

Business Mathematics

NEW SYLLABUS

Full Marks: 100

Teaching Hrs: 150

Course Contents

Unit 1: Number System

LH 7

Review of system of Natural numbers, Integers, Rational and Irrational numbers, Real numbers, Concept of inequalities and their properties, Absolute values and their properties (verification only), Complex numbers and their properties (verification only)

Unit 2: Sets and Relations

LH 7

Review of sets, Euler-Venn diagram and operation on sets, Properties of algebra of sets and their verification only (without theoretical proof), Number of elements in a set and the problems relating upon 3 sets, Cartesian product of two sets, Relation and function, Domain and range (Excluding types of function, inverse and composite functions)

Unit 3: Sequence and Series

LH 7

Difference between sequence, series and progression, Finite and infinite series, Types of progression (A.P., G.P. and H.P.), n^{th} term of an A.P., sum of the n terms of the series in A.P., Arithmetic means, n^{th} term of G.P., sum of the n terms of the series reducible to G.P. of the type $4 + 44 + 444 + \dots$ (excluding sum to n terms of the type $1 + 4 + 13 + 40 + \dots$)

Unit 4: Permutation and Combination

LH 5

Basic principles of counting, Meaning of ${}^n P_r$, Permutation of things when some are alike (simple cases only), Meaning of ${}^n C_r$, problems relating to combination (simple cases only) (Avoid the problems relating to restricted permutation like "two things arranged together". not arranged together)

Unit 5: Matrices and Determinants

LH 12

Matrix and its size, Types of matrices, Algebra of matrices, Determinants and its evaluation upto third order, Solving simultaneous of two and three variables by using Cramer's rule, solution of verbal problems of two variables only.

Unit 6: Co-ordinate Geometry

LH 9 teaching hours

Rectangular coordinates systems, Slope of a straight line joining two points, Distance between two points, Coordinates of a point dividing a line joining two points in a given ratio, Locus and equation, Equation of a straight line in slope-intercept form, double intercepts forms, point slope form and two points form, The point of intersection of two straight lines.

Unit 7: Logarithms

LH 6

Logarithm and its basic properties, change of base, Common logarithm table, use of common logarithm table in finding logarithm of a number, Antilog table, finding antilog of logarithm of a number.

Unit 8: Functions, Limit and Continuity

LH 10

Constant and variable, Definition and notation of function, Types of function and its graphic representation, Computation of functional values, Application of functions to Commerce and Economics, An intuitive idea of limit of a function, Basic rules of limit; limit at infinity, Concept of continuity and discontinuity (Note: Algebraic only)

Unit 9: Differentiation

LH 10

Definition and notation of derivatives, Geometrical meaning of derivatives, Differentiation of a function by first principle of algebraic functions only, Methods of differentiation, Differentiation of implicit function and parametric function, Second order derivatives, (Note: Derivative of algebraic, logarithmic and exponential functions only)

Unit 10: Application of Derivatives**LH 6**

Application of derivative of commerce and economics, Increasing and decreasing function, point of inflection, Maximum and minimum of a function and its application (Algebraic only)

Unit 11: Integration**LH 9**

Integration as an inverse process of differentiation, Methods of integration by substitution and by parts, Concept of definite integral, Methods of evaluating definite integrals, Application of integration to commerce and economics. (Note: Anti derivative of algebraic, logarithmic and exponential functions only)

Unit 12: Linear Programming Problems**LH 7**

Linear inequality in two variables and its graphical solution, System of linear inequalities in two variables and its graphical solution, Meaning of L.P.P. and its importance, Constraints, objective function, optimization, Mathematical formulation of L.P.P., Graphic method of solving L.P.P.

Unit 13: Measures of Dispersion**LH 12**

Review of measures of Central Tendency, Range, quartile deviation, mean deviation and standard deviation and their relative measures

Unit 14: Probability**LH 6**

Concept of probability, Addition and multiplication theorems without proof (mutually exclusive and independent cases with simple problems only)

Unit 15: Mathematics of Gain and Loss**LH 15**

Ratio and proportion, Profit and loss, Partnership

Unit 16: Mathematics of Finance**LH 22**

Money and exchange (chain method), Present worth and discount, Compound interest and compound depreciation, Annuity and its terminology: (a) Immediate annuity and computation of amount, present value only, (b) Annuity due and computation of amount, present value only (excluding deferred cases)

MODEL QUESTIONS- SET: A

Time: 3hrs.

Full Marks: 100

Code No. 908

Pass Mark: 35

Candidates are required to give their answers in their own words as far as possible. The figures in the margin indicate full marks.

Attempt all questions:

Group A [10×2×3=60]

1. (a) Rewrite without modulus sign: $|3x + 5| \leq 1$

Ans: $-2 \leq x \leq \frac{4}{3}$

- (b) If $A = \{-1, 0, 2, 4, 6\}$ and $f: A \rightarrow R$ be defined by $f(x) = \frac{x}{x+2}$, find the range of f .

Ans: Range of $f = \left\{-1, 0, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}\right\}$

2. (a) Find the sum of the series: $-10 - 5 - 0 + \dots + 75$

Ans: 585

- (b) Find the three numbers in G.P. whose sum is 14 and product is 64.

Ans: 2, 4, 8 or 8, 4, 2.

3. (a) In how many ways can be letters of the word "Business" be arranged?

Ans: 6,720

- (b) Construct a 2×2 matrix whose elements are given by: $a_{ij} = 3i - 2j$

Ans: $\begin{pmatrix} 1 & -1 \\ 4 & 2 \end{pmatrix}$

4. (a) If the slope of the line joining the points $(x, 5)$ and $(-1, 2)$ is $\frac{3}{4}$. Find the value of x . Also determine the distance between them.

Ans: $x = 3$ and distance = 5

- (b) Find the slope, x -intercept and y -intercept of the line whose equation is $3x - 4y = 6$

Ans: Slope = $\frac{3}{4}$; x -intercept = 2; y -intercept = $-\frac{3}{2}$

5. (a) Find the value of r where $\log\left(1 - \frac{r}{100}\right) = \frac{\log 3843 - \log 5555}{20}$

Ans: 1.83

- (b) Prove that: $\lim_{x \rightarrow 1} \frac{x^2 - \sqrt{x}}{\sqrt{x} - 1} = 3$

6. (a) A function $g(x)$ is defined by: $g(x) = \begin{cases} x^2 - 9 & \text{at } x \neq 3 \\ k & \text{at } x = 3 \end{cases}$

Find the value of k so that the function $f(x)$ is continuous.

Ans: $k = 6$

- (b) Find $\frac{dy}{dx}$, if $x^2 + y^2 = a^2$

Ans: $-\frac{x}{y}$

7. (a) Evaluate: $\int \frac{ax^2 + bx + c}{x^2} dx$

Ans: $ax + b \log x - \frac{c}{x} + K$

- (b) A manufacturer's marginal revenue function $MR = 3 - 2x - 3x^2$. Find the increase in the manufacturer's total revenue if production is increased from 10 to 30 units.

Ans: -26740

8. (a) Compute coefficient of variation of the following individual series: Share price (x): 35, 52, 53, 56, 58, 52, 50, 51, 49

Ans: Coefficient of variation C.V. = 12.13.

- (b) The chance that A can solve a certain problem is $\frac{2}{3}$ and the chance that B can solve it is $\frac{3}{4}$. Find the chance that the problem would be solved by at least one of them.

Ans: $\frac{11}{12}$

9. (a) If the three quantities a , b and c are such that $a:b = 2:3$ and $b:c = 5:8$. Find the ratio between a and c and also the continued proportion.

Ans: $a : b : c = 10 : 15 : 24$

- (b) The list price of an article is 25% above the selling price. And the cost price is 40% below the list price. Find the rate of discount.

Ans: Rate of discount = 20%

10. (a) Find the scrap value of the machine costing Rs. 20,000 after 10 years on 10% p.a.

Ans: Rs. 6966

- (b) The interest on a sum is Rs. 600 and the discount for the same time at the same rate is Rs. 500. Find the sum.

Ans: Rs. 3,000

Group B [8 × 5 = 40]

11. There are 50 worker employed in a sugar factory. If the total daily wage of the employees is Rs. 5,800 when a man gets Rs. 120 and a woman gets Rs. 100 a day, find the number of men and women employed in the factory by using Cramer's rule.

Ans: Men = 40 and Women = 10

12. Find $\frac{dy}{dx}$ when (i) $y = \frac{e^x}{1 + \log x}$ (ii) $y = \frac{1}{\sqrt[3]{ax^2 + bx + c}}$

Ans: (i) $\frac{e^x(x + x \log x - 1)}{x(1 + \log x)^2}$ (ii) $-\frac{(2ax + b)}{3(ax^2 + bx + c)^{4/3}}$

13. Examine whether the function $y = x^3 - 3x^2 - 24x + 8$ is increasing or decreasing at the points $x = 1$ and $x = 3$. Also find the point of inflection.

Ans: Decreasing at $x = 1$, $x = 3$ and $x = 1$;

14. Find the extreme value of the function G defined by $G = 10x + 15y$ over the convex polygon given by the inequalities: $x + 2y \leq 20$, $x + y \leq 16$, $x \geq 0$, $y \geq 0$

Ans: The maximum value of $G = 180$ at $B(12, 4)$ and the minimum value of $G = 0$ at $O(0, 0)$.

15. From the following distribution, find the most appropriate measure of dispersion:

Wages:	Below 25	25-29	30-34	35-39	40 & above
Frequency:	5	12	22	25	17

Ans: The quartile deviation = 4.305

16. A, B and C engage in a business with a joint capital of Rs. 18,000. A gives Rs. 2,000 more than B and B Rs. 2,000 more than C. Divide a profit of Rs. 1,080 among them.

Ans: A- Rs. 480; B- Rs. 360 and C- Rs. 240

17. Determine the par of exchange between London and New York if £1 contained 61.635 grains of gold 11/12 fine and \$1 contained 25.8 grains of gold 9/10 fine.

Ans: £1 = \$2.43

18. In how many years will an annuity of Rs. 400 amount to Rs. 4,064 at 3% p.a. compound interest?

Ans: 9 years.

