

NAME _____ INDEX NUMBER _____

SCHOOL _____ DATE _____

LINEAR PROGRAMMING

<i>KCSE 1989 – 2012 Form 4 Mathematics</i> <i>Answer all the questions</i>	Working space
<p>1. 1989 Q18 P2</p> <p>At an agricultural research station, a rectangular plot is to be allocated for a certain experiment. The length of the plot must be greater than the breadth but not more than twice the breadth. The area must be more than 400m^2 and the perimeter must be less than 200m.</p> <p>(a) Form inequalities representing the above information and graph them on the grid below. (graph was provided) (6marks)</p> <p>(b) If the plot must also be exactly divisible into the sub plots of 10m by 10m, determine the size of the plot which will give maximum area (2marks)</p>	
<p>2. 1990 Q20 P1</p> <p>A farmer has 15 hectares of land on which he can grow maize n beans only. In a year he grows maize on more land than beans. It costs him sh 4400 to grow maize per hectare and sh. 10,800 to grow beans per hectare.</p> <p>He is prepared to spend at most sh 90000 per year to grow the crops. He makes a profit of sh 2400 from one hectare of maize and sh3200 from one hectare of beans.</p> <p>Find the maximum profit he can make from the crops in a year. (8marks)</p>	

		Working space
3.	<p>1991 Q24 P1</p> <p>A chemical firm has 160 litres of solution A, 110 litres of solution B and 150 litres of solution C. To prepare a bottle of syrup X, 200ml of solution A, 100ml of solution B and 100ml of solution C are needed.</p> <p>For a bottle of Y 100ml of A, 200ml of B and 300ml of C are needed. Syrup X sells at sh 60 per bottle and syrup Y sells at sh 100 per bottle.</p> <p>How many bottles of each type of syrup should the firm make in order to obtain the maximum amount of money? (8marks)</p>	
4.	<p>1992 Q20 P1</p> <p>A transporter has two types of trucks to transport sugar. Type A truck carries 2000 bags while type B carries 3000 bags per trip. The transporter has to transport 120000 bags. He has to make more than 50 trips. Type B trucks are to make at most twice the number of trips made by type A (B to be at most twice A).</p> <p>(a) By taking x to be the number of trips made by type A trucks and y to be the number of trips made by type B trucks, write down the inequalities representing this information (3marks)</p> <p>(b) If the transporter makes a profit of sh 1000 per trip for the type A truck and sh 2000 per trip for the type B truck use graphical methods to find the number of trips he should make with each type of truck in order to maximize his profit (5marks)</p>	
5.	<p>1993 Q23 P2</p> <p>A coffee merchant has 400kg of Robusta coffee and 480kg of Arabica coffee. The coffee is packed by weight as follows:</p> <p>Type I : 30% Robusta and 70% Arabica Type II: 50% Robusta and 50% Arabica Type I is sold at sh 34 per kg while type II is sold at sh 36 per kg.</p> <p>Use graphical method to determine the number of kilograms of type I and type II which should be packed to maximize the profit. (8marks)</p>	

		Working space
6.	<p>1994 Q 18 P2</p> <p>A factory manufacturers two products which are produced on the three machines X, Y and Z. The first product requires 2 hours on machine X, 3hours on machine Y and 1 hour on machine Z. The second product requires 1 hour on machine X, 4hours on machine Y and 2 hours on machine Z.Machine X can be used for at most 100 hours, machine Y for at most 240 hours and machine Z for at most 90 hours The profit per unit is sh 300 for the first product and sh 400 for the second product.</p> <p>Form inequalities representing the above information and represent them on the grid provided.. From the graph determine the number of units of each product that should be produced to give maximum profit.</p> <p style="text-align: right;">(8marks)</p>	
7.	<p>1995 Q24 P2</p> <p>A manufacture of jam has 720 kg of strawberry syrup and 800 kg of mango syrup for making two types of jam, grade A and B. Each types is made by mixing strawberry and mango syrups as follows:</p> <p style="padding-left: 40px;">Grade A: 60% strawberry and 40% mango Grade B: 30% strawberry and 70% mango</p> <p>The jam is sold in 400 gram jars. The selling prices are as follows:</p> <p style="padding-left: 40px;">Grade A: Kshs. 48 per jar Grade B: Kshs 30 per jar.</p> <p>(a) Form inequalities to represent the given information (3 marks)</p> <p>(a) (i) On the grid provided draw the inequalities (3 marks)</p> <p>(ii) From your, graph, determine the number of jars of each grade the manufacturer should produce to maximize his profit (1 mark)</p>	

