

SECTION A (40 MARKS)

Answer all the questions in this section.

1. The determinant of the matrix

$$P = \begin{pmatrix} 3a & -1 \\ 7 & a \end{pmatrix} \text{ is } 55.$$

- (a) Find the values of a . (03 marks)
(b) Using one of the values of a , determine the inverse of P . (02 marks)

2. The table below shows the 3-month moving averages for the quantity of goods (in tonnes) manufactured by a certain company from January to August of 2019.

Month	February	March	April	May	June	July
3-month Moving Average (tonnes)	15	17.5	19	20	21.5	22.5

- (a) Find the moving totals. (03 marks)
(b) If 20 tonnes and 10 tonnes of goods were manufactured in February and March respectively, calculate the quantity that was manufactured in January. (02 marks)
3. A man's monthly salary in his first year of work was Shs 250,000. He got an increment of 5% every year. Calculate;
(a) the man's total earnings at the end of the year. (02 marks)
(b) his total earnings after 5 years. (03 marks)
4. Three letters are chosen at random from the word CLOTHINGS. Determine the probability that two of the three letters chosen are consonants. (05 marks)
5. The polynomial $f(x) = x^4 + 2x^2 - 3$ has factors $x - 1$ and $x + 1$. Find the other factor of $f(x)$. (05 marks)
6. Given that $P(A) = \frac{3}{4}$ and $P(B/A) = \frac{8}{15}$, find $P(A \cap B')$. (05 marks)
7. Differentiate the following with respect to x :
(a) $(5x - 2)^2$. (02 marks)
(b) $\frac{3x^4 + 4x^2 - 1}{2x^2}$. (03 marks)

8. Two points A and B are 800 metres apart. A particle moving in a straight line with a constant acceleration passes point A with a velocity of 10 m/s. It then passes the point B with a velocity of 40 m/s.
Calculate the time taken by the particle to move from A to B . (05 marks)

SECTION B (60 MARKS)

Answer only **four** questions from this section.

All questions carry equal marks.

9. The frequency distribution table below shows the marks of 50 students scored in a test.

Marks	Number of Students
50-52	3
53-55	16
56-58	14
59-61	13
62-64	2
65-67	2

- (a) Calculate the:
- mean mark. (04 marks)
 - standard deviation. (05 marks)
- (b) (i) Plot a cumulative frequency curve (Ogive) for the given data. (04 marks)
- (ii) Use the Ogive to estimate the median mark. (02 marks)
10. The rate of cooling of a body is proportional to the difference in temperature T of the body at any time t and that of the surroundings. If the temperature of the surroundings is 25°C and the body cools from 85°C to 70°C in 15 minutes;
- form a differential equation for the cooling of the body.
 - solve the differential equation formed in (i). (12 marks)
 - determine the temperature of the body after 30 minutes. (03 marks)

11. The time taken for a bus to make a journey is normally distributed with mean $3\frac{1}{2}$ hours and standard deviation $\frac{3}{4}$ hours.

(a) Determine the probability that the bus makes a journey:

(05 marks)

(i) in less than 2 hours.

(07 marks)

(ii) between $3\frac{1}{4}$ and $3\frac{3}{4}$ hours.

(b) If the bus made two hundred journeys, how many of these journeys did it take less than 2 hours? (03 marks)

12. (a) Given that $\tan \theta = \frac{1}{2}$, evaluate $\operatorname{cosec}^2 \theta - \sec^2 \theta$ without using mathematical tables or a calculator. (05 marks)

(b) Prove that $\frac{1 + \cos 2x}{2 \sin 2x} = \frac{1}{2} \cot x$.

Hence solve the equation $\frac{1 + \cos 2x}{2 \sin 2x} = 1$ for $0^\circ \leq x \leq 180^\circ$. (10 marks)

13. The table below shows the expenditure of a family for the months of January and July in a certain year.

ITEM	EXPENDITURE (Shs)		WEIGHT
	JANUARY	JULY	
Food	150,000	174,000	8
Rent	50,000	60,000	2
Clothing	100,000	125,000	6
Power	20,000	25,000	1
Water	60,000	90,000	4

(a) Calculate the:

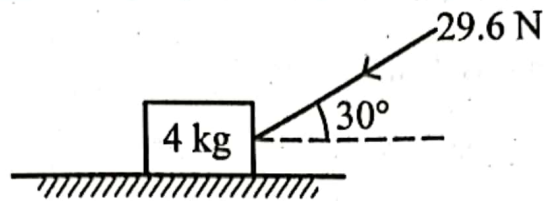
(i) Price relative for each item. (03 marks)

(ii) Simple aggregate index. (04 marks)

(b) (i) Find the weighted aggregate price index. (06 marks)

(ii) Comment on your result in (b) (i). (02 marks)

14. (a) The diagram below shows a block of mass of 4 kg in limiting equilibrium on a rough horizontal table under the action of a force of 29.6 N. The force is inclined at an angle of 30° to the horizontal.



Calculate the:

- (i) normal reaction exerted by the table on the block. (03 marks)
 - (ii) coefficient of friction between the block and the table. (03 marks)
- (b) Forces of magnitude 3 N, 2 N, 6 N and 5 N act from a point in the directions 090° , 180° , 330° , and 060° respectively.
- Find the:
- (i) magnitude of the resultant force. (07 marks)
 - (ii) inclination of the resultant force to the 3 N force. (02 marks)