केन्द्रीय विद्यालय संगठन

KENDRIYA VIDYALAYA SANGATHAN

आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, चंडीगढ़

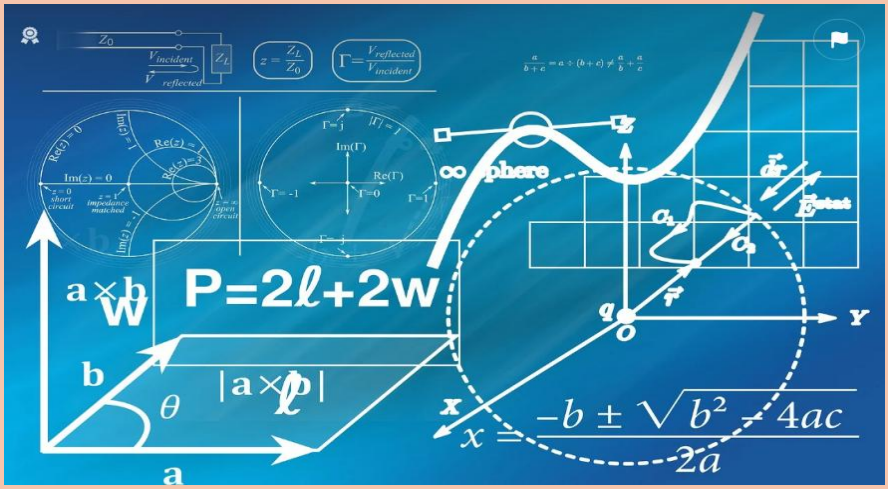
ZONAL INSTITUTE OF EDUCATION AND TRAINING, CHANDIGARH

तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

MATERIAL ON COMPETENCY BASED QUESTIONS:
CLASS XI

MATHEMATICS (041)

(5 DAY WORKSHOP FROM 18.08.2025-22.08.2025)



संरक्षक

श्रीमती प्राची पांडे, आई.ए.एवं ए.एस.

आयुक्त

केन्द्रीय विद्यालय संगठन,नई दिल्ली

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उपायुक्त एवं निदेशक,

केन्द्रीय विद्यालय संगठन

आंचलिक शिक्षा एवं प्रशिक्षण संस्थान

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CHANCHAL KALRA
PGT MATHS
PM SHRI KENDRIYA VIDYALAYA
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Foreword

It gives me immense pleasure to present this *Competency-Based Question Bank* developed during the workshop organized by **ZIET Chandigarh** for **PGT (Mathematics)** teachers. This initiative aligns with the vision of the **National Education Policy (NEP) 2020**, which emphasizes a shift from rote learning to competency-based and application-oriented education.

The resource has been meticulously curated by a team of experienced and dedicated teachers, who have collaboratively prepared question bank that promote conceptual understanding, analytical thinking, and real-life application of mathematical ideas. Each question reflects an effort to align classroom assessment with clearly defined learning outcomes and competencies, ensuring that our students not only "know" mathematics but also "understand" and "apply" it meaningfully.

This Question Bank will serve as a valuable resource for teachers in planning assessments that truly reflect student competencies and support continuous, comprehensive, and joyful learning. It is also a testimony to the professional commitment and creative spirit of our teachers who continue to innovate and contribute to improving the quality of education in Kendriya Vidyalayas.

I extend my sincere appreciation to all the participants for their dedication and teamwork in bringing this important academic resource to fruition.

I also extend my sincere gratitude to Mr. Deepak Singh Bhati, Principal, PM Shri Kendriya Vidyalaya Sabarmati, Ahmedabad for the meticulous vetting of the Question Bank developed for the students of Mathematics. The time and effort devoted by him in ensuring the pedagogical soundness and alignment with the CBSE curriculum are truly commendable.

I am confident that this compilation will serve the purpose of assessment of students to ensure attainment of learning outcomes.