MODEL QUESTIONS- SET: B

Time: 3hrs.
Code No. 908

Full Marks: 100
Pass Mark: 35

Candidates are required to give their answers in their own words as far as possible. The figures in the margin indicate full marks.

Attempt all questions:

Group A [10×2×3=60]

1. (a) If $x - iy = \frac{2-3i}{2+3i}$, prove that: $x^2 + y^2 = 1$.
- (b) In a city of 26,000 populations, 5000 read English local newspaper, 12000 read Nepali local newspaper and 1000 read both. What percentage read neither English nor Nepali newspaper?
Ans: 38.46
2. (a) Find the first term and the common difference of an A.P. whose 7th and 15th terms are $2\frac{5}{16}$ & $5\frac{1}{2}$ respectively.
Ans: First term = $\frac{5}{64}$ and common difference $\frac{51}{128}$
- (b) A person borrows Rs. 19682 and pays it back in 9 annual installments, each installment being double of the preceding one. Find the first installment. Ignore interest.
Ans: First installment = Rs. 38.52
3. (a) In how many ways can a committee of 5 members be selected from 6 men and 5 women consisting of 3 men and 2 women?
Ans: 200
- (b) If $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, show that: $A^2 - 2A - 5I = 0$, where I & O are the identity and null matrices of order 2 respectively.
4. (a) Find the equation of the locus of a point which moves so that it is equidistant from the points $(-1, -2)$ and $(3, 4)$.
Ans: $2x + 3y - 5 = 0$
- (b) Find the equation of the line which passes through the origin and the point of intersection of $2x - 3y + 1 = 0$ and $x + 2y = 3$.
Ans: $y = x$
5. (a) Using four figures log table, compute: $\frac{\sqrt[3]{12.7} \times (0.84)^4}{0.625}$
Ans: 1.859
- (b) The fixed cost of a new product is Rs. 35,000 and the variable cost per unit is Rs. 500. If the demand function is $p = 5000 - 100x$, where x is the item demanded. Find the break-even point.
Ans: BEP = 35 or 10

6. (a) Evaluate: $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2}-\sqrt{4-x}}$ Ans: 1
- (b) Find the derivative of: $\frac{1}{\sqrt{2x-3}-\sqrt{2x-5}}$ Ans: $\frac{1}{2} \left(\frac{1}{\sqrt{2x-3}} + \frac{1}{\sqrt{2x-5}} \right)$
7. (a) Evaluate: $\int x \log x \, dx$ Ans: $\frac{x^2}{2} \log x - \frac{1}{4} x^2 + C$
- (b) If the marginal revenue function for output x is given by $MR = 3x^2 - 2x + 5$, find the total revenue function. Also deduce demand function or law.

$$\text{Ans: } R = x^3 - x^2 + 5x \text{ and } p = x^2 - x + 5$$

8. (a) Compute the mean deviation from mean of the following data:

Marks:	10	15	20	25	30
No. of students	2	4	6	8	5

Ans: 5.12

- (b) From a pack of 52 cards, three are drawn at random. Find the chance that they are a king, a queen and a jack.

Ans: $\frac{16}{5525}$

9. (a) If 30 men can do a piece of work in 11 days working 9 hours a day. How many hours a day have 55 men to work in order to finish another work thrice as great in 18 days. Ans: 9
- (b) An article is sold for Rs. 150 at a gain. Had it been sold for Rs. 135, there would have been a loss equal to 50% of the original gain. Find the cost of an article. Ans: Rs. 140
10. (a) A bill of Rs. 16790 drawn for 150 days was discounted in the bank at the rate of 5% p.a. What was banker's discount and how much did the holder of the bill receive? Ans: B.D. = Rs. 345 and D.V. = Rs. 16445
- (b) What is the rate percent per annum of a sum of money doubles itself in 17 years at compound interest? Ans: 4.2%

Group B [8 × 5 = 40]

11. Prove that: $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$
12. Find from first principles, the derivative of $\sqrt{x+1}$. Ans: $\frac{1}{2\sqrt{x+1}}$
13. The demand equation for a certain commodity is $P = \frac{1}{3} Q^2 - 10Q + 75$. Find the value of Q and the corresponding value of P that maximizes the revenue. Ans: $Q = 5$ and $p = \frac{100}{3}$
14. Solve the following L.P. problem graphically:
 Maximize $(Z) = x + y$
 Subject to the constraints $x + y \geq 3$, $2x + 3y \leq 18$, $x \leq 6$ and $x, y \geq 0$
Ans: The maximum value of $Z = 8$ at the vertex $(6, 2)$
15. In two factories A and B, 1100 employees are employed, the average weekly wages (in Rs.) and the standard deviation are as follows:

	Factory A	Factory B
No. of employee:	500	600
Average wages:	586	575
Standard deviation:	9	10

- (i) Which factory, A or B pays out the larger wage?
 (ii) In which factory A or B, is the greater variability in individual wage?

Ans: (i) Factory B (ii) Factory B

16. Ram, Shyam and Hari form a business with capitals Rs. 5000, Rs. 4500 and Rs. 6500 respectively. After 6 months, Ram doubles his capital and after next three months Shyam trebles his capital. If the profit at the end of the year amounted to Rs. 8300, find the profits obtained by each of Ram, Shyam and Hari.

Ans: Ram: Rs. 3,000; Shyam: Rs. 2,700; Hari: Rs. 2,600

17. A Kathmandu merchant owes 5100 Bhats to merchant in Bangkok, the rate of remitting the amount by T.T. is Rs. 424 per 100 Bhats while the rate of remitting through the amount by sight draft is 0.24 Bhat for a rupee. Which is the cheaper method and how much does he gain by remitting the amount through cheaper method?

Ans: Remittance through sight draft is cheaper by (Rs. 21,624 - Rs. 21,250) = Rs. 374

18. Find the present value of an annuity of Rs. 400 for 10 years at 5% compound interest. Find the extra payment if it had been annuity due.

Ans: Present value of annuity = Rs. 3089.60; Extra payment = Rs. 154.48

MODEL QUESTIONS- SET: C

Time: 3hrs.
Code No. 908

Full Marks: 100
Pass Mark: 35

Candidates are required to give their answers in their own words as far as possible. The figures in the margin indicate full marks.

Attempt all questions:

Group A [10×2×3=60]

1. (a) Express the complex number $\frac{3-\sqrt{-4}}{2+\sqrt{-1}}$ in the form of $A + iB$. Ans: $A = \frac{4}{5}$ and $B = \frac{-7}{5}$
 (b) If $A = \{1, 2, 3\}$ and $B = \{2, 3\}$, find the relation in $A \times B$ satisfying $y > x$. Is this relation a function? Ans: $R = \{(1, 2), (1, 3), (2, 3)\}$
2. (a) How much salary does a man receive in the 9th year and also find the total salary for 9 years if his salary was Rs. 2,000 with an increment of Rs. 200 in each year? Ans: Rs. 3600; Rs. 25,200
 (b) Insert 3 geometric means between $2\frac{1}{4}$ and $\frac{4}{9}$. Ans: $\frac{3}{2}, 1$ and $\frac{2}{3}$
3. (a) How many plates of the vehicles consisting of 4 different digits can be made out of integers 4, 5, 6, 7, 8, 9? Ans: 360 plates
 (b) If $A = \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & 2 & 3 \\ 1 & -1 & 0 \end{pmatrix}$, find $5AB$. Ans: $\begin{pmatrix} 5 & 15 & 30 \\ 0 & -30 & -45 \end{pmatrix}$
4. (a) Prove that the points $(-1, 0)$, $(3, 1)$, $(2, 2)$ and $(-2, 1)$ are the vertices of a parallelogram.
 (b) Find the equation of the straight line passing through the point $(-3, 5)$ and making equal intercepts on the axes. Ans: $x + y = 2$
5. (a) Evaluate the following: $\frac{(3.678)^4}{\sqrt[3]{42.75}}$ Ans: 52.38
 (b) Find the limit of: $\lim_{x \rightarrow 0} \frac{\sqrt{x+4} - 2}{x}$ Ans: $\frac{1}{4}$
6. (a) Examine the continuity of the following function $f(x) = 3x^2 - 8x + 6$ at $x = 1$. Ans: $f(x)$ is continuous at $x = 1$.
 (b) Find the derivative of: $e^x \log x$. Ans: $\frac{dy}{dx} = e^x \left(\frac{1}{x} + \log x \right)$
7. (a) Evaluate the integral: $\int \frac{2x+5}{\sqrt{x^2+5x}} dx$ Ans: $2\sqrt{x^2+5x} + C$
 (b) If the marginal cost of the product is given by $MC = 36 - 20x + 6x^2$ and the initial cost is Rs. 20, find the total cost and average cost function. Ans: $36x - 10x^2 + 2x^3 + 20$ and $36 - 10x + 2x^2 + \frac{20}{x}$

8. (a) The following table gives the height of 8 persons:
Height in cm: 158, 156, 162, 161, 163, 164, 165, 159.
Find the quartile deviation. Ans: 2.75 cm
- (b) Two coins are tossed simultaneously. Determine the sample space and the probability of getting (i) two heads, (ii) one head and one tail.
Ans: {(H, H), (H, T), (T, H), (T, T)} (i) $\frac{1}{4}$ (ii) $\frac{1}{2}$
9. (a) A contractor had to complete his work of a road in 16 days. He employed 30 persons for 12 days and completes $\frac{5}{7}$ of the work. How many more persons should be employed now in order to complete the work in time? Ans: 6 persons
- (b) A merchant buys a watch for Rs. 300 and marks it at such a price that he may make a profit of 25% after allowing a discount of 10%. Find his marked price. Ans: Rs. 416.67
10. (a) A merchant in Nepal buys goods in London to the value of £ 1000. Find the value of the goods in N.C. when the rate of exchange between India and Nepal is Rs. 1.60 (N.C.) for Re. 1 (I.C.) and between London and India is £ 10 = Rs. 833.
Ans: Rs. 1,33,280 (NC)
- (b) Find the amount of an annuity of Rs. 400 per year for 5 years at 6% p.a. Ans: Rs. 2260

