31.3.12.25

TEVETA
Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN PRODUCTION AND OPERATIONS MANAGEMENT

LEVELS 6 YEAR I EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER/DECEMBER 2025

SUBJECT: MATHEMATICS AND STATISTICS

TIME ALLOWED: 3 HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO THE CANDIDATE

1. Write your examination number and National Registration Card number on the answer booklet provided. Ensure to append your signature in the answer space provided on the answer booklet.
2. Write your answer **SCRIPT SERIAL NUMBER** on the examination register and on the entry slip provided.
3. There are Seven questions in this paper
4. Question One (1) is compulsory
5. Answer any Four (4) questions of your choice from the remaining Six (6) questions
6. All questions carry equal marks
7. Programmable calculators and cellular phones are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

QUESTION 1 (COMPULSORY)

a) A company manufactures two types of boxes, corrugated and ordinary cartons. The boxes undergo two major processes: cutting and pinning operations. The profits per unit are K30 and K10 respectively. Each corrugated box requires 2 minutes for cutting and 2 minutes for pinning operation, whereas each carton box requires 3 minutes for cutting and 1 minute for pinning. The available operating time is 120 minutes and 60 minutes for cutting and pinning machines respectively.

Required:

i) State the decision variables (2 marks)

ii) State the objective function (2 marks)

iii) Graph the constraint functions (8 marks)

iv) Determine the optimum quantities boxes to maximize the profits (2 marks)

b) Three quarters of a pile of pipes were used for certain project at a new site. When two thirds of the remainder had been used; 50 pipes were left. Calculate how many pipes were there from the starts? (6 marks)

Total (20 marks)

QUESTION 2

a) A firm has analyzed their operating conditions, prices and costs. The accountant has developed the following functions: Revenue $R(x) = 350x - 5x^2$ and cost $C(x) = x^2 + 20x + 60$ where $x =$ Number of units sold. The firm wishes to maximize profit.

Determine;

i) The quantity to be sold in order to maximize profit (5 marks)

ii) The price to maximize profit (4 marks)

iii) The maximum profit (3 marks)

b) Differentiate:

i) $f(x) = \frac{2}{(3x-5)^2}$ (4 marks)

ii) $y = (2x + 6)^4$ (4 marks)

Total (20 marks)

QUESTION 3

a) Calculate the principal amount of K70,000.00 after an investment for 5 years at 10% simple interest. (3 marks)

b) A sum of K80,000.00 is invested in an account that offers 10% interest compounded every after 6 months for three 3 years. Calculate the accrued amount of the investment

after three years. (5 marks)

c) A machine costing K50,000.00 depreciates to a scrap value of K5000.00 after 12 years.

i) Calculate the annual percentage rate of depreciation by reducing balance method. (5 marks)

ii) Find the book value of the machine at the end of the sixth year. (4 marks)

d) Calculate how long will a sum of money take to triple at 25% rate per annum simple Interest. (3 marks)

Total (20 marks)

QUESTION 4

The following table displays wage ranges of various categories of production managers at a factory.

Wages Range (K)	Number of Managers
120 -130	6
130 -140	18
140 -150	20
150 -160	15
160-170	1

a) Determine the mean wage (15 marks)

b) Draw a histogram to display the distribution of wages (5 marks)

Total (20 marks)

QUESTION 5

a) The following data relate to a set of commodities used in a particular process.

Commodity	2023		2024	
	Price (K)	Quantity (units)	Price (K)	Quantity (units)
P	20	50	22	45
Q	40	44	45	48
R	50	36	55	50

Taking 2023 as base year, calculate;

i) Simple price index number for commodity P. (3 marks)

ii) Laspeyres price index number for 2024. (6 marks)

iii) Paasche price index numbers for 2024. (6 marks)

b) Given matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 3 \\ 1 & 4 \end{bmatrix}$ determine the transpose of AB (5 marks)

Total (20 marks)

QUESTION 6

a) A certain factory produces 5% defectives items. The components are packed in boxes of 30. A box is selected at random. Calculate the probability that;

i) The box contains exactly one defective items. (3 marks)

ii) There are at least three defective items. (3 marks)

b) A box contains 10 computer components, 3 of which are defective. Two components are drawn in succession without replacement.

i) Construct a tree diagram for the information above. (2 marks)

ii) Calculate the probability that one component is defective. (4 marks)

iii) Calculate the probability that both components drawn are defective. (4 marks)

c) The accrued amount formula is given by: $A = P(1 + i)^n$, make P the subject of the formula. (4 marks)

Total (20 marks)

QUESTION 7

a) Solve the following simultaneous equations using Cramer's rule:

$$5x - 6y = 37$$
$$2x + 3y = 8$$ (6 marks)

b) Given; $A = \begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$ $B = (7 \quad 8)$, Determine the product of BA. (4 marks)

c) Evaluate:

i) $log_3 81 + \frac{1}{3} log_3 27$ (4 marks)

ii) $log_2 x + log_2(x - 1) = 2 - log_2 \frac{1}{3}$ (6 marks)

Total (20 marks)