(SHRUTI BHARGAVA)
Deputy Commissioner and Director
ZIET, Chandigarh

Material Developed by:

S.No.	Name of Participant	Designation	Name of KV	Topic
1	POOJA YADAV	PGT MATHS	SHAHDRA	Sets
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3	JAIPAL SINGH	PGT MATHS	NO. 3 DELHI CANTT	Trigonometric Function
4	PUSHPA YADAV	PGT MATHS	ITBP BHANU	Linear Inequalities
5	MONIKA	PGT MATHS	HISAR	Complex Number
6	PREMLATA	PGT MATHS	SAINJ KULLU	Permutation and Combination
7	VIVEK BHARTI	PGT MATHS	RAJGARHI	Binomial Theorem
8	RUPAM YADAV	PGT MATHS	MANESAR	Sequence and Series
9	MUKESH ATTRI	PGT MATHS	JHAJJAR	Straight Line
10	RAJSHRI	PGT MATHS	ALMORA	CONIC SECTION
11	VIKAS KUMAR	PGT MATHS	MATHANA	Introduction to 3-D Geometry
12	NEERAJ SHARMA	PGT MATHS	ALHILAL	Limits and Derivative
13	RAVI LUTHRA	PGT MATHS	CHAMERA-II	Statistics
14	PRITAM SINGH	PGT MATHS	FRI D.DUN	Probability

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5	GULSHAN KUMAR	PGT MATHS	SUNDERBANI
6	SANJAY SINGH	PGT MATHS	NO.2 SRINAGAR
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12	JYOTI SAXENA	PGT MATHS	SEC 8 RK PURAM
13	LEEJA P.N.	PGT MATHS	NARELA

SETS

Learning Outcomes: Students will be able to

1. **Define and represent sets using proper notation**
2. **Perform operations on sets (union, intersection, complement)**
3. **Apply Venn diagrams to solve real-life problems**

Q.No.	Question	LO	Competency
	MCQ		
1	The cardinality of the power set of $\{x: x \in N, x \leq 10\}$ is a) 1024 b)1023 c) 2048 d) 2043	LO1	Conceptual application computational thinking
2	What is the solution set of the equation $x^2 + 3x + 2 = 0$ in roster form? a) {-1, 2} b) {-1, -2} c) {1, -2} d) {1, 2}	LO1	Problem solving Application
3	Number of proper subsets of set A, A= {∅}, are a) 0 b) 2 c) 1 d) 4	LO1 LO2	Conceptual clarity Problem Interpretation
4	Two finite sets have m and n element. The number of elements in the power set of first set is 48 more than the total number of elements in power set of the second set. Then, the value of m and n are (a) 7,6 (b) 6,3 (c) 6,4 (d) 7,4	LO1 LO2 LO3	Analytical Thinking Critical analysis
5	Which of the following is not equivalent to $A \subset B$. (a) $A - B = \emptyset$ (b) $A \cap B = A$ (c) $A \cup B = B$ (d) None of these	LO1 LO2 LO3	Integration of Knowledge Visualization
	2 MARKS QUESTIONS		
1	If $Y = \{x: x \text{ is a positive factor of the number } 2^{p-1}(2^P - 1), \text{where } 2^p - 1 \text{ is a prime number}\}$. Write Y in roaster form.	LO1 LO2	Generalisation skill Collaborative learning
2	Given $L = \{1,2,3,4\}, M = \{3,4,5,6\}$ and $N = \{1,3,5\}$. Verify that $L - (M \cup N) = (L - M) \cap (L - N)$	LO1 LO2	Understanding Application
3	$T = \{x: \frac{x+5}{x-7} - 5 = \frac{4x-40}{13-x}\}$. Is T an empty set? Justify your answer.	LO1 LO2 LO3	Critical thinking Computational
4	Write all the elements of set $\{P[P(P(\emptyset))]\}$	LO1 LO2	Recall and Comprehension Logical reasoning