Group B [8x5 = 40]

11. Solve the following system of equation with the help of determinant:
 $9y - 5x = 3; x + y = 1; z + 2y = 2$
Ans: $x = \frac{3}{7}; y = \frac{4}{7}; z = \frac{6}{7}$
12. Find $\frac{dy}{dx}$ of: (i) $y = \frac{1}{\sqrt{x+a} - \sqrt{x-b}}$ (ii) $y = z^3 + 2z + 1, x = z^2 + 2$
Ans: (i) $\frac{1}{2(a+b)} \left[\frac{1}{\sqrt{x+a}} + \frac{1}{\sqrt{x-b}} \right]$ (ii) $\frac{3z^2 + 2}{2z}$
13. Given the demand function $P = 20 - Q$ and the total cost function $C = Q^2 + 8Q + 2$, determine the optimal output Q, price P and total profit under profit maximization.
Ans: Optimal output (Q) = 3; Price (P) = 17 and Profit (π) = 16
14. Find the objective value of the function:
Max. $Z = 9x + 7y$ subject to
 $x + 2y \leq 7; x - y \leq 4; x \geq 0, y \geq 0$
Ans: The maximum value of Z = 52 at B (5, 1)
15. Calculate the mean and the standard deviation for the data given below:
- | | | | | | |
|-----------------|------|-------|-------|-------|-------|
| Marks: | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| No. of students | 7 | 12 | 24 | 10 | 7 |
- Ans: Mean (\bar{x}) = 24.67 marks; S.D. (σ) = 11.397 marks
16. A and B are partners. A contributes Rs. 2000 and B Rs. 3,000. A, however, acts as manager, the understanding being that of the profits, A should get 25% for his service as manager, the remaining to be divided in the ratio of their contributions. B gets Rs. 1350 in his share, what would A get?
Ans Rs. 1,650
17. If the bankers' discount of Rs. 28000 at 3.5% per annum be equal to the true discount on Rs. 28735 for the same time at the same rate, when are the sums due?
Ans: 9 months
18. Find the compound interest on Rs. 6900 for 3 years if the interest be payable half yearly and the rate of interest for the first 2 years being 6% per annum and for the third year 9% per annum.
Ans: CI = Rs. 1576

UNIT 1: NUMBER SYSTEM**A. REAL NUMER SYSTEM****1. 2073 Set C Q.No.1a**

Find the modulus of $\frac{1+2i}{1-2i}$.

[3]

2. 2073 Set D Q.No.1a

If $x = -5$ and $y = 4$, verify that $|x+y| \leq |x| + |y|$.

[3]

3. 2072 Set C Q.No. 1

Rewrite $-5 < 2x + 3 < 11$ using the absolute value sign.

$$\text{Ans: } |x| < 4 \quad [3]$$

4. 2072 Set D Q.No. 1a

Rewrite $|x - 6| \leq 2$ without using the modulus sign.

$$\text{Ans: } 4 \leq x \leq 8 \quad [3]$$

5. 2071 Supp Q.No. 1a

Write using modulus sign: $-1 \leq x \leq 5$.

$$\text{Ans: } |x - 2| \leq 3 \quad [3]$$

6. 2069 Q.No. 1a

Rewrite without using modulus sign $|x - 6| \leq 2$.

$$\text{Ans: } 4 \leq x \leq 8 \quad [3]$$

7. 2068 Q.No. 1a

If $-10 < 5x + 10 < 5$, prove that $-4 < x < -1$

[3]

8. 2067 Q.No. 1a

Rewrite without absolute value sign $|3 - 5x| \leq 2$.

$$\text{Ans: } \frac{1}{5} \leq x \leq 1 \quad [3]$$

9. 2066 Old Q.No. 1 b

Rewrite $|3x + 2| \leq 1$ without absolute value sign.

$$\text{Ans: (a) } 2 \text{ (b) } -1 \leq x \leq -\frac{1}{3} \quad [3]$$

10. 2066 Supp Q.No. 1 a

Rewrite so that x is alone between the inequality sign: $|4x + 3| \leq 9$.

$$\text{Ans: } -3 \leq x \leq \frac{3}{2} \quad [3]$$

11. 2065 Q.No. 1 a

Rewrite so that x is alone between the inequality sign.

$$-7 < -2x + 3 < 5$$

$$\text{Ans: } 5 > x > -1. \quad [3]$$

12. 2065 Old Q.No. 1 b

Solve the inequality $|3x - 2| < 5$.

$$\text{Ans: (a) } \sqrt{2} \text{ (b) } x < \frac{7}{3}, x > -1 \quad [3]$$

13. 2064 Old Q.No. 1 b

Rewrite: $-1 \leq x \leq 5$ in absolute value form.

$$\text{Ans: } |x - 2| \leq 3 \quad [3]$$

14. 2063 Q.No. 1 b

If $x = -2$ and $y = -1$, verify that $|x + y| \leq |x| + |y|$

[3]

15. 2062 Q.No. 1 b

Rewrite: $-5 \leq x \leq -2$ in absolute value form.

$$\text{Ans: (a) } (-1) \text{ (b) } |2x + 7| \leq 3 \quad [3]$$

16. 2061 Q.No. 1 b

If $-14 < 3x - 8 < -2$, prove that $-2 < x < 2$.

$$\text{Ans: (a) } 5 - 10 \quad [3]$$

17. 2060 Q.No. 1 a

For any real numbers x and y , prove that: $|x + y| \leq |x| + |y|$.

[3]

18. 2059 Q.No. 1 a

If $x = 4$ and $y = -2$, verify that: $\left| \frac{x}{y} \right| = \frac{|x|}{|y|}$

[3]

19. 2058 Q.No. 1 b

If $-6 \leq 3x + 3 \leq 12$, prove that $-3 \leq x \leq 3$.

[3]

20. 2057 Q.No. 1 b

If $x = -4$, $y = 7$ verify the following: $|x| - |y| \leq |x - y|$

[3]

B. COMPLEX NUMER SYSTEM**21. 2072 Supp Q.No. 1a**Express the complex number $(3 - 2i)(6 - 8i)$ in the form of $A + iB$.

[3]
Ans: $2 + (-36)i$

22. 2072 Set E Q.No. 1aFind the value of $i^2 + \frac{1}{i^2}$.

[3]
Ans: -2

23. 2071 Set C Q.No. 1aExpress the complex number $(3 - 2i)(6 - 8i)$ in the form of $A + iB$.

[3]
Ans: $2 + (-36)i$

24. 2071 Set D Q.No. 1aFind the modulus of $\frac{3 + 4i}{4 - 3i}$

[3]
Ans: 1

25. 2070 Supp Q.No. 1aIf $x = 1 - 2i$ and $y = 2 + i$, find $(x + y)^2$

[3]
Ans: $8 - 6i$

26. 2070 Set C Q.No. 1 aFind the values of x and y if $5x + (3x - y)i = 10 + 2i$.

[3]
Ans: $x = 2, y = 4$

27. 2070 Set D Q.No. 1 aIf $a + ib = \sqrt{\frac{i+1}{i-1}}$, show that $a^2 + b^2 = 1$.

[3]

28. 2069 Supp Q.No. 1 aExpress the complex number $(1+3i)^2$ in the form of $A + iB$.

[3]
Ans: $-8 + 6i$, where $A = -8, B = 6$

29. 2067 Supp Q.No. 1aFind the modulus of $\frac{8 + 6i}{5 - 12i}$

[3]
Ans: $\frac{10}{13}$

30. 2066 Q.No. 1 aExpress the complex number $\frac{1-i}{1+i}$ in the form $A + iB$.

[3]
Ans: $0 + (-1)i$

31. 2066 Old Q.No. 1 aFind the modulus of $z = \frac{(1-i)^3}{1-i^3}$

[3]

32. 2065 Old Q.No. 1 aFind the modulus of $\frac{(1+i)^2}{1-i}$

[3]

33. 2064 Q.No. 1 aFind the values of x and y if $5x + (3x - y)i = 10 + 2i$.

[3]
Ans: $x = 2, y = 4$

34. 2064 Old Q.No. 1 aIf $x + iy = \frac{a+ib}{a-ib}$, prove that $x^2 + y^2 = 1$.

[3]

35. 2063 Q.No. 1 aReduce $\left(\frac{1-i}{1+i}\right)^3$ in the form of $A + iB$

[3]

Ans: $0 + i$

36. 2062 Q.No. 1 a

Simplify: $\frac{1+2i}{1-i} + \frac{1-2i}{1+i}$

[3]

37. 2061 Q.No. 1 a

Express the complex number $(4-3i)(2-i)$ in the form of $A+ib$.

[3]

38. 2060 Q.No. 1 b

If $z_1 = 2+3i$ and $z_2 = 3-2i$, find the value of $\bar{z}_1^2 + \bar{z}_2^2$ [3]
Ans: (b) 0

39. 2059 Q.No. 1 b

If $x = 4+5i$ and $y = 4-5i$, find the value of $x^2 - xy + y^2$ [3]
Ans: (b) -59

40. 2058 Q.No. 1 a

If $x-iy = \frac{2-3i}{2+3i}$, prove that $x^2 + y^2 = 1$

[3]

41. 2057 Q.No. 1 a

If $x+iy = \sqrt{\frac{1+i}{1-i}}$, show that $x^2 + y^2 = 1$

[3]

UNIT 2: SETS AND RELATIONS**A. SETS**

1. 2071 Set D Q.No. 1b

If $n(U) = 200$, $n(A) = 150$, $n(B) = 80$, $n(A \cup B) = 160$, find: $n(A \cap B)$, $n(A - B)$ and $n(\overline{A \cup B})$ [3]
Ans: 70, 80, 40

2. 2070 Supp Q.No. 1b

Students of Grade XII Management, 65% students have taken Business Math and 55% students Marketing. How many students have taken both the subjects?

