Unit 3 · Linear Programming

WORKSHEET

Full marks 29

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 29

1 Key words [3]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

boundary line	**constraints**	**equation**	**feasible region**	**inequality**	**objective function**
simplex	**test point**				

A statement such as $2x + y \leq 8$ is a linear _____. The line $2x + y = 8$ is its _____, and a point not on it, put into the inequality to find the side, is a _____. The part of the graph allowed by every inequality of a system is the _____. In a linear programming problem, the limits written as inequalities are the _____, and the quantity to be made largest or smallest is the _____.

2 Multiple choice [5]

Choose the correct option for each of the following questions.

i. A bus can carry at most 40 passengers. If x is the number of passengers, which inequality is correct? [1]

a. $x < 40$ **b.** $x \leq 40$

c. $x > 40$ **d.** $x \geq 40$

ii. The boundary line of $4x - 3y > 12$ is drawn [1]

a. solid, and the region contains O

b. solid, and the region does not contain O

c. dashed, and the region contains O

d. dashed, and the region does not contain O

iii. Which point lies in the feasible region of $x + y \leq 5, x - y \geq 1, y \geq 0$? [1]

a. $(0, 0)$ **b.** $(3, 1)$

c. $(2, 2)$ **d.** $(4, 2)$

iv. The vertices of a feasible region are $O(0, 0)$, $A(6, 0)$, $B(4, 3)$ and $C(0, 5)$. What is the maximum of $Z = 2x + 5y$? [1]

a. 12 **b.** 23

c. 25 **d.** 35

v. Which inequality describes the half-plane to the left of the line $x = -2$, the line included? [1]

a. $x \geq -2$ **b.** $x \leq -2$

c. $y \leq -2$ **d.** $x < -2$

3 Very short answers [3]

Write very short answers to the following questions.

a. A Nepali citizen must be at least 18 years old to vote. Write this as an inequality, with x the age in years. [1]

b. Is the point $(2, 3)$ in the solution region of $x + 2y < 8$? Show why. [1]

c. Find where the lines $x + y = 6$ and $x - y = 2$ meet. [1]

4 Short answers [8]

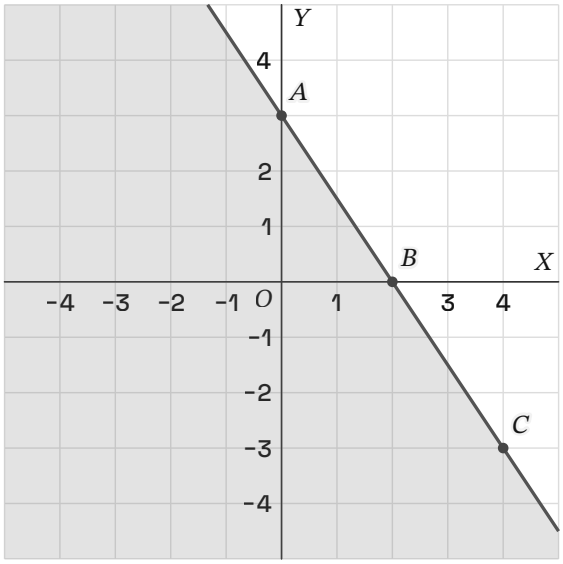
Write short answers to the following questions.

a. Find the mistake. To graph $2x + 5y \geq 10$, Asha drew a solid line through $(0, 2)$ and $(5, 0)$, put in O to get $0 \geq 10$, and shaded the side of the line that contains O. What has she done wrong? Which side should she shade? [2]

b. What is a feasible region? Why must its vertices satisfy every inequality of the system? [2]

c. Explain in your own words why the maximum of $Z = ax + by$ over a closed feasible region is found at a vertex. [2]

d. Find the inequality represented by the shaded region. The boundary passes through $A(0, 3)$, $B(2, 0)$ and $C(4, -3)$. **[2]**



5 Long answers [8]

Solve the following problems. Show your working.

a. Draw the graph of the system $x + 2y \leq 10$, $3x + y \leq 15$, $x \geq 0$, $y \geq 0$. Shade the feasible region, find its vertices, and find the maximum and minimum values of $Z = 4x + 5y$. **[4]**

Answer:

Science Playground, Katunje, Bhaktapur
https://science-playground.com/learn/grade-10-optional-math/linear-programming

b. A farmer in Kavre has 8 ropani of land and Rs 12,000 for seed. Potatoes need Rs 2,000 of seed a ropani and earn Rs 5,000 profit a ropani; cauliflower needs Rs 1,000 of seed a ropani and earns Rs 3,000. How many ropani of each should she plant for the most profit? (The numbers are made up for practice.) **[4]**



Answer: _____

6 Think **[2]**

Think, then answer.

The feasible region of $x + y \geq 4$, $x \geq 0$, $y \geq 0$ has the corners (4, 0) and (0, 4). Does $Z = 2x + 3y$ have a minimum on it? A maximum? Explain.

_____

_____

_____

7 Activity: One point decides the side (not marked)

Work with a partner on $2x + y \leq 6$. Draw its boundary line on graph paper. One of you calls out a point, the other works out $2x + y$ and says whether the inequality is true. Mark each point on the graph: a tick for true, a cross for false.

Point	$2x + y$	True or false?	Which side of the line?
(0, 0)			
(1, 2)			
(3, 0)			
(2, 3)			
(−1, 5)			
(4, −1)			