5	If A = {x : x is a positive integer and a factor of 12} and B = {x : x is a positive integer and a factor of 18}. Find $A \cup B$ and $A \cap B$. Also, determine the number of subsets of $(A \cap B)$.	LO1 LO2 LO3	application computational thinking
	3 MARKS QUESTIONS		
1	Suppose A_1, A_2 ,…A_n are 30 sets each having 5 elements and B_1 , B_2 ,…B_n are n sets each with 3 elements, let$\bigcup_{i=1}^{30} A_i = \bigcup_{j=1}^{n} B = S$ and each element of S belong to exactly 10 of the $A_{i's}$ and exactly 9 of the $B_{i's}$. Then find the value of n.	LO2 LO3	Problem solving Application Critical thinking
2	For all the sets A, B and C, if $A \subset B, then\ A \cup C \subset B \cup C$.	LO2 LO3	Conceptual application
3	For any two sets A and B, prove that $A \cup B = A \cap B$ iff A=B.	LO2 LO3	Problem solving Application Critical thinking
4	If $A \cup B = C$ and $A \cap B = \emptyset$, then prove that $A = C - B$.	LO2 LO3	Problem Interpretation Collaborative learning
5	If ∪ = {a, e, i. o. u} A = {a, e, i} And B = {e, o, u} C = {a, i, u} Then verify that $A \cap (B - C) = (A \cap B) - (A \cap C)$	LO1 LO2 LO3	Verification skill Problem Solving
	5 MARKS QUESTIONS		
1	Let A and B be any two sets. Using properties of sets prove that $i) A - (A \cap B) = A - B$ ii) $(A \cup B) \cap (A \cup B') = A$	LO2 LO3	Theoretical Understanding Systematic approach
2	Let A, B and C be sets. Then show that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$	LO2 LO3	Theoretical Understanding Systematic approach
3	Let P be the set of prime numbers and let $S = \{t: 2^t - 1\ is\ a\ prime\}$.Prove that S⊂ P.	LO1 LO2 LO3	Analytical thinking Application
	CASE STUDY BASED QUESTIONS		
1	In a town of 10,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B, 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C. If 2% families buy all the three newspapers. Find: (a)The number of families which buy newspaper A only. (b) The number of families which buy newspaper C only (c) The number of families which buy none of A, B and C	LO1 LO2 LO3	Real life application Understanding Analytical thinking

2	Draw the Venn diagrams to illustrate the following relationship among sets E, M and U, where E is the set of students studying English in a school, M is the set of students studying Mathematics in the same school, U is the set of all students in that school. **(**i) All the students who study Mathematics study English, but some students who study English do not study Mathematics (ii) There is no student who studies both Mathematics and English. (iii) Some of the students study Mathematics but do not study English, some study English but do not study Mathematics, and some study both. (iv) Not all students study Mathematics, but every students studying English studies Mathematics.	LO1 LO2 LO3	Mathematical Modelling Critical thinking Representation

FINAL ANSWERS FOR EACH QUESTION

MCQ Answers: 1. (a) 2. (b) 3. (c) 4. (c) 5. (d)

2-Mark Answers

1. Y = $\{1, 2, 2^2, 2^3, \ldots 2^{p-1}, 2^p - 1\}$ 3. T =$\emptyset$ 4. $\{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}, \{\{\emptyset\}\}\}$

5. A = {1,2,3,4,6,12}, B = {1,2,3,6,9,18}; A∪B = {1,2,3,4,6,9,12,18}, A∩ B = {1,2,3,6};

subsets of A ∩ B = 16.

3-Mark Answers:

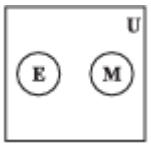
1. n = 45

Case Study Based Answers:

1(i). 3300 1(ii)500 1(iii).4000

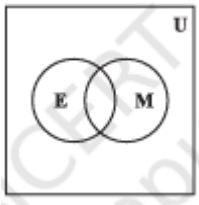
2(i)

ii)



2(i)..

iii)



iv)

Relations and Functions

Learning Outcomes: Students will be able to

1. **Differentiate between relation and function**
2. **Identify domain, codomain, and range**
3. **Represent functions graphically and algebraically**

Part A: Multiple Choice Questions (1 mark each)