[3]
Ans: 20%

3. 2070 Set D Q.No. 1 b

In a market survey of 600 consumers of tea, it was found that 300 purchased Tokala tea, 250 purchased Muna tea and 150 purchased both brands. How many purchased neither of them? [3]

Ans: 200

4. 2067 Supp Q.No. 1b

If $U = \{x: 2 \leq x+1 \leq 11\}$, $A = \{x: x \text{ is an even integer}\}$ and $B = \{x: x \text{ is an odd integer}\}$. Find $(A \cap B)^c$ and $(A \cup B)^c$.[3]
Ans: $\{1, 2, 3, \dots, 10\}$ and ϕ

5. 2066 Old Q.No. 1 c

If $A = \{a, b, c\}$, $B = \{b, c\}$ then show that $A - (A - B) = A \cap B$.

[3]

6. 2065 Old Q.No. 1 c

If 85% of students in a school know English and 75% know Nepali while each student knows at least one of these languages, find what percentage of students know both the languages.

[3]
Ans: 60%

7. 2064 Q.No. 1 c Old

In a group of 50 students, 25 play hockey, 30 play football, and 8 play neither game. Find the number of students who play both games.

[3]

Ans: 13

8. 2063 Q.No. 1 c

In a statistical investigation of 500 families in certain town, it was found that 40 families had neither a radio nor a TV, and 320 families had a radio and 190 a TV. How many families in that group had both radio and TV?

[3]
Ans: 50 [3]

9. 2062 Q.No. 1 c

In a survey of a city market, it was found that 143 families used Colgate toothpaste, 135 used Everest toothpaste and 70 families used both. Find the number of families using at least one type of toothpaste.

[3]
Ans: 208

10. 2061 Q.No. 1 c

If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$, find $(A - B) \cap C'$. [3]

Ans: {1}

11. 2060 Q.No. 1 c

If $A = \{a, b, c, d, e\}$; $B = \{a, c, e, g\}$; $C = \{b, e, f, g\}$, prove that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ [3]

12. 2059 Q.No. 1 c

In a class, 65% students have taken physics and 55% students have taken chemistry. How many students have been taken both the subjects?

[3]
Ans: 20%

13. 2058 Q.No. 1 c

In a city of 26,000 populations, 5000 read English local newspaper, 12000 read Nepali local newspaper and 1000 read both. What percentage read neither English nor Nepali newspaper? [3]

Ans: 38.46%

14. 2057 Q.No. 1 c

In a market survey of 600 consumers of tea it was found that 300 purchased Mechi tea, 250 purchased Muna tea and 150 purchased both brands. How many purchased neither of them? [3]

Ans: 200

B. RELATIONS

1. 2073 Set C Q.No. 1b

Given $A = \{1, 2, 3, 4\}$, find the relation set in $A \times A$ determined by the condition $y < x$; $x, y \in A$. [3]

Ans: $\{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$

2. 2073 Set D Q.No. 1b

Let $A = \{1, 2, 3\}$. Find the relation in $A \times A$ satisfying the condition $x > y$ where $x, y \in A$. [3]

Ans: $\{(2, 1), (3, 1), (3, 2)\}$

3. 2072 Supp Q.No. 1b

If $A = \{1, 2, 3\}$ and $B = \{a, c\}$, find the $A \times A$, $A \times B$ and $B \times A$. [3]

Ans: $\{(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$;
 $\{(1, a), (1, c), (2, a), (2, c), (3, a), (3, c)\}$; $\{(a, 1), (a, 2), (a, 3), (c, 1), (c, 2), (c, 3)\}$

4. 2072 Set C Q.No. 2

Let $A = \{1, 2, 3, 4\}$. Find the relation in $A \times A$ determined by $y = 2x$. [3]

Ans: $\{(1, 2), (2, 4)\}$

5. 2072 Set D Q.No. 1b

Let $A = \{a, b\}$, $B = \{1\}$. Write all relations from A to B . [3]

Ans: $\{(a, 1)\}$; $\{(b, 1)\}$; $\{(a, 1), (b, 1)\}$

6. 2072 Set E Q.No. 1b

Find the domain and range in relation $R = \{4, 8\}, \{4, 12\}, \{5, 10\}, \{6, 12\}, \{7, 7\}$. [3]

Ans: Domain = $\{4, 5, 6, 7\}$, Range = $\{7, 8, 10, 12\}$

7. 2071 Supp Q.No. 1b

Find the domain range and the inverse relation of the relation $R = \{(0, 2), (1, 7), (3, 8)\}$. [3]

Ans: Domain = $\{0, 1, 3\}$; Range = $\{2, 7, 8\}$; Inverse relation = $\{(2, 0), (7, 1), (8, 3)\}$

8. 2071 Set C Q.No. 1b

If $A = \{a, b, c\}$, $B = \{p, q\}$, find $A \times B$ and $B \times A$. Show that $A \times B \neq B \times A$. [3]

Ans: $A \times B = \{(a, p), (b, p), (c, p), (a, q), (b, q), (c, q)\}$; $B \times A = \{(p, a), (p, b), (p, c), (q, a), (q, b), (q, c)\}$

9. 2070 Set C Q.No. 1b

Let $A = \{1, 2, 3\}$. Find the relation in $A \times A$ satisfying the condition $x > y$. Also, find the domain of the relation. [3]

Ans: Relation = $\{(2, 1), (3, 1), (3, 2)\}$; Domain of the relation = $\{2, 3\}$

10. 2069 Supp Q.No. 1b

Let $A = \{1, 2, 3\}$ and $B = \{1, 3, 5\}$. Find $A \times B$ and also find the relation from A to B satisfying the condition $x + y \geq 5$ where $x \in A$ and $y \in B$. [3]

Ans: $A \times B = \{(1, 1), (1, 3), (1, 5), (2, 1), (2, 3), (2, 5), (3, 1), (3, 3), (3, 5)\}$
Relation = $\{(1, 5), (2, 3), (2, 5), (3, 3), (3, 5)\}$

11. 2069 Q.No. 1b

Let $A = \{1, 2, 3, 4\}$. Find the relation in $A \times A$ determined by $y = 2x$, $x \in A$, $y \in A$. [3]
 Ans: $\{(1, 2), (2, 4)\}$

12. 2068 Q.No. 1b

Let $A = \{1, 2, 3\}$. Find the relation in $A \times A$ satisfying the condition $x + y < 4$, where $x, y \in A$. [3]
 Ans: $\{(1, 1), (1, 2), (2, 1)\}$

13. 2067 Q.No. 1b

If $A = \left\{-1, -\frac{1}{2}, 0, \frac{1}{2}, 1, \frac{3}{2}, 2\right\}$ and $f: A \rightarrow R$ be a function defined by $f(x) = 2x + 1$, find $f(x) = 2x + 1$ the range of f . [3]
 Ans: $\{-1, 0, 1, 2, 3, 4, 5\}$

14. 2066 Q.No. 1 b

If $f(x) = x + |x|$ find $f(2)$, $f(-5/2)$ and $f(-2)$. [3]
 Ans: $2 + 2i; -\frac{5}{2}; -2 + 2i$

15. 2066 Supp Q.No. 1 b

Two students are discussing the function $f(x) = \frac{x^2 - 4}{x^2 - 9}$ and one says to other "f(2) exists but f(3) does not". Explain what they are talking about? [3]

16. 2065 Q.No. 1 b

If $A = \{-1, 0, 1\}$ and R be a relation on A such that $R = \{(x, y) : x + y \leq 2\}$, write the elements of the relation R . Also find the domain and range of R . [3]
 Ans: $R = \{(-1, -1), (-1, 0), (-1, 1), (0, -1), (0, 0), (0, 1), (1, -1), (1, 0), (1, 1)\}$;
 Domain of $R = \{-1, 0, 1\}$; Range of $R = \{-1, 0, 1\}$

17. 2064 Q.No. 1 b

Let $A = \{1, 2, 3\}$. Find the relation in $A \times A$ satisfying the condition $x > y$ for all $(x, y) \in A \times A$. Find the domain of the relation. [3]
 Ans: Relation = $\{(2, 1), (3, 1), (3, 2)\}$; Domain of the relation = $\{2, 3\}$

UNIT 3: SEQUENCE AND SERIES

A. ARITHMETIC PROGRESSION

1. 2073 Set C Q.No.2a

What term is 359 in the sequence 5, 11, 17, 23, 29, ...? [3]
 Ans: 60

2. 2073 Set D Q.No. 2a

If 7, 2, a, b, -13 are in A.P., find a and b. [3]
 Ans: $a = -3, b = -8$

3. 2072 Supp Q.No. 2a

A man is appointed on a salary of Rs. 3,100. He gets an increment of Rs. 80 every year. What will be his salary in the 10th year? [3]
 Ans: Rs 3820

4. 2072 Set C Q.No. 2a

If 7 times the 7th term of an A.P. is equal to 11 times its 11th term, show that the 18th term of the A.P. is zero. [3]

5. 2072 Set D Q.No. 2a

Three numbers are in the ratio of 1 : 2 : 4. If 3 is added to the first and 8 is subtracted from the third, the new numbers will be the first and third terms of an A.P., whose second term is the second number. Find the original numbers. [3]
 Ans: 5, 10, 20

6. 2072 Set E Q.No. 2a

How many terms of the series $2 + 4 + 6 + \dots$ must be taken in order that the sum may be 420? [3]
 Ans: 20

7. 2071 Supp Q.No. 2a

In A.P., what term of 5, 11, 17, 23, 29, ... will be 377? [3]
 Ans: 63

8. 2071 Set C Q.No. 2a

Insert 5 A.M.'s between 1 and 43.

[3]
Ans: 8, 15, 22, 29, 36

9. 2071 Set D Q.No. 2a

How many terms of the series $20 + 16 + 12 + \dots$ amounts to 48? Explain the double answers. [3]

Ans: 3, 8

10. 2070 Supp Q.No. 2a

A man has a monthly salary of Rs. 65,000. If he gets an increment of Rs. 150 every year, how much salary does he receive in 10th year? [3]

Ans: Rs. 78,500

11. 2070 Set C Q.No. 2 a

Find the sum of the following arithmetic series: [3]

 $7 + 11 + 15 + 19 + \dots$ to 20 terms.

