1. (a) Define the following types of matrices, giving an example in each case.

(i) Null matrix;
(ii) Equal matrices;
(iii) Transpose matrix;
(iv) Identity matrix.

(8 marks)

(b) Laiko Construction company intends to construct a building. The following information relates to the project activities, A to G, along with their time estimates for completion.

Activity	Preceding Activity	Time Estimates (Weeks)		
		Optimistic (a)	Most Likely (M)	Pessimistic (b)
A	-	1	4	7
B	A	2	6	4
C	A,D	3	4	5
D	A	5	12	13
E	D	3	7	11
F	B,C	6	8	16
G	E,F	3	5	7

(i) Draw a network diagram for the project;

(ii) Determine the critical path and the expected project duration.

(12 marks)

2. (a) Integrate each of the following functions:

(i) $y = 8 + 2x$
(ii) $y = x^5 - 4x^8$
(iii) $y = x + 5$, for $2 \leq x \leq 5$.

(8 marks)

(b) The cost of one rubber and three pencils is Kshs 8, while 6 rubbers and one pencil cost Kshs 7.

(i) Formulate simultaneous equations from the above information.

(ii) Determine the price of each item, using cramer's rule.

(12 marks)

3. (a) Differentiate between each of the following terms as used in hypothesis testing:

(i) Null hypothesis and alternative hypothesis;
(ii) Type I error and type II error.

(8 marks)

(b) A manufacturing company produces two products, X and Y. The company has 3 machines, A, B and C. Product X requires 2 minutes of machine A, 3 minutes of machine B and 1 minute of machine C. Product Y requires 3 minutes of machine A, 2 minutes of machine B and 1 minute of machine C. The capacity available is 1,500 minutes for machine A, 1,500 minutes for machine B and 600 minutes for machine C. The profit per unit of product X is Kshs 30 and that of product Y is Kshs 36.

(i) Formulate a linear programming problem.

(ii) Solve (i) above using the graphical method.

(12 marks)

4. (a) Outline **four** objectives of time series analysis. (8 marks)

(b) The annual demand for raw material XD is 7,580 units. The ordering cost per order is Kshs 65. The purchase cost per unit is Kshs 35 and the carrying cost per unit per annum is 15% of the purchase cost.

Calculate:

(i) economic order quantity;
(ii) number of orders;
(iii) average stock;
(iv) total relevant cost, excluding purchase cost.

(12 marks)

5. (a) Explain **four** uses of index numbers in business decision making. (8 marks)

(b) The following information shows the marks scored in English and Shorthand tests by eight students.

English (X)	**Shorthand (Y)**
4	12
6	17
8	28
9	32
12	42
15	38
17	43
19	58

(i) Calculate the Pearson's Product Moment Correlation Coefficient.

(ii) Interpret your answer in (i) above.

(12 marks)

6. (a) A group of students sat for an examination and only 40% of them passed. Three students were selected at random. Calculate the probability that:

(i) All the three passed;
(ii) Exactly two passed;
(iii) At least two passed.

(8 marks)

(b) The demand function of a firm is given by: $P=1200-4Q^2$

where P is the price in Kshs.
Q is the quantity in units.

Determine the:

(i) quantity that maximizes the total revenue;
(ii) maximum total revenue;
(iii) price that maximizes the total revenue.

(12 marks)

7. (a) Outline **four** areas in business that quantitative techniques can be applied.

(8 marks)

(b) An amount of Ksh 10,000 can be invested at compound interest rate of 12% per annum for 2 years. Calculate the value of the investment if interest is compounded:

(i) Annually;
(ii) Semi-annually;
(iii) Quarterly;
(iv) Monthly.

(12 marks)