Q. NO.	QUESTION	LOs	COMPETENCY
1.	If n(A)=3 and n(B)=4, then the number of elements in the Cartesian product A×B is: a. 7 b. 12 c. 3 d. 4	LO1	Conceptual, Identification, Logical clarity, accuracy
2.	If the number of relations from set A to set B is 64, and n(A)=2, then the value of n(B) is: a. 3 b. 4 c. 6 d. 8	LO1 LO2	Conceptual Logical reasoning, Critical thinking, Clarity of thought, Justification
3.	The domain of the function $f(x) = 1/ (x- 2)^{1/2}$ is: a. (2,∞) b. [2,∞) c. (−∞,2) d. (−∞,2]	LO1 LO2	Conceptual & Applications, Problem solving, Calculation, Persistence, Accuracy
4.	If $f(x)=x^2$ and g(x)=2x+1, then (f+g)(x) is: a. x^2+2x+1 b. $2x^3+x2$ c. x^2-2x-1 d. $x^2(2x+1)$	LO1 LO2	Conceptual Procedural fluency, Algebraic manipulation Accuracy, Consistency
5.	The range of the function f(x)=x|x| is: a. {−1,1} b. {−1,0,1} c. (−∞,∞) d. (0,∞)	LO1 LO2	Properties & Graphs, Analysis, Interpretation, Critical reasoning, Precision
6.	Which of the following relations is a function? a. $R=\{(x,y)\in R\times R:x=y^2\}$ b. $R=\{(x,y)\in R\times R:y=\|x\|\}$ c. $R=\{(x,y)\in R\times R:x^2+y^2=4\}$ d. $R=\{(x,y)\in R\times R:x=2\}$	LO1 LO2 LO3	Conceptual, Identification, Understanding, Logical clarity, accuracy
7.	The domain and range of the signum function are: a. Domain: R, Range: {−1,0,1} b. Domain: R, Range: {−1,1} c. Domain: R - {0}, Range: {−1,1} d. Domain: R - {0}, Range: R	LO1 LO2 LO3	Conceptual, Identification, Understanding, Logical clarity, accuracy
8.	The range of the function $f(x)=x^2+1$ for the domain {−1,0,1,2} is: a. {1,2,5} b. {1,2,5,10} c. {2,1,5} d. {2,5}	LO1 LO2 LO3	Conceptual & Applications, Problem solving, Calculation, Persistence, Accuracy
9.	If $f(x)= x^2$ and g(x) = x+1, then (f/g) (2) is: a. 4/3 b. 2 c. 3 d. 4	LO1 LO2	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency

10.	The greatest integer function f(x)=⌊x⌋ has the range: a. R b. Z (Set of integers) c. Q (Set of rational numbers) d. Z+ (Set of positive integers)	LO1 LO2 LO3	Conceptual, Identification, Understanding, Logical clarity, accuracy

B. Short Answer Questions (2 marks each)

Q. NO.	QUESTION	LOs	COMPETENCY
1.	Find the domain and range of the function $f(x)= (9-x^2)^{1/2}$.	LO1 LO2	Conceptual, Identification, Understanding, Logical clarity, accuracy)
2.	Let A={1,2,3} and B={a,b,c,d}. How many relations can be defined from A to B? Justify your answer.	LO1 LO2	Conceptual, Identification, Understanding, Logical clarity, accuracy)
3.	If (x+1,y−2) = (3,1), find the value of 3x -2 y.	LO1	Conceptual,Identification, Understanding, Logical clarity, accuracy
4.	A relation R from a set A={1,2,3,4,5,6} to a set B={4,6,9} is defined by R={(x,y):x∈A,y∈B,y is divisible by x}. List the elements of R and find its domain and range.	LO1 LO2	Conceptual, Identification, Understanding, Logical clarity, accuracy)
5.	Find the domain and range of the function $f(x)= (x^2-9)/(x-3)$	LO1 LO2	Conceptual,Identification, Understanding, Logical clarity, accuracy)

