$.

By sliding the line $P = 0$, the maximum is attained at $(x, y) = (3, 4)$.



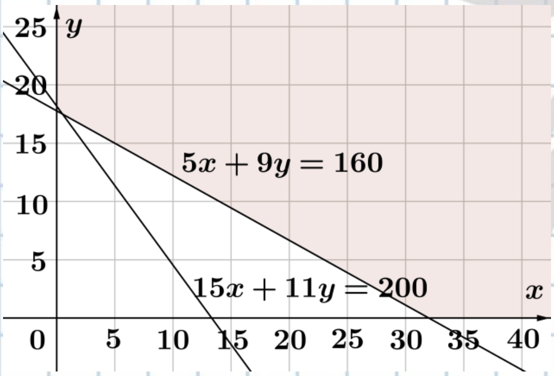
Thus, the maximum profit is \$5400.

6. (a) $\begin{cases} x(25\%) + y(45\%) \geq 8 \\ x(75\%) + y(55\%) \geq 10 \\ x \geq 0 \\ y \geq 0 \end{cases}$

$\begin{cases} 5x + 9y \geq 160 \\ 15x + 11y \geq 200 \\ x \geq 0 \\ y \geq 0 \end{cases}$

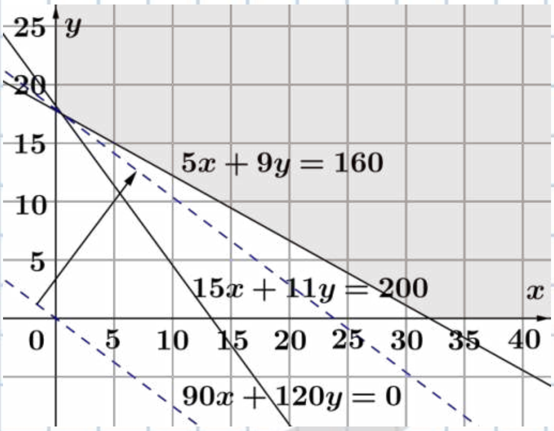
(or equivalent)

(b)



(c) Let the cost be $C = 90x + 120y$.

By sliding the line $C = 0$, the minimum is attained at $(x, y) = \left(\frac{1}{2}, \frac{35}{2}\right)$.



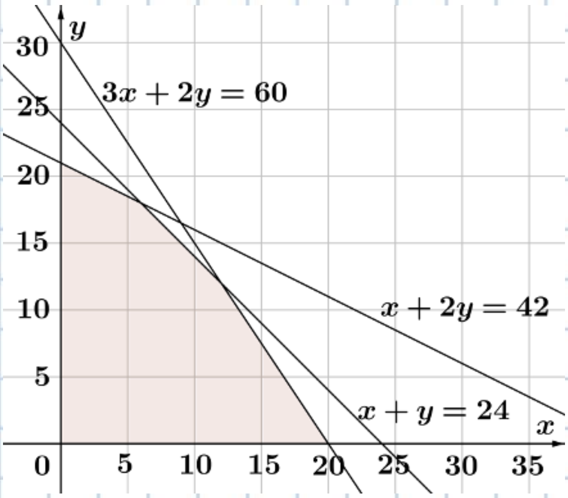
Thus, the minimum cost is \$2145.

7. (a) Let x kg and y kg be the amount of blend M and blend N coffee produced respectively.

Then, the constraints on x and y are:

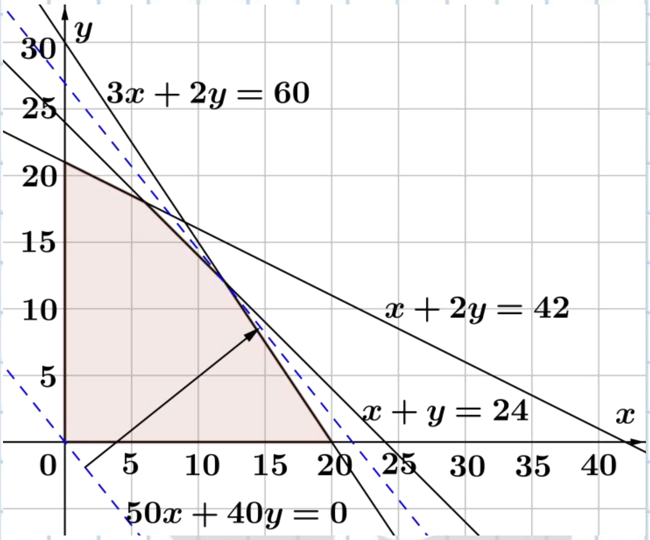
$$\begin{cases} \frac{3}{6}x + \frac{1}{3}y \le 10 \\ \frac{2}{6}x + \frac{1}{3}y \le 8 \\ \frac{1}{6}x + \frac{1}{3}y \le 7 \\ x \ge 0 \\ y \ge 0 \end{cases}$$

i.e., $$\begin{cases} 3x + 2y \le 60 \\ x + y \le 24 \\ x + 2y \le 42 \\ x \ge 0 \\ y \ge 0 \end{cases}$$



(b) Let the profit be $P = 50x + 40y$.

By sliding the line $P = 0$, the maximum is attained at $(x, y) = (12, 12)$.



Thus, the maximum profit is \$1080.