Ans: 900

12. 2070 Set D Q.No. 2

a. A man has a monthly salary of Rs. 10,000. If he gets an annual increment of Rs. 300, how much salary does he receive in 10th year? [3]

b. Insert 4 arithmetic means between 6 and 192. [3]

Ans: (a) Rs. 12,700 (b) 43.2, 80.4, 122.6 and 154.8

13. 2069 Supp Q.No. 2 a

What is common difference of an A.P. whose first term is 3 and 15th term is 143? [3]

Ans: 10

14. 2069 Q.No. 2a

Find the sum of the series $-3+3+9+\dots$ to 14 terms. [3]

Ans: 504

15. 2068 Q.No. 2a

Find the sum of the series. [3]

 $49 + 44 + 39 + \dots$ 17 terms

Ans: 153

16. 2067 Q.No. 2 a

Find the sum of the following A.S. [3]

 $5 + 7 + 9 + 11 + \dots + 25$.

Ans: 165

17. 2067 Supp Q.No. 2a

Find the sum of all the natural numbers between 1 and 100 which are divisible by 5. [3]

Ans: 1050

18. 2066 Q.No. 2 a

A small town whose population was 12,317 ten years ago, has lost 250 inhabitants each year since then. What is the present population of small town? [3]

Ans: 10,067

19. 2066 Old Q.No. 2 a

A man starts repaying a loan with first installment of Rs. 100. If he increases the installment by Rs. 5 every month, what amount will be paid by him in the 30th installment? [3]

Ans: Rs. 245

20. 2066 Supp Q.No. 2 a

If m times the m^{th} term is equal to n times the n^{th} term of an A.P. prove that $(m+n)^{\text{th}}$ term of the A.P. is zero. [3]

21. 2065 Q.No. 2 a

A firm produced 100 calculator sets during its first year. The total number of calculator sets produced at the end of five years is 4,500. Assume that the production increases uniformly each year. Estimate the increase in production each year. [3]

Ans: 400

22. 2065 Old Q.No. 2 a

Find 4 arithmetic means between $\frac{1}{2}$ and $4\frac{1}{4}$ [3]Ans: $1\frac{1}{4}, 2, 2\frac{3}{4}, 3\frac{1}{2}$

23. 2064 Q.No. 2 a

A man has a monthly salary of Rs. 6,500. If he gets an increment of Rs. 150 every year, how much salary does he receive in the 10th year? [3]

Ans: Rs. 7,850

24. 2064 Q.No. 2 a Old

Find three numbers in A.P. such that their sum is 30 and the sum of their squares is 350. [3]

Ans: 5, 10, 15 or 15, 10, 5

25. 2063 Q.No. 2 a

A firm produced 1000 radio sets during its first year. The total number of radio sets produced at the end of 10 years is 14,500. Assume that the production increases uniformly each year. Estimate the increase in production each year. [3]

Ans: 100

26. 2062 Q.No. 2 a

Starting salary of a man is Rs. 7,200 per month. If he gets an increment of Rs. 200 every year, what will his salary be in the tenth year? [3]

Ans: Rs. 9000

27. 2061 Q.No. 2 a

In an arithmetic sequence, the 4th and the 15th terms are 11 and 44 respectively. Find the first term and the common difference. [3]

Ans: $a = 2, d = 3$

28. 2060 Q.No. 2 a

Insert five arithmetic means between 2 and 26. [3]

Ans: 6, 10, 14, 18, 22

29. 2059 Q.No. 2 a

Find the sum of the series of the multiple of 5 from 5 to 100 inclusive. [3]

Ans: 1050

30. 2058 Q.No. 2 a

If the n^{th} term of an A.P. 23, 26, 29, 32, is equal to the n^{th} term of an A.P. 59, 58, 57, 56,, find the number of terms. [3]

Ans: 10

31. 2057 Q.No. 2 a

If $x + 2, 3x$ and $4x + 1$ are in A.P., find x [3]

Ans: 3

B. GEOMETRIC PROGRESSION

1. 2073 Set C Q.No. 2b

Find the sum of the series $3 + 6 + 12 + 24 + \dots + 768$. [3]

Ans: 1533

2. 2073 Set D Q.No. 2b

Find the sum of the following geometric series: $3 + 6 + 12 + 24 + \dots + 768$ [3]

Ans: 1533

3. 2072 Supp Q.No. 2b

Insert 3 geometric means between $2\frac{1}{4}$ and $\frac{4}{9}$. [3]

Ans: $\frac{3}{2}, 1$ and $\frac{2}{3}$

4. 2072 Set C Q.No. 2b

Insert 4 geometric means between 6 and 92. [3]

Ans: 10.38, 17.96, 31.07, 53.74

5. 2072 Set D Q.No. 2b

Insert three geometric means between 5 and 405. [3]

Ans: 15, 45, 135

6. 2072 Set E Q.No. 2b

Find the first term of a G.P. whose fifth term is 243 and common ratio is 3. [3]

Ans: 3

7. 2071 Supp Q.No. 2b

Find the common ratio of a G.P. whose first term is 3 and fifth term is 243. [3]

Ans: ± 3

8. 2071 Set C Q.No. 2b

Find the sum of the geometric series: $3 + 6 + 12 + 24 + \dots + 768$.

[3]

Ans: 1533

9. 2071 Set D Q.No. 2b

The fifth term of a series in G.P. is 48. If the common ratio of the series be 2, find the first term. [3]

Ans: 3

10. 2070 Supp Q.No. 2b

Insert 3 geometric means between 5 and 405.

[3]

Ans: 15, 45, 135

11. 2070 Set C Q.No. 2 b

In a GP, the first term is 5, the last term 1215 and the sum 1820, find the common ratio. [3]

Ans: 3

12. 2069 Supp Q.No. 2 b

Find the sum of the geometric series $3 + 6 + 12 + 24 + \dots + 768$.

[3]

Ans: 1533

13. 2069 Q.No. 2b

If the second and the fifth term of a G.P. are 24 and 81 respectively, find the series. [3]

Ans: $16 + 24 + 36 + \dots$

14. 2068 Q.No. 2b

The sum of a series in G.P. whose common ratio is 3 is 728 and the last term is 486. Find the first term. [3]

Ans: 2

15. 2067 Q.No. 2 b

Insert 3 G.M's between $2\frac{1}{4}$ and $\frac{4}{9}$.

[3]

Ans: $\frac{3}{2}$, 1 and $\frac{2}{3}$

16. 2067 Supp Q.No. 2b

The product of three numbers in a geometric progression is 729 and the sum of their square is 819. Determine the numbers. [3]

Ans: 3, 9, 27 or 27, 9, 3 or -3, 9, -27 or -27, 9, -3

17. 2066 Q.No. 2 b

Insert 5 geometric mean between $3\frac{5}{9}$ and $40\frac{1}{2}$.

[3]

Ans: $5\frac{1}{3}$, 8, 12, 18, 27

18. 2066 Old Q.No. 2 b

The sum of first three terms of a G.P. is $\frac{39}{10}$ and their product is 1. Find the first term, the common ratio and the terms. [3]Ans: First term = $\frac{2}{5}$ or $\frac{5}{2}$; common ratio = $\frac{5}{2}$ or $\frac{2}{5}$ and terms = $\frac{2}{5}$, 1, $\frac{5}{2}$ or $\frac{5}{2}$, 1, $\frac{2}{5}$

19. 2066 Supp Q.No. 2 b

One grain of rice is placed on the first square of a chess board, 2 on the second, 4 on the third and so on, every time doubling the number of grains. Find the total number of grains required assuming that the number of squares on chess board is 64. [3]

Ans: $2^{64} - 1$

20. 2065 Q.No. 2 b

Find three numbers in geometric progression whose sum is 14 and whose product is 64. [3]

Ans: 2, 4, 8 or 8, 4, 2

21. 2065 Old Q.No. 2 b

The sum of a series in geometric progression having common ratio 3 is 728 and the last term is 486. Find the first term. [3]

Ans: 2

22. 2064 Q.No. 2 b

Insert 3 geometric means between $2\frac{1}{4}$ and 36.

[3]

Ans: $\frac{9}{2}$; 9 and 18

23. 2064 Q.No. 2 b Old

Three numbers are in the ratio 1:2:3. If 2, 4 and 11 are added to them respectively, the resulting numbers are in G.P. Find the original three numbers. [3]

Ans: 3, 6, 9 or -2, -4, -6

24. 2063 Q.No. 2 b

Find the sum of the geometric series. [3]

$$3 + 6 + 12 + 24 + \dots + 384.$$

Ans: 765

25. 2062 Q.No. 2 b

The sum of a G.P., whose common ratio is 2 and the last term is 768, is 1533. Find the first term. [3]

Ans: 3

26. 2061 Q.No. 2 b

Insert 3 geometric means between $\frac{16}{9}$ and 9. [3]

Ans: $\frac{8}{3}, 4, 6$

27. 2060 Q.No. 2 b

Find the sum of the series $3 + 33 + 333 + 3333 + \dots$ to n terms. [3]

Ans: $\frac{10}{27} (10^n - 1) - \frac{n}{3}$

28. 2059 Q.No. 2 b

Sum to n terms of the following series: $5 + 55 + 555 + \dots$ [3]

Ans: $\frac{50}{81} (10^n - 1) - \frac{5n}{9}$

29. 2058 Q.No. 2 b

The sum of three numbers in G.P. is 14 and their product is 64. Find the numbers. [3]

Ans: 2, 4, 8 or 8, 4, 2

30. 2057 Q.No. 2 b

The sum of a series in G.P., whose common ratio is 3, is 728 and the last term is 486. Find the first term. [3]

Ans: 2

UNIT 4: PERMUTATION AND COMBINATION

A. PERMUTATION

1. 2073 Set C Q.No. 3a

Find in how many ways the letters of the word 'COMMERCE' can be arranged. [3]

Ans: 5040

2. 2072 Supp Q.No. 3a

In how many ways can the letters of the word "MANAGEMENT" be arranged? [3]

Ans: 226800

3. 2072 Set C Q.No. 3a

In how many ways can the letters of the word 'PENCIL' be permuted? [3]

Ans: 720

4. 2072 Set E Q.No. 3a

In how many ways the letters of the word 'BUSINESS' can be arranged? [3]