C. Long Answer Questions (3 marks each)

Q. NO.	QUESTION	LOs	COMPETENCY
1.	Let R be a relation from Q to Q defined by R={(a,b):a,b∈Q and a−b∈Z}. Show that if (a,b)∈R and (b,c)∈R, then (a,c)∈R.	LO1 LO2	Conceptual, Logical reasoning, Critical thinking, Clarity of thought, Justification
2.	Let A={9,10,11,12,13} and f:A→N be a function defined by f(n)= the highest prime factor of n. Find the range of f.	LO1 LO2 LO3	Conceptual, Application, Calculation, Systematic reasoning, Practical understanding
3.	If $f(x)=x^2-1$ and g(x)=2x+3, find (f·g)(x) and (g−f)(x).	LO1 LO2 LO3	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency
4.	A function f is defined by f(x)=2x−5. Write down the values of: i. f(0) ii. f(7) iii. f(−3)	LO1 LO2	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency
5.	Sketch the graph of the modulus function f(x)=|x| and identify its domain and range.	LO1 LO2 LO3	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency

D. Very Long Answer Questions (5 marks each)

Q. NO.	QUESTION		COMPETENCY
1.	Let A={x∈Z:−2≤x≤2} and B={x∈N:x^2<10}. Write down the elements of A and B. Find the number of elements in A×B and write down number of all possible relations from B to A.	LO1 LO2	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency, Practical understanding)
2.	The function f(x)=ax+b is defined on the set of real numbers. If f(1)=5 and f(2)=8, find the values of a and b and hence find the value of f(4).	LO1 LO2	Conceptual, Procedural fluency, Algebraic manipulation, Accuracy, Consistency
3.	A function f is defined as $f(x) = \begin{cases} 2x-1, & x<0 \\ 0, & x=0 \\ 3x+1, & x>0 \end{cases}$ Find the values of f(−2), f(0), and f(5). Sketch the graph of this function.	LO1 LO2 LO3	Knowledge (Properties & Graphs), Skill (Analysis, Interpretation), Value (Critical reasoning, Precision)

E. Case Study Based Questions

Q. NO.	QUESTION	LOs	COMPETENCY
1.	**The Cost of a Taxi Ride:** A taxi company charges a fixed amount plus a per-kilometer charge. The cost C (in rupees) of a taxi ride is a function of the distance travelled d (in kilometers). The function is given by C(d)=15d+50. a)Is this a real-valued function? What is its domain and range in this context? b)If a person travels a distance of 10 km, what is the cost of the ride? c)If a person paid ₹350 for a taxi ride, how many kilometers did they travel?	LO1 LO2 LO3	Knowledge (Concepts & Definitions), Skill (Identification, Understanding), Value (Logical clarity, accuracy)
2.	**Temperature Conversion :** The temperature conversion from Celsius to Fahrenheit is given by the function F(C)=9C/ 5 +32. a) Find the value of F(0). What does it represent? b) Find the value of C when F(C)=212. What does this value represent? c) What is the domain of this function in the context of real-world temperatures? What is its range?	LO1 LO2	Knowledge (Concepts & Definitions), Skill (Identification, Understanding), Value (Logical clarity, accuracy)

ANSWERS :