	<p>(iii) Calculate the total amount of money realized if all the jars are sold (1 mark)</p>	<p>Working space</p>
<p>8.</p>	<p>1997 Q19 P2 An institute offers two types of courses technical and business courses. The institute has a capacity of 500 students. There must be more business students than technical students but at least 200 students must take technical courses. Let x represent the number of technical students and y the number of business students.</p> <p>(a) Write down three inequalities that describe the given conditions (b) On the grid provided, draw the three inequalities (c) If the institute makes a profit of Kshs 2, 500 to train one technical students and Kshs 1,000 to train one business student, determine (i) the number of students that must be enrolled in each course to maximize the profit (ii) The maximum profit.</p>	
<p>9.</p>	<p>1998 Q24 P2 A draper is required to supply two types of shirts A and type B. The total number of shirts must not be more than 400. He has to supply more type A than of type B however the number of types A shirts must be more than 300 and the number of type B shirts not be less than 80. Let x be the number of type A shirts and y be the number of types B shirts.</p> <p>(a) Write down in terms of x and y all the linear inequalities representing the information above. (b) On the grid provided, draw the inequalities and shade the unwanted regions Type A: Kshs 600 per shirt Type B: Kshs 400 per shirt (i) Use the graph to determine the number of shirts of each type that should be made to maximize the profit. (ii) Calculate the maximum possible profit.</p>	

		Working space
10.	<p>2000 Q24 P2</p> <p>A theatre has a seating capacity of 250 people. The charges are Kshs. 100 for an ordinary seat and Kshs 160 for a special seat. It cost Kshs 16,000 to stage a show and the theater must make a profit. There are never more than 200 ordinary seats and for a show to take place at least 50 ordinary seats must be occupied. The number of special seats is always less than twice the number of ordinary seats.</p> <p>(a) Taking x to be the number of ordinary seats and y the number of special seats write down all the inequalities representing the information above.</p> <p>(b) On the grid provided, draw a graph to show the inequalities in (a) above</p> <p>(c) Determine the number of seats of each type that should be booked in order to maximize the profit.</p>	
11.	<p>2001 Q24 P2</p> <p>Bot juice Company has two types of machines, A and B, for juice production. Type A machine can produce 800 litres per day while type B machine produces 1,600 litres per day.</p> <p>Type A machine needs 4 operators and type B machine needs 7 operators. At least 8,000 litres must be produced daily and the total number of Operators should not exceed 41. There should be 2 more machines of each type.</p> <p>Let x be the number of machines of type A and Y the number of machines for type B,</p> <p>a) Form all inequalities in x and y to represent the above information.</p> <p>b) On the grid provided below, draw the inequalities to shade the unwanted regions.</p>	

		Working space
12.	<p>2003 Q20 P2</p> <p>Omondi makes two types of shoes: A and B. He takes 3 hours to make one pair of type A and 4 hours to make one pair of type B. He works for a maximum of 120 hours to make x pairs of type A and y pairs of type B. It costs him sh 400 to make a pair of type A and sh 150 to make a pair of type B. His total cost does not exceed sh 9000. He must make 8 pairs of type A and more than 12 pairs of type B.</p> <p>(a) Write down four inequalities representing the information above (3marks)</p> <p>(b) On the grid provided, draw the inequalities and shade the unwanted regions (3marks)</p> <p>(c) Omondi makes a profit of sh40 on each pair of type A and sh70 on each pair of type B shoes. Use the graph provided to determine the maximum possible profit he makes. (2marks)</p>	
13.	<p>2005 Q24 P2</p> <p>Diet expert makes up a food production for sale by mixing two ingredients N and S. One kilogram of N contains 25 units of protein and 30 units of vitamins. One kilogram of S contains 50 units of protein and 45 units of vitamins. The food is sold in small bags each containing at least 175 units of protein and at least 180 units of vitamins. The mass of the food product in each bag must not exceed 6kg. If one bag of the mixture contains x kg of N and y kg of S</p> <p>(a) Write down all the inequalities, in terms of x and y, representing the information above (2 marks)</p> <p>(b) On the grid provided draw the inequalities by shading the unwanted regions (2 marks)</p> <p>(c) If one kilogram of N costs Kshs 20 and one kilogram of S costs Kshs 50, use the graph to determine the lowest cost of one bag of the mixture (3 marks)</p>	