Ans: 6720

5. 2071 Set C Q.No. 3a

How many license plates consisting of 3 different digits can be made out of given integers 1, 2, 3, 4, 5, 6? [3]

Ans: 120

6. 2071 Set D Q.No. 3a

In how many ways can the letters of the words 'BUSINESS' be arranged? [3]

Ans: 6720

7. 2070 Supp Q.No. 3a

How many numbers of 4 different digits can be formed from the digits 1, 2, 3, 4, 5, 6, and 7? [3]

Ans: 840

8. 2069 Supp Q.No. 3 a

If three persons enter a bus in which there was 10 vacant seats, find in how many ways they can sit. [3]

Ans: 720

9. 2069 Q.No. 3a

In how many ways the letters of the word 'MANAGEMENT' can be arranged? [3]

Ans: 226800

10. 2067 Q.No. 3 a

In how many ways can the letters of the word commerce be arranged? [3]

Ans: 5040

11. 2066 Q.No. 3 a

In how many ways can the letter of the word EXAMINATION be arranged? [3]

Ans: $\frac{11!}{2! 2! 2!}$

12. 2062 Q.No. 2 c

In how many ways can the letters of the word 'COMMERCE' be arranged? [3]

Ans: 5040

13. 2061 Q.No. 2 c

If three persons enter a bus in which there are 12 vacant seats, find in how many ways they can sit. [3]

Ans: 1320

14. 2058 Q.No. 2 c

If 5 persons enter a bus in which there are 8 vacant seats, in how many ways they can take their seats? [3]

Ans: 6720

B. COMBINATION

1. 2073 Set D Q.No. 3a

A college has 7 good badminton players. In how many ways can a team of 5 players be selected? [3]

Ans: 21

2. 2072 Set D Q.No. 3a

A committee is to be formed from 12 men and 8 women and is to consist of 3 men and 2 women. In how many ways can it be done? [3]

Ans: 6160

3. 2071 Supp Q.No. 3a

In how many ways a committee of 3 boys and 2 girls can be formed from 12 boys and 8 girls? [3]

Ans: 6160

4. 2070 Set C Q.No. 3 a

A school has 6 badminton players. A team of 4 has to be sent to a tournament. In how many ways can the team be selected? [3]

Ans: 15

5. 2070 Set D Q.No. 3 a

In an entrance test 22 questions are set. In how many ways can you choose 18 questions to answer? [3]

Ans: 7315

6. 2068 Q.No. 3a

In an examination paper on Business Mathematics, 18 questions are set. In how many different ways can you choose 15 questions to answer? [3]

Ans: 816

7. 2067 Supp Q.No. 3a

What do you mean by permutation and combination? [3]

Evaluate: ${}^4P_3 + {}^7C_4$

Ans: 59

8. 2066 Old Q.No. 2 c

Find the value of x if ${}^{44}C_{20} \cdot x^{20} = {}^{44}C_{21} \cdot x^{21}$ [3]

Ans: 7/8

9. 2066 Supp Q.No. 3 a

State the meaning of ${}^n P_r$ and ${}^n C_r$. Find the value of ${}^3 P_2 + {}^7 C_2$.

[3]

Ans: 27

10. 2065 Q.No. 3 a

In how many ways can a committee of 5 members be selected from 6 men and 5 women consisting of 3 men and 2 women?

[3]

Ans: 200 ways

11. 2065 Old Q.No. 2 c

In how many ways of 5 members committee of 3 men and 2 women can be formed out of 8 men and 7 women?

[3]

Ans: 1,176

12. 2064 Q.No. 2 c Old

A person has got 12 friends of whom 8 are relatives. In how many ways can he invite 7 guests such that 5 of them may be relatives?

[3]

Ans: 336

13. 2064 Q.No. 3 a

In an examination paper on Business Mathematics, 10 questions are set. In how many ways can you choose 6 questions to answer?

[3]

Ans: 210

14. 2063 Q.No. 2 c

A college has 8 good badminton players. A team of 4 has to be sent to a tournament. In how many ways can the team be selected?

[3]

Ans: 70 ways

15. 2060 Q.No. 2 c

From seven boys and four girls, in how many ways a committee of five can be formed so as to include at least one girl?

[3]

Ans: 441

16. 2059 Q.No. 2 c

In how many ways can 6 players be selected from 7 men and 5 ladies consisting of 4 men and 2 ladies?

[3]

Ans: 350

17. 2057 Q.No. 2 c

A bag contains 8 red balls and 5 blue balls. In how many ways can 3 red balls and 4 blue balls be drawn?

[3]

Ans: 280

UNIT 5: MATRICES AND DETERMINANTS

A. MATRICES

1. 2073 Set C Q.No.3b

Construct a 2×2 matrix whose elements are given by $a_{ij} = 2i - 2j$.

[3]

Ans: $\begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$

2. 2073 Set D Q.No. 3b

If $A = \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & 2 & 3 \\ 1 & -1 & 0 \end{pmatrix}$ find $5AB$.

[3]

Ans: $\begin{bmatrix} 5 & 15 & 30 \\ 0 & -30 & -45 \end{bmatrix}$

3. 2072 Supp Q.No. 3b

Simplify: $-3 \begin{pmatrix} 2 & 1 \\ 0 & -7 \\ 1 & 2 \end{pmatrix} + \begin{pmatrix} 0 & 4 \\ -3 & 7 \\ 10 & 8 \end{pmatrix}$

[3]

Ans: $\begin{pmatrix} -6 & 1 \\ -3 & 28 \\ 7 & 2 \end{pmatrix}$

4. 2072 Set C Q.No. 3b

If $A = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$, show that AB is a null matrix. [3]

5. 2072 Set D Q.No. 3b

If $A = \begin{pmatrix} 2 & 3 \\ 5 & 7 \end{pmatrix}$ and $C = \begin{pmatrix} 8 & 9 \\ 10 & 11 \end{pmatrix}$, find matrix B such that $2A + 3B = C$. [3]

$$\text{Ans: } \begin{pmatrix} 4/3 & 1 \\ 0 & -1 \end{pmatrix}$$

6. 2072 Set E Q.No. 3b

If $A = \begin{pmatrix} 3 & 2 \\ 1 & 5 \end{pmatrix}$ find a matrix B such that $A - 3B = \begin{pmatrix} 3 & 5 \\ -8 & 2 \end{pmatrix}$. [3]

$$\text{Ans: } \begin{pmatrix} 0 & -1 \\ 3 & 1 \end{pmatrix}$$

7. 2071 Supp Q.No. 3b

Given $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 1 \\ 4 & 6 \end{pmatrix}$, verify $A + B = B + A$. [3]

8. 2071 Set C Q.No. 3b

If $A = \begin{pmatrix} -1 & 4 & 2 \\ 3 & 0 & 7 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -5 & -4 \\ 4 & 0 & 2 \end{pmatrix}$, find $3A - 4B$ [3]

$$\text{Ans: } \begin{pmatrix} -15 & 32 & 22 \\ -7 & 0 & 13 \end{pmatrix}$$

9. 2071 Set D Q.No. 3b

Find A and B , if $A + B = \begin{pmatrix} 7 & 0 \\ 2 & 5 \end{pmatrix}$ and $A - B = \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ [3]

$$\text{Ans: } A = \begin{pmatrix} 5 & 0 \\ 1 & 4 \end{pmatrix}, B = \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$$

10. 2070 Supp Q.No. 3b

Find the value of x , y and z if

$$\begin{pmatrix} x+y & 2y-z \\ 3y+z & z \end{pmatrix} = \begin{pmatrix} 4 & 3 \\ 7 & 1 \end{pmatrix} \quad [3]$$

$$\text{Ans: } x = 2, y = 2, z = 1$$

11. 2070 Set C Q.No. 3b

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 2 & -3 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$, find $A(B+C)$. [3]

$$\text{Ans: } \begin{pmatrix} 6 & -5 \\ 14 & -11 \end{pmatrix}$$

12. 2070 Set D Q.No. 3b

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, show that $A^2 - 2A - 5I = 0$, where I is the unit matrix of order 2. [3]

13. 2069 Supp Q.No. 3b

If $A = \begin{pmatrix} 3 & 2 \\ 1 & 5 \end{pmatrix}$, find a matrix X such that $A - 3X = \begin{pmatrix} 3 & 5 \\ -8 & 2 \end{pmatrix}$. [3]

$$\text{Ans: } \begin{pmatrix} 0 & -1 \\ 3 & 1 \end{pmatrix}$$

14. 2069 Q.No. 3b

If $A = \begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ 1 & 0 \end{bmatrix}$, find AB . [3]

$$\text{Ans: } \begin{bmatrix} 19 & 10 \\ 11 & 6 \end{bmatrix}$$

15. 2068 Q.No. 3b

If $A = \begin{bmatrix} 4 & 2 & -1 \\ 3 & -7 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ -3 & 0 \\ -1 & 5 \end{bmatrix}$, find the product AB. [3]

Ans: $\begin{pmatrix} 3 & 7 \\ 26 & 14 \end{pmatrix}$

16. 2067 Q.No. 3 b

Define a matrix. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$ show that $A^2 - 2A - 5I = 0$, where I and O are 2×2 identity and null matrix respectively. [3]

17. 2067 Supp Q.No. 3b

If $A = \begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 1 \\ 4 & 2 \end{pmatrix}$, prove that $AB \neq BA$. [3]

18. 2066 Q.No. 3 b

If $A = \begin{pmatrix} 4 & 2 & -1 \\ 3 & -7 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ -3 & 0 \\ -1 & 5 \end{pmatrix}$, find the product AB and BA. Comment on the result. [3]

Ans: $AB = \begin{pmatrix} 3 & 7 \\ 26 & 14 \end{pmatrix}$ and $BA = \begin{pmatrix} 17 & -17 & 1 \\ -12 & -6 & 3 \\ 11 & -37 & 6 \end{pmatrix}$; $AB \neq BA$

19. 2066 Old Q.No. 3 a

If $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{pmatrix}$; form the products AB and BA and show that $AB \neq BA$. [3]