MCQs (1 Marks each)	
Q. NO.	**ANSWERS**
1.	b. 12
2.	a. 3
3.	a. $(2,\infty)$
4.	a. x^2+2x+1
5.	c. $(-\infty,\infty)$
6.	b. $R=\{(x,y)\in R\times R: y=\|x\|\}$
7.	a.Domain: R, Range: $\{-1,0,1\}$
8.	a. $\{1,2,5\}$
9	a. 4/3
10.	b. Z (Set of integers)
B. Short Answer Questions (2 marks each)	
1.	Domain is $[-3,3]$ and the range is $[0,3]$
2.	Number of relations = 4096
3.	0
4.	The relation $R=\{(1,4),(1,6),(1,9),(2,4),$ $(2,6),(3,6),(3,9),(4,4),(6,6)\}$. The domain of R is the set of all first components: $\{1,2,3,4,6\}$. The range of R is the set of all second components: $\{4,6,9\}$.
5.	Domain: $R-\{3\}$, Range: $R-\{6\}$
C. Long Answer Questions (3 marks each)	
1.	Correct proof
2.	Range = $\{3,5,11,13\}$.
3.	$(f\cdot g)(x)=2x^3+3x^2-2x-3$. $(g-f)(x)=-x^2+2x+4$
4.	i. $f(0)=-5$. ii. $f(7)=9$. iii. $f(-3)=-11$
5.	Domain = R or $(-\infty,\infty)$. Range = $[0,\infty)$ or $\{y\in R: y\geq 0\}$.
D. Very Long Answer Questions (5 marks each)	
1.	$A=\{-2,-1,0,1,2\}$. $B=\{1,2,3\}$. $n(A)\times n(B)=15$. The number of possible relations is $2^{n(B)\times n(A)}=2^{15}$
2.	$a=3$, $b=2$, $f(4)=14$.
3.	$f(-2)=-5.$, $f(0)=0.$, $f(5)=16$
E. Case Study Based Questions	
1.	a) Domain is $[0,\infty)$ & Range is $[50,\infty)$. (b) d=10 , cost is ₹200. (c) The person travelled 20 km.
2.	(a) F(0) =32. This represents the temperature in Fahrenheit at which water freezes. (b) C=100, This value represents the boiling point of water in Celsius. (c) The function is a linear function R or $(-\infty,\infty)$, as temperature can be any value.

TRIGONOMETRIC FUNCTIONS

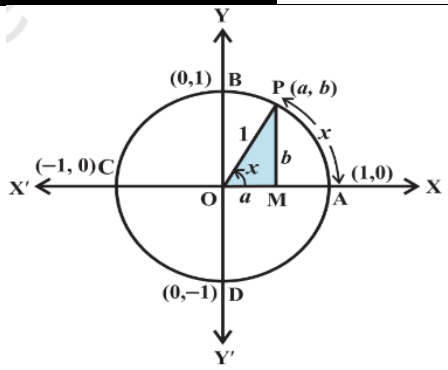
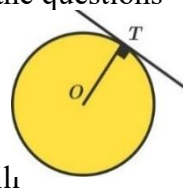
Learning Outcomes:

1. **Understand angles in radians and degrees**
2. **Derive and use identities**
3. **Solve trigonometric equations and apply in real-life contexts**

Q.No.	**Question**	**LOs**	**Competency**
1	The value of $\sin\left(\frac{25\pi}{3}\right)$ is $(A).\ -\frac{\sqrt{3}}{2}$ $(B).\ \frac{\sqrt{3}}{2}$ $(C).\ \frac{1}{2}$ $(D).\ -\frac{1}{2}$	LO1	1.Conceptual understanding 2.Rational Thinking 3. accuracy 4.precision
2	If $\tan x = \frac{a}{b}$ then $b\cos 2x + a\sin 2x$ s equal to $(A).$ a $(B)\ b$ $(C).\ ab$ $(D)\ \frac{a}{b}$	LO1 LO2	1.Understanding of concepts 2. Co-relation between trig. functions 3. Analytical reasoning 4 problem solving
3	$\frac{\cos 10°+\sin 10°}{\cos 10°-\sin 10°}$ is equal to $(A)\ \tan 55°$ $(B)\ \cot 55°$ (C) -tan 35° $(D).-\cot 35°$	LO1 LO2	1.Conceptual understanding of trig. identities 2. Analytical skills 3. decision-making
4	$\tan 3A - \tan 2A - \tan A$ is equal to $(A).\ \tan 3A\ \tan 2A\ \tan A$ $(B).\ -\tan 3A\ \tan 2A\ \tan A$ (C)tanAtan2A − tan2Atan3A − tan3atanA (D). None of these	LO2	1.Understanding of concepts 2. Application of trig. identities 3. analytical skills 4. problem solving 5. Decision-making
5	The value of $\tan(-2025°)$ is $(A).$ 1 $(B).\ -1$ $(C).\ \frac{1}{\sqrt{3}}$ $(D).\ -\frac{1}{\sqrt{3}}$	LO1 LO2	1.Conceptual understanding 2.Accuracy 3. analytical reasoning 4 computational skills
6	The value of $cos^2\left(\frac{\pi}{6}+\theta\right) - sin^2\left(\frac{\pi}{6}-\theta\right)$ is $(A).\ \frac{1}{2}\cos 2\theta$ $(B).\ 0$ $(C).\ -\frac{1}{2}\cos 2\theta$ $(D).\ \frac{1}{2}$	LO2	1.Conceptual understanding 2. application 3 precision
7	If $\tan 69° + \tan 66° - \tan 69°\tan 66°$=2k, then k= $(A).\ -1$ $(B).\ \frac{1}{2}$ $(C).\ -\frac{1}{2}$ $(D).$ 0	LO1 LO2	1. knowledge 2. application 3.accuracy 4.interpretation