Working space

14. **2006 Q23 P2**
Mwanjoki flying company operates a flying service. It has two types of aeroplanes. The smaller one uses 180 litres of fuel per hour while the bigger one uses 300 litres per hour.
The fuel available per week is 18,000 litres. The company is allowed 80 flying hours per week while the smaller aeroplane must be flown for y hours per week.
- (a) Write down all the inequalities representing the above information
- (b) On the grid provided on page 21, draw all the inequalities in a) above by shading the unwanted regions (3 marks)
- (c) The profits on the smaller aeroplane is Kshs 4000 per hour while that on the bigger one is Kshs 6000 per hour
Use the graph drawn in (b) above to determine the maximum profit that the company made per week.
(3 marks)

15. **2007 Q22 P2**
A company is considering installing two types of machines. A and B.
The information about each type of machine is given in the table below.
- | Machine | Number of operators | Floor space | Daily profit |
|---------|---------------------|-----------------|--------------|
| A | 2 | 5m ² | Kshs 1,500 |
| B | 5 | 8m ² | Kshs 2,500 |
- The company decided to install x machines of types A and y machines of type B
- (a) Write down the inequalities that express the following conditions
- I. The number of operators available is 40
 - II. The floor space available is 80m²
 - III. The company is to install not less than 3 type of A machine
 - IV. The number of type B machines must be more than one third the number of type A

	<p style="text-align: center;">machines</p> <p>(b) On the grid provided, draw the inequalities in part (a) above and shade the unwanted region</p> <p style="text-align: right;">(4 marks)</p>	Working space
	<p>(c) Draw a search line and use it to determine the number of machines of each type that should be installed to maximize the daily profit.</p> <p style="text-align: right;">(2 marks)</p>	
16.	<p>2010 Q20 P2</p> <p>A carpenter takes 4 hours to make a stool and 6 hours to make chair. It takes the carpenter and at least 144 hours to make x stools and y chairs. The labour cost should not exceed Ksh.4800. the carpenter must make a least 16 stools and more than 10 chairs.</p> <p>a) Write down inequalities to represent the above information.</p> <p style="text-align: right;">(3 marks)</p> <p>b) Draw the inequality in (a) above on a grid.</p> <p style="text-align: right;">(4 marks)</p> <p>c) The carpenter makes a profit of Ksh 40 on a stool and Ksh 100 on a chair. Use the graph to determine the maximum profit the carpenter can make.</p> <p style="text-align: right;">(3 marks)</p>	
17.	<p>2011 Q24 P2</p> <p>A building contractor has two Lorries, P and Q used to transport atleast 42 tonnes of sand to a building site. Lorry P carries 4 tonnes of sand per trip while lorry Q carries 6 tonnes of sand per trip. Lorry P uses 2litres of fuel per trip while lorry Q uses 4litres of fuel per trip.</p> <p>The two Lorries are to use less than 32 litres of fuel. The number of trips made by lorry P should be less than 3 times the number of trips made by lorry Q. Lorry p should make more than 4 trips.</p> <p>(a) Taking x to represent the number of trips made by the lorry Pand y to represent the number of trips made by lorry Q, write the inequalities that represent the above information.</p> <p style="text-align: right;">(4marks)</p> <p>(b) On the grid provided, draw the inequalities and shade the unwanted regions</p> <p style="text-align: right;">(4marks)</p> <p>(c) Use the graph drawn in (b) above to determine the number of trips made by lorry P and by lorry Q to</p>	

	deliver the greatest amount of sand	
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(2marks)