Ans: $AB = \begin{pmatrix} 2 & 5 & 2 \\ 4 & 8 & 6 \\ 6 & 11 & 10 \end{pmatrix}$ and $BA = \begin{pmatrix} 4 & 7 & 10 \\ 5 & 8 & 11 \\ 2 & 5 & 8 \end{pmatrix}$

20. 2066 Supp Q.No. 3 b

If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 0 \\ 2 & -1 \end{bmatrix}$. Find the product AB and explain why BA is not defined. [3]

Ans: $\begin{bmatrix} 3 & -2 \\ 5 & -5 \\ 7 & -8 \end{bmatrix}$

21. 2065 Q.No. 3 b

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 2 & -3 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$

Verify that: $A(BC) = (AB)C$ [3]

22. 2065 Old Q.No. 3 a

If $A = \begin{bmatrix} 4 & 2 & -1 \\ 3 & -7 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ -3 & 0 \\ -1 & 5 \end{bmatrix}$, find the products AB and BA. Comment on the results. [3]

Ans: $AB = \begin{pmatrix} 3 & 7 \\ 26 & 14 \end{pmatrix}$ $BA = \begin{pmatrix} 17 & -17 & 1 \\ -12 & -6 & 3 \\ 11 & -37 & 6 \end{pmatrix}$; $AB \neq BA$

23. 2064 Q.No. 3 b

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$ show that $A^2 - 2A - 5I = 0$ where I and O are 2×2 identity and zero matrices respectively. [3]

24. 2064 Q.No. 3 a Old

If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, show that $A^2 - 5A - 2I = 0$ where O is the null and I is an identity matrix of order 2. [3]

25. 2063 Q.No. 3 a

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, find A^2 . [3]

$$\text{Ans: } \begin{pmatrix} 7 & 4 \\ 6 & 7 \end{pmatrix}$$

26. 2062 Q.No. 3 a

If $A = \begin{pmatrix} 5 & 2 & -1 \\ 0 & -3 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 2 & 3 \\ 5 & 0 & -2 \end{pmatrix}$
Find a matrix C such that $C = 2A + 3B$. [3]

$$\text{Ans: } \begin{pmatrix} 7 & 10 & 7 \\ 15 & -6 & -2 \end{pmatrix}$$

27. 2061 Q.No. 3 a

If $A = \begin{bmatrix} 2 & 3 \\ -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 \\ 5 & -3 \end{bmatrix}$, find the product AB . [3]

$$\text{Ans: } \begin{bmatrix} 13 & -5 \\ 1 & -2 \end{bmatrix}$$

28. 2060 Q.No. 3 a

If $A = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$, show that $A^2 - 2A - 5I = O$, where I and O are 2×2 identity and null matrix of order respectively. [3]

29. 2059 Q.No. 3 a

If $A = \begin{bmatrix} 2 & 0 & -1 \\ 3 & -1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -5 & 2 \\ -1 & 2 & -4 \end{bmatrix}$, find $6A - 4B$. [3]

$$\text{Ans: } \begin{bmatrix} 0 & 20 & -14 \\ 22 & -14 & 46 \end{bmatrix}$$

30. 2058 Q.No. 3 a

If $A = \begin{bmatrix} 4 & 2 & -1 \\ 3 & -7 & 1 \end{bmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ -3 & 0 \\ -1 & 5 \end{pmatrix}$, find (BA) and $(BA)'$ [3]

$$\text{Ans: } BA = \begin{bmatrix} 17 & -17 & 1 \\ -12 & -6 & 3 \\ 11 & -37 & 6 \end{bmatrix} \text{ and } (BA)' = \begin{bmatrix} 17 & -12 & 11 \\ -17 & -6 & -37 \\ 1 & 3 & 6 \end{bmatrix}$$

31. 2057 Q.No. 3 a

Find $5AB$, if $A = \begin{bmatrix} 2 & 1 \\ -3 & 0 \end{bmatrix}$, and $B = \begin{bmatrix} 0 & 2 & 3 \\ 1 & -1 & 0 \end{bmatrix}$ [3]

$$\text{Ans: } \begin{bmatrix} 5 & 15 & 30 \\ 0 & -30 & -45 \end{bmatrix}$$

B. DETERMINANTS

1. 2073 Set D Q.No. 11

Prove that: $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a)$ [5]

2. 2072 Set C Q.No. 11

Show that $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$ [5]

3. 2072 Set D Q.No. 11

$$\text{Show that } \begin{vmatrix} a+b+c & -c & -b \\ -c & a+b+c & -a \\ -b & -a & a+b+c \end{vmatrix} = 2(a+b)(b+c)(c+a) \quad [5]$$

4. 2071 Supp Q.No. 11

$$\text{Without expanding show that } \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (b-c)(c-a)(a-b). \quad [5]$$

5. 2071 Set C Q.No. 11

$$\text{Prove that } \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a). \quad [5]$$

6. 2070 Supp Q.No. 11

$$\text{Prove that: } \begin{vmatrix} 1 & a & a^3 \\ 1 & b & b^3 \\ 1 & c & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c) \quad [5]$$

7. 2070 Set D Q.No. 11

$$\text{Show that: } \begin{vmatrix} x-y-z & 2x & 2x \\ 2y & y-z-x & 2y \\ 2z & 2z & z-x-y \end{vmatrix} = (x+y+z)^3 \quad [5]$$

8. 2067 Q.No. 11

$$\text{Prove that: } \begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3 \quad [5]$$

9. 2067 Supp Q.No. 11

$$\text{Prove that: } \begin{vmatrix} a+b+2c & a & b \\ c & c+b+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3. \quad [5]$$

10. 2066 Q.No. 11

$$\text{Prove that } \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a). \quad [5]$$

11. 2066 Supp Q.No. 11

$$\text{Prove that: } \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix} = \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (x-y)(y-z)(z-x) \quad [5]$$

12. 2063 Q.No. 3 b

$$\text{Prove that: } \begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+a \end{vmatrix} = a^2(a+3) \quad [3]$$

13. 2061 Q.No. 3 b

$$\text{Prove that: } \begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = xyz \left(1 + \frac{1}{x} + \frac{1}{y} + \frac{1}{z} \right) \quad [3]$$

14. 2060 Q.No. 3 b

$$\text{Show that: } \begin{vmatrix} x-y-z & 2x & 2x \\ 2y & y-z-x & 2y \\ 2z & 2z & z-x-y \end{vmatrix} = (x+y+z)^3 \quad [3]$$

15. 2058 Q.No. 3 b

$$\text{Show that: } \begin{vmatrix} b-c & b+c & b \\ c-a & c+a & c \\ a-b & a+b & a \end{vmatrix} = 0 \quad [3]$$

C. CRAMER'S RULE

1. 2073 Set C Q.No. 11

Solve using Cramer's rule: $x + y = 8$, $y + z = 4$, $x + z = 6$. [5]

Ans: $x = 5$, $y = 3$, $z = 1$

2. 2072 Supp Q.No. 11

Using Cramer's rule solve the following equations: $2x + 3y = 4$; $4x - z = 5$; $4y + 3z = -5$ [5]

Ans: $x = \frac{1}{2}$; $y = 1$; $z = -3$

3. 2072 Set E Q.No. 11

Solve by Cramer's rule: $x + y + z = 6$, $2x + 3y - z = 5$, $3x + 4y + 5z = 26$. [5]

Ans: $x = 1$, $y = 2$, $z = 3$

4. 2071 Set D Q.No. 11

Solve the following equation using Cramer's rule: $2x + 3y = 4$, $4x - z = 5$, $4y + 3z = -5$ [5]

Ans: $x = 1/2$, $y = 1$, $z = -3$

5. 2070 Set C Q.No. 11

Applying Cramer's rule, solve the following equations: [5]

$x - y - z = -2$; $5x + 20z = 30$; $10y - 20z = 10$

Ans: $x = 2$, $y = 3$, $z = 1$

6. 2069 Supp Q.No. 11

Using the Cramer's rule, solve the following equations: [5]

$9y - 5x = 3$, $x + z = 1$, $z + 2y = 2$.

Ans: $x = 3$, $y = 2$ and $z = -2$

7. 2069 Q.No. 11

Solve by Cramer's rule. [5]

$x + 2y + 3z = 14$, $3x + 4y + 2z = 17$, $2x + 3y + z = 11$.

Ans: $x = 1$, $y = 2$, $z = 3$

8. 2068 Q.No. 11

Using Cramer's rule, solve the following equations: [5]

$x + y = 8$, $y + z = 4$, $x + z = 6$

Ans: $x = 5$, $y = 3$, $z = 1$

9. 2066 Old Q.No. 3 b

Solve, by Cramer's rule, the system of equations $x + y = \frac{7}{6}$, $2x - 3y = -1$. [3]

Ans: $x = 1/2$ and $y = 2/3$

10. 2065 Q.No. 11

Solve the following equation using Cramer's rule. [5]

$x + y - 2z = 1$; $2x - 7z = 3$; $x + y - z = 5$

Ans: $x = 31/2$, $y = -13/2$, $z = 4$

11. 2065 Old Q.No. 3 b

By using Cramer's rule solve the equation $\frac{4}{x} + \frac{5}{y} = 58$, $\frac{7}{x} + \frac{3}{y} = 67$ [3]

Ans: $x = \frac{1}{7}$, $y = \frac{1}{6}$

12. 2064 Q.No. 11

Solve the following equation using Cramer's rule. $2x + 3y = 4$; $4x - z = 5$; $4y + 3z = -5$ [5]

Ans: $x = \frac{1}{2}$, $y = 1$, $z = -3$

13. 2064 Q.No. 3 b Old

Solve the system of equations using Cramer's rule: $3x - 4 = 4y$; $x - 6y = -36$ [3]

Ans: $x = 12$, $y = 8$

14. 2062 Q.No. 3 b

Using Cramer's rule, solve the following equations: $5x - 3y = 8$; $2x + 5y = 59$ [3]

Ans: $x = 7$, $y = 9$

15. 2059 Q.No. 3 b

Solve the equation by using Cramer's Rule: $2x - 3y = 3$; $4x - y = 1$ [3]