8	The minimum value of $3\cos x + 4\sin x + 8\ is$ $(A).\ 5$ $(B).\ 9$ $(C).\ 7$ $(D).\ 3$	LO2	1. Understanding 2. conceptual knowledge 3. computation ability 4 precision 5. Critical thinking
9	If the arcs of the same length in two circles subtend angles $65°and\ 110°$ at the Centre, then the ratio of the radii of the circles is $(A).$ 22:13 $(B).\ 11:13$ $(C).$ 22:15 $(D).$ 21:13	LO1 LO2	1. interpretation 2. analyze 3. application 4 precision
10	A horse is tied to a post by a rope. If the horse moves along a circular path always keeping the rope tight and describes 88 metres when it has traced out 72° at the centre ,then the length of the rope. $(A).$ 60 metres $(B).$ 70 metres $(C).$ 80 metres $(D).$ 90 metres	LO1 LO2	1. Understanding of concepts 2. analyze 3. application 4 precision
	SECTION (B) 2 MARKS QUESTIONS		
11	If A+B=$\frac{\pi}{4}$,Then prove that $(\cot A - 1)(\cot B - 1) = 2.$	LO2	1. Understanding 2. analyze 3. Critical thinking 4 precision
12	Prove that: $(\cos A - \cos B)^2 + (\sin A - \sin B)^2 = 4sin^2\frac{A-B}{2}$	LO2	1. Understanding of concepts 2. analyze 3. problem solving 4 precision 5. critical thinking
13	Prove that:$\tan 70° = \tan 20° + 2\tan 50°$	LO2	1. Understanding 2. application 3. accuracy 4 precision 5. problem solving
14	Prove that:$\sin 20°\sin 40°\sin 80° = \frac{\sqrt{3}}{8}$	LO1 LO2	1. Understanding 2. analyze 3. critical thinking 4 accuracy 5. computational skills
15	Prove that: $\cos\left(\frac{\pi}{4}+x\right) + \cos\left(\frac{\pi}{4}-x\right) = \sqrt{2}\cos x$	LO2	1. knowledge 2. problem solving 3. application 4. logical reasoning
	SECTION (C) 3 MARKS QUESTIONS		
16	Find the value of $\tan\frac{\pi}{8}$	LO1 LO2	1. Understanding 2. knowledge 3. accuracy 4 application

17	Prove that:$\frac{\cos 8A \cos 5A - \cos 12A \cos 9A}{\sin 8A \cos 5A + \cos 12A \sin 9A} = \tan 4A$	LO2	1. knowledge 2. application 3. problem solving 4 precision
18	If $\cos x = -\frac{3}{4}$ and x lies in the 3rd quadrant, then find the value of $\cos\frac{x}{2}, \sin\frac{x}{2} and \tan\frac{x}{2}$	LO1 LO2	1. Understanding 2. computational skill 3. analyzing 4 precision
19	Prove that:$\tan 4x = \frac{4\tan x(1-tan^2x)}{1-6tan^2x+tan^4x}$	LO2	1.knowledge 2.problem solving 3. precision 4 application
20	Prove that: $\cos 6x = 32cos^6x - 48cos^4x + 18cos^2x - 1$	LO2	1. Understanding 2. recall 3. computational 4.precision 5.logical thinking
	SECTION (D) 5MARKS QUESTION		
21	Prove that:$\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}}$ =$2\cos\theta$	LO2	1. knowledge 2. analyze 3. accuracy 4 application 5. critical thinking
22	Prove that :$cos^2x + cos^2\left(x+\frac{2\pi}{3}\right) + cos^2\left(x-\frac{2\pi}{3}\right) = \frac{3}{2}$	LO2	1.Understanding 2. recall 3. accuracy 4 precision 5. critical thinking
23	Prove that :$\cos 5x = 16cos^5x - 20cos^3A + 5\cos A$	LO2	1. computational 2. analyze 3. accuracy 4.precision 5.critical thinking

