

1. (a) Simplify the expression $5 \times 4^{3n+1} - 20 \times 8^{2n}$.
(4 marks)
- (b) Find the values of:
- (i) $\frac{\log 81}{\log 9}$;
- (ii) $\frac{8^{\frac{2}{3}} + 4^{\frac{2}{3}}}{16^{\frac{1}{3}}}$.
(6 marks)
- (c) Given that $2 \log_8 N = p$, $\log_2 2N = q$ and that $q - p = 4$, determine the value of N .
(10 marks)
2. (a) The second term of an arithmetical progression is 15 and the fifth term is 21.
Determine the:
- (i) common difference;
- (ii) first term;
- (iii) sum of the first-ten terms.
(7 marks)
- (b) Find the difference between the sums of the first ten terms of the arithmetical progressions whose first terms are 12 and 8, and whose common differences are 2 and 3, respectively.
(5 marks)
- (c) Given the first, third and sixth terms of an arithmetical progression are in geometrical progression, find the common ratio of the geometrical progression.
(8 marks)
3. (a) Given that matrices $A = \begin{bmatrix} 1 & -3 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix}$ determine:
- (i) $A(BC)$;
- (ii) $A^2 - B^2 + 2C$;
- (iii) $(ABC)^{-1}$.
(15 marks)

- (b) Currents I_1 , and I_2 in an electric circuit satisfy the simultaneous equations

$$2I_1 + 3I_2 = 13$$

$$5I_1 - 2I_2 = 14$$

Use a matrix method to determine the values of the currents.

(5 marks)

4. (a) Convert the binary number 11101.1 to a decimal number. (4 marks)

- (b) Given the numbers 18, 48 and 63, determine the:

(i) L.C.M;

(ii) H.C.F.

(6 marks)

- (c) Simplify the following expressions, giving the answers as mixed numbers, where applicable :

(i) $\frac{1}{2} \div \frac{1}{4} + \left(\frac{6}{5} - 1\frac{2}{3}\right)$;

(ii) $\frac{1}{2}$ of $\frac{3}{4} \div \frac{1}{4} \times \frac{1}{3}$.

(10 marks)

5. (a) (i) Find the sum of the integers between 1 and 100 which are divisible by 3.

- (ii) Determine the sum of the first six terms of the geometrical progression

$$5 + 15 + 45 + \dots$$

(12 marks)

- (b) A sum of Ksh 4000 is deposited in a bank account at a simple interest rate of 3% per annum. Determine, using AP's and GP's, the:

(i) amount after ten years;

(ii) number of years required for the amount in (i) to be realised at compound interest rate of 2% per annum.

(8 marks)

6. (a) (i) Use logarithms to find the value of $\log_4 0.65$.

(ii) Given that $x = \log_a n$, $y = \log_c n$, use the change of base formula to prove that

$$\frac{x - y}{x + y} = \frac{\log_b c - \log_b a}{\log_b c + \log_b a}$$

(8 marks)

(b) (i) Given the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, show that $A^3 = AA^2 = A^2A$.

(ii) Find the value of x if the determinant

$$\begin{vmatrix} 1 & -x+2 \\ 1 & x \end{vmatrix} = 0$$

(12 marks)

7. Table 1, shows the heights of students in a certain class.

Table 1

Height (cm)	140-144	145-149	150-154	155-159	160-164	165-169
Frequency(f)	12	20	30	45	38	26

Determine the:

- (i) mean;
- (ii) standard deviation;
- (iii) mode;
- (iv) median;
- (v) coefficient of skewness.

(20 marks)

8. Table 2 shows the number of components produced in one hour by a machine:

Table 2

66	87	79	74	84	72	81	78	68	74
80	71	91	62	77	86	87	72	80	77
76	83	75	71	83	67	94	64	82	78
77	67	76	82	78	88	66	79	74	64

(a) Classify the data using classes of size 5, starting with the classes 60 - 64, 65 - 69 ...

(b) Draw a cumulative frequency curve for the data.

(c) From the curve, determine the:

- (i) median;
- (ii) interquartile range;
- (iii) 9th decile;
- (iv) 30th percentile.

(20 marks)