Ans: $x = 0$, $y = -1$

16. 2057 Q.No. 3 b

Solve the equation by using Cramer's Rule: $3x - 2y = 1$; $-x + 4y = 3$ [3]

Ans: $x = 1$, $y = 1$

UNIT 6: CO-ORDINATE GEOMETRY

1. 2073 Set C Q.No. 4

a. For what value of k will the point $(1, -2)$ lie on the curve $x^2 + y^2 + kx - 4y - 15 = 0$? [3]

Ans: $k = 2$

b. Find the equation of straight line through the point of intersection of the lines $x + y = 3$ and $x - y = 1$, and having slope equal to 1. [3]

Ans: $x - y = 1$

2. 2073 Set D Q.No. 4

a. Let $A(a, 0)$ and $B(-a, 0)$ be two fixed points. Find the locus of a point P so that $PA^2 + PB^2 = AB^2$. [3]

Ans: $x^2 + y^2 = a^2$

b. Obtain an equation of a straight line whose intercepts on x -axis and y -axis are 8 and -5 respectively. [3]

Ans: $5x - 8y = 40$

3. 2072 Supp Q.No. 4

a. Let $A(a, 0)$ and $B(-a, 0)$ be two fixed points. Find the locus of a point P which moves such that $PA^2 + PB^2 = AB^2$. [3]

Ans: $x^2 + y^2 = a^2$

b. Find the equation of a straight line passing through the points $(5, 6)$ and $(6, 9)$. [3]

Ans: $3x - y = 9$

4. 2072 Set C Q.No. 4

a. Find the point dividing the line joining the points $(5, -2)$ and $(9, 6)$ in the ratio $3 : 1$ internally. [3]

Ans: $(8, 4)$

b. Find the equation of the straight line through the intersection of $3x + 2y = 8$ and $4x + y = 9$ with the slope of 3. [3]

Ans: $3x - y - 5 = 0$

5. 2072 Set D Q.No. 4

a. $A(20, 19)$ and $B(16, 23)$ are the positions of two sources of water. Nepal Water Supply Corporation wants to supply water in a city $P(2, 0)$. From which source should the corporation supply the water so that the corporation may choose only a minimum distance? [3]

Ans: Source A

b. Find the equation of the straight line through the point $(1, 2)$ and its x -intercept equals its y -intercept in magnitude but opposite in sign. [3]

Ans: $x - y + 1 = 0$

6. 2072 Set E Q.No. 4

a. Show that the points $(0, 0)$, $(0, 4)$, $(4, 0)$ are the vertices of an isosceles right angle triangle. [3]

b. Find the slope and intercepts of the line $2x - 3y + 10 = 0$. [3]

Ans: $\frac{2}{3}$; -5 , $\frac{10}{3}$

7. 2071 Supp Q.No. 4

a. Find the equation to the locus of a point which moves so that its distance from the point $(2, 1)$ is 5. [3]

Ans: $x^2 + y^2 - 4x - 2y - 20 = 0$

b. Find the equation of the line which passes through $(3, -2)$ and has slope -2 . [3]

Ans: $2x + y = 4$

8. 2071 Set C Q.No. 4

- a. Show that the three points (2, 4), (6, 4) and (6, 7) represent the vertices of a right angled triangle. [3]
- b. Find the equation of a straight line passing through the point (1, -3) with slope $= -\frac{2}{3}$. [3]

Ans: $2x + 3y + 7 = 0$

9. 2071 Set D Q.No. 4

- a. Show that the set of points (-4, 0), (0, 0), (0, 3) represent the vertices of a right angled triangle. [3]
- b. Find the equation of the straight line joining the points (2, 1) and (3, -5), and express it in double intercept form. [3]

Ans: $6x + y = 13; \frac{x}{13} + \frac{y}{13} = 1$

10. 2070 Supp Q.No. 4

- a. Prove that the points (-1, 0), (3, 1), (2, 2) and (-2, 1) are the vertices of a parallelogram. [3]
- b. Find the equation of a line which passes through the origin and the point of intersection of the lines $2x - 3y = 1$ and $x + 2y = 3$. [3]

Ans: $x - 2y = 0$

11. 2070 Set C Q.No. 4

- a. Prove that the following points represent the vertices of parallelogram (1, 3), (2, 3), (7, 5) and (6, 5). [3]
- b. Find the equation of a straight line making 9 and 15 as x - intercept and y - intercept respectively. [3]

Ans: (b) $5x + 3y = 45$

12. 2070 Set D Q.No. 4

- a. Find the equation of a straight line through the points (a, 0) and (0, b). [3]
- b. If the line through the points (-3, 5) and (3, y) has slope $-\frac{4}{3}$, find the distance between the points. [3]

Ans: $\frac{x}{a} + \frac{y}{b} = 1$

13. 2069 Supp Q.No. 4

- a. Obtain the equation of the locus of a point which moves so that distance from the point (2, 1) is always 3. [3]
- b. Find the equation of a straight line passing through the points (1, 3) and (-2, -5). [3]

Ans: $x^2 + y^2 - 4x - 2y - 4 = 0$

Ans: $8x - 3y + 1 = 0$

14. 2069 Q.No. 4

- a. Find the coordinates of the point which divides internally the line joining the points (-3, 9) and (1, -3) in the ratio 3:1. [3]
- b. Find the equation of the line joining the points (3, 4) and (5, 6). [3]

Ans: (a) (0, 0) (b) $x - y + 1 = 0$

15. 2068 Q.No. 4

- a. For what value of K will the point (2, -1) lie on the curve: $kx^2 - 2y^2 - 2x + 3y - 3 = 0$ [3]
- b. Find the equation of a straight line passing through the point (1, 2) and making an intercept of 3 on the positive y-axis. [3]

Ans: (a) 3 (b) $x + y = 3$

16. 2067 Q.No. 4

- a. Find the equation of the locus of the point which moves so that it is always equidistance from the points (1, 3) and (-2, 6). [3]
- b. Find the equation of a straight line passing through the point (5, -3) and having the slope $-\frac{3}{4}$. [3]

Ans: (a) $x - y + 5 = 0$ (b) $3x + 4y = 3$

17. 2067 Supp Q.No. 4

- a. Determine the ratio in which $2y - x + 2 = 0$ divides the line joining $(3, -1)$ and $(8, 9)$. [3]
 b. Find the equation of the line through the point of intersection of $x + 2y = 5$, $x - 3y = 7$ and passing through the point $(0, 0)$. [3]

Ans: (a) 1:4 (b) $2x + 29y = 0$ **18. 2066 Q.No. 4**

- a. Derive the result if the points $(a, 0)$, $(0, b)$ and (x, y) are collinear? [3]
 b. Where does the straight line through $(3, 4)$ and $(5, 6)$ intersect y-axis? [3]

Ans: (a) $\frac{x}{a} + \frac{y}{b} = 1$ (b) $(0, 1)$ **19. 2066 Old Q.No. 5**

- a. Determine the ratio in which the line segment joining $(2, -3)$ and $(5, 6)$ is divided by x-axis. [3]
 b. Find the equation to the locus of a point which is always equidistant from the points $(a + b, a - b)$ and $(a - b, a + b)$. [3]
 c. Determine the value of K so that the three st. lines. [3]

$\frac{x}{a} + \frac{y}{b} = 1$, $\frac{x}{b} + \frac{y}{a} = 1$ and $x(a + b) - K^2 ab = 0$ may be concurrent. [3]

Ans: (a) 1:2 (b) $y = x$ (c) $K = \pm 1$ **20. 2066 Supp Q.No. 4**

- a. If the points $(-2, -1)$, $(1, 0)$, $(x, 3)$ and $(1, y)$ represent the vertices of a parallelogram. Find the value of x and y. [3]
 b. Determine the equation of the line with gradient $-\frac{3}{2}$ and which is concurrent with the lines $4x + 3y - 7 = 0$ and $34x + 5y - 1 = 0$. [3]

Ans: (a) $x = 2$ and $y = 2$ (b) $33x + 22y = 62$ **21. 2065 Q.No. 4**

- a. If the points $(-2, -1)$, $(1, 0)$, $(x, 3)$ and $(1, y)$ represent the vertices of a parallelogram. Find the value of x and y. [3]
 b. Where do the straight line passing through the points $(1, 3)$ and $(-1, 2)$ intersect x-axis and y-axis? [3]

Ans: (a) $x = 4$ and $y = 2$ (b) $(0, 5/2)$ and $(-5, 0)$ **22. 2065 Old Q.No. 5**

- a. If A, B and C are three collinear points such that $AB = BC$. If the coordinates of A, B and C are $(a, 2)$, $(1, 3)$, and $(5, b)$ respectively, find a and b. [3]
 b. Let A $(a, 0)$ and B $(-a, 0)$ be two fixed points. Find the locus of a point which moves so that $PA^2 + PB^2 = AB^2$. [3]
 c. Find the value of k, if the lines $2x - 3y + k = 0$, $3x - 4y - 13 = 0$ and $8x - 11y - 33 = 0$ are concurrent. [3]

Ans: (a) $a = -3$, $b = 4$ (b) $x^2 + y^2 = a^2$ (c) -7 **23. 2064 Q.No. 4**

- a. Prove that the points $(4, 8)$, $(0, 2)$, $(3, 0)$ and $(7, 6)$ are the vertices of a parallelogram. [3]
 b. Find the equation of a straight-line making 9 and 15 as the x-intercept and y-intercept respectively. [3]

Ans: (b) $5x + 3y = 45$ **24. 2064 Old Q.No. 5**

- a. If the distance between two points $(x, 5)$ and $(2, 2)$ is 5, find the slope of the line joining them. [3]
 b. Find the equation of the locus of a point which moves so that its distance from the x-axis is half its distance from the origin. [3]
 c. Find the equation to the straight line passing through the point $(3, -4)$ and cutting off intercepts, equal but of opposite signs, from the axes. [3]

Ans: (a) $m = \pm 3/4$ (b) $x^2 - 3y^2 = 0$ (c) $x - y = 7$ **25. 2063 Q.No. 5**

- a. If A $(2, 3)$, B $(9, 6)$ and C $(10, 9)$ are three points. Prove that $AC = 2AB$. [3]