

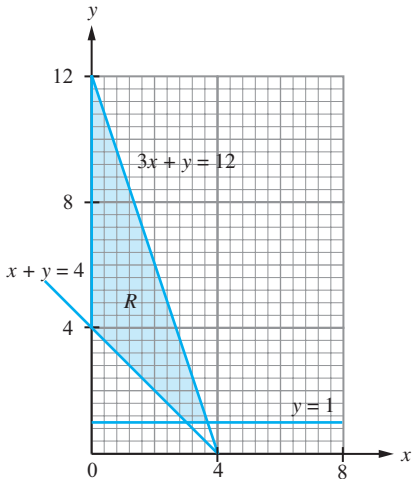
Fully-Worked Solutions

FORM 5

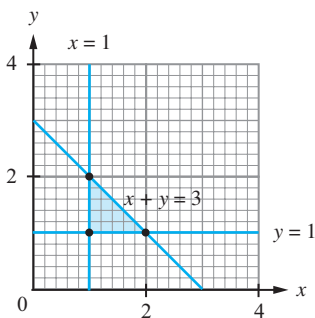
CHAPTER 7 Linear Programming

Self Test 1

1



2



Ordered pairs = (1, 1), (2, 1), (1, 2)
Number of ordered pairs = 3

3 (a) Inequality I: $x \geq 1$

Straight line:

$$\frac{y-5}{x-0} = -\frac{5}{15}$$

$$y-5 = -\frac{1}{3}x$$

$$3y+x = 15$$

\therefore Inequality II: $3y+x < 15$

Straight line:

$$\frac{y-3}{x-0} = \frac{5-3}{6-0}$$

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

$$3y-x = 9$$

\therefore Inequality III: $3y-x \leq 9$

(b) Inequality I: $0 \leq y < 6$

Inequality II: $x \leq 0$

Straight line:

$$\frac{y-4}{x-0} = -\frac{4}{2}$$

$$y-4 = -2x$$

$$y+2x = 4$$

\therefore Inequality III: $y+2x \leq 4$

Straight line:

$$\frac{y+4}{x-0} = -\frac{4}{-10}$$

$$y+4 = -\frac{2}{5}x$$

$$5y+2x = -20$$

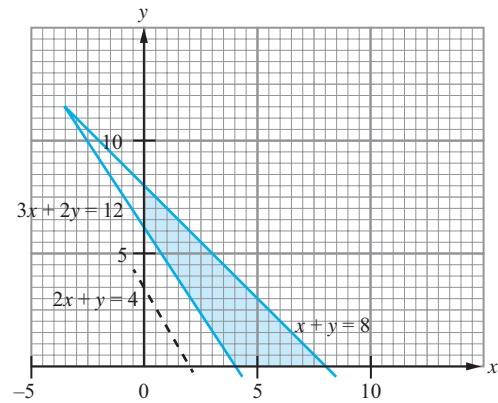
\therefore Inequality IV: $5y+2x \geq -20$

Self Test 2

1 Let $2x+y=4$

$2x+y$ is maximum at point (8, 0)

$$2x+y = 2(8)+0 = 16$$



2 Inequality I: $2y \leq 3x$

Straight line:

$$\frac{y-70}{x-0} = -\frac{70}{35}$$

$$y-70 = -2x$$

$$y+2x = 70$$

\therefore Inequality II: $y+2x \geq 70$

Straight line:

$$\frac{y-70}{x-0} = -\frac{70}{70}$$

$$y-70 = -x$$

$$y+x = 70$$

\therefore Inequality III: $y+x \leq 70$

(b) $P = 10x + 30y$

$$\text{Let } 10x + 30y = 300$$

Intersection point of $2y = 3x$ and $x + y = 70$:

$$2y = 3x$$

$$y = 1.5x$$

$$x + 1.5x = 70$$

$$x = 28$$

$$y = 1.5(28) = 42$$

P is maximum at point (28, 42)

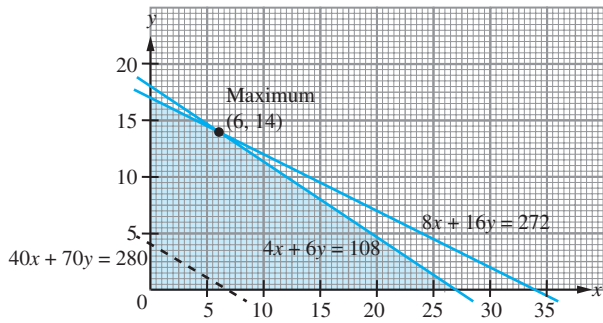
$$P = 10x + 30y = 10(28) + 30(42) = 1\,540$$

3 Number of model A = x , Number of model B = y

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

$$4x + 6y \leq 108$$

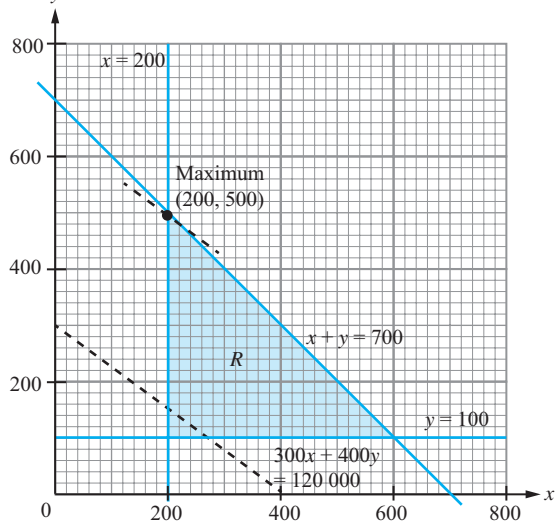
$$8x + 16y \leq 272$$



Objective function: Profit, $K = 40x + 70y$
 Maximum profit is achieved at point $(6, 14)$
 \Rightarrow 6 model A machines and 14 model B machines

4 Amount of chemical $P = x$, Amount of chemical $Q = y$

- (a) Objective function: $K = 300x + 400y$
 (b) $x \geq 200, y \geq 100, x + y \leq 700$
 (c)

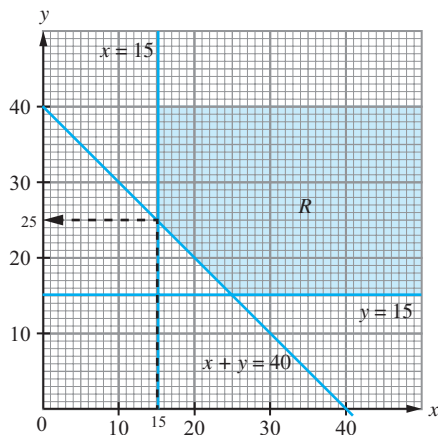


Maximum profit is at point $(200, 500)$
 \Rightarrow 200 kg of chemical P and 500 kg of chemical Q
 $K = 300x + 400y = 300(200) + 400(500) = \text{RM}260\,000$

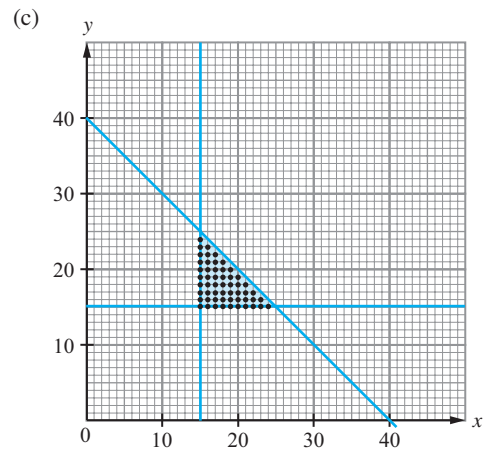
SPM Practice

Paper 2

- 1 (a) Marks for Paper 1 = x , Marks for Paper 2 = y
 $x \geq 15, y \geq 15, x + y \geq 40$

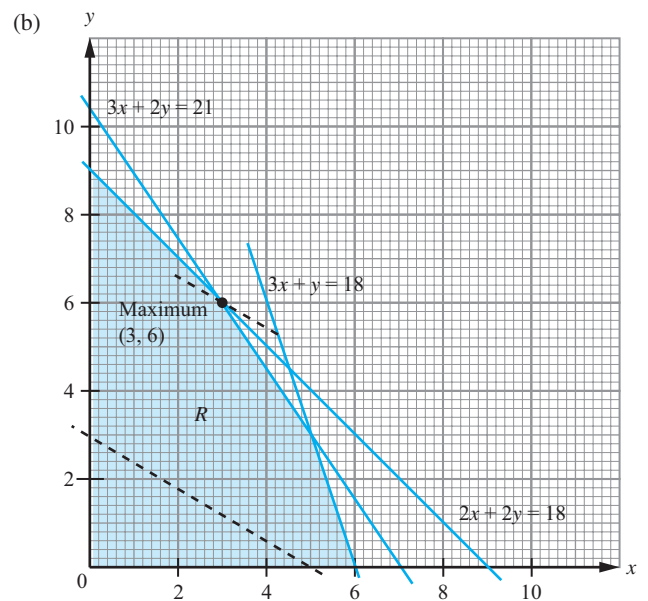


- (b) When $x = 15$, the student fails the exam if $0 \leq y < 25$



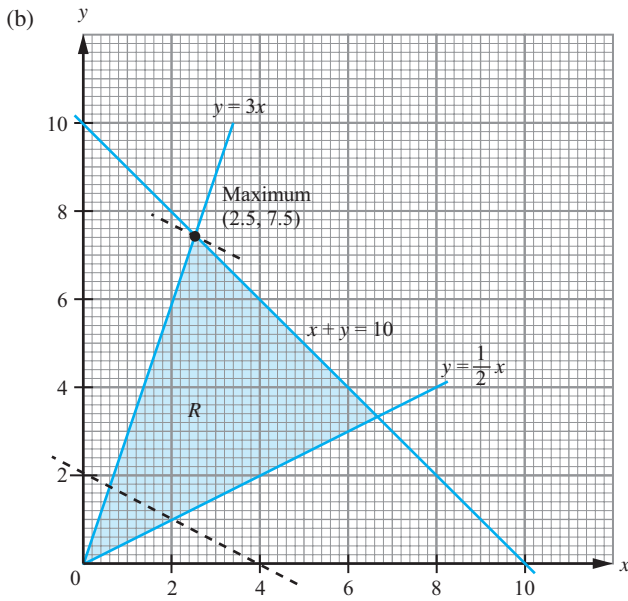
55 ways (55 ordered pairs (x, y))

- 2 (a) $2x + 2y \leq 18, 3x + 2y \leq 21, 3x + y \leq 18$



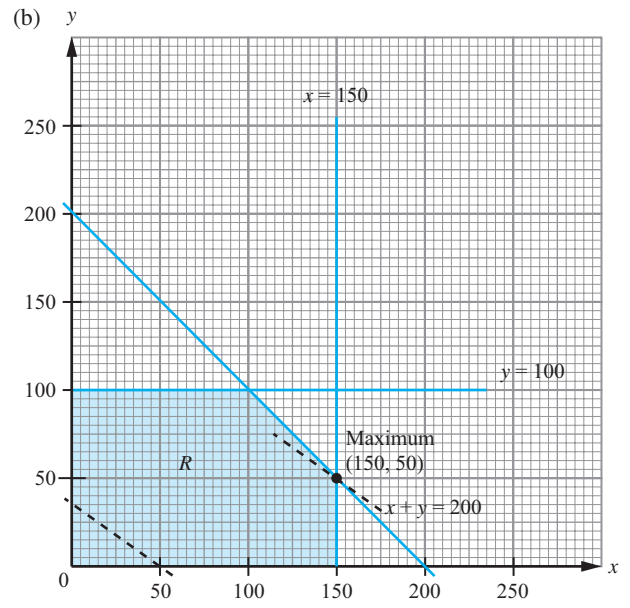
- (c) (i) Maximum number of bottles of shampoo $K = 6$
 (ii) Maximum number of bottles of shampoo $L = 9$
 (iii) Objective function, $J = 6x + 10y$
 3 bottles of shampoo K and 6 bottles of shampoo L need to be sold to achieve the maximum sales.
 Maximum sales,
 $J = 6x + 10y = 6(3) + 10(6) = \text{RM}78$

3 (a) $x + y \leq 10, y \leq 3x, y \geq \frac{1}{2}x$



- (c) (i) Maximum value of $x = 6$
 Maximum value of $y = 7$
 (ii) Maximum value of $x + 2y = 2.5 + 2(7.5) = 17.5$

4 (a) $x \geq 0, y \geq 0, x + y \leq 200, x \leq 150, y \leq 100$



- (c) Profit, $K = 50x + 35y$
 From the graph, 150 exercise books of version M and 50 exercise books of version N need to be sold to achieve the maximum profit.