	SECTION (D) 4 MARKS QUESTION (CASE STUDY BASED)		
24	Consider the information given below Let P(a, b) be any point on the unit circle given below, which has its centre at the origin O.  It is given that $< AOP = x\ radian.$ Now, answer the questions based on the figure given above. 1.If a=$\frac{\sqrt{3}}{2}$ and b=$-\frac{1}{2}$, then find the value of x in radian 2.If x=75°, then find the value of $\tan x$ 3.If x=25°, then what is the value of x in radian ?	LO1 LO2 LO3	1. Understanding 2. analyze 3. accuracy 4 precision 5. recalling 6. interpretation
25	Read the following passage and answer the questions given below.  Consider a unit circle with centre O. Let A be any point on the circle. Consider OA as initial side of an angle. Then the length of an arc of the circle will give the radian measure of the angle which the arc will subtend at the centre of the circle. A circle subtends an angle at the centre whose radian measure s 2π and ts degree measure is 360° (i). What is the radian measure of 240°? (ii). $A\ wheel$ makes 360 revolutions in one minute. Through how many radians does it turn in one second? (iii).What is the radius of the circle in which a central angle of 45° intercepts an arc of 132cm? $\left(Use\ \pi = \frac{22}{7}\right)$.	LO1 LO2 LO3	1. Understanding 2. analyze 3. accuracy 4 precision 5. critical thinking Problem solving

ANSWER KEY

1. B 2. B 3. A 4. A 5. B 6. A

7. C 8. D 9. A 10.B 16. $\sqrt{2}-1$ 18. $-\frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}}, -2$

24. (i). (d). $\cot x = \frac{a}{b} = \frac{11\pi}{6}$ $(x\ lies\ in\ 4rth\ \ quadrants)$ (ii). (a). $2+\sqrt{3}$ (iii). (c). $\frac{5\pi}{36}$

25. (i).240× $\frac{\pi}{180} = \frac{4\pi}{3}$ (ii). $number\ of\ radian = 6 \times 2\pi = 12\pi$ (iii). $\theta = \frac{l}{r}$, $\frac{\pi}{4} = \frac{132}{r} \rightarrow r = 168cm$

COMPLEX NUMBERS

Learning Outcomes: Students will be able to

1. **Represent complex numbers in different forms**
2. **Perform arithmetic operations**
3. **Solve quadratic equations with complex roots**

Q. NO.	**Section (A) MCQs**	LO	COMPETENCY
1	The value of $(i^{17} + i)^{10}$ is (a) 0 (b) -1024 i (c) 1024 i (d)- 1024	LO1	Understanding, Identifying ,Problem Solving, Computational Analytical Mindset
2	Find modulus of complex number $-\sqrt{3}$ + i. (a) 0 (b) 2 (c) 3 (d) 4	LO1 LO2	Understanding, Problem Solving, Conceptual
3	Conjugate of complex number z = 2 – 3i is (a) - 2 – 3i (b) 2 – 3i (c) - 2 + 3i (d) 2 + 3i	LO1 LO2	Procedural Fluency, Problem Solving, Conceptual Logical Conclusion
4	Find the real numbers x if (x – 3i) (3 + 2i) is the conjugate of 12 - 5i. (a) 2 (b) 3 (c) -2 (d) -3	LO1 LO2	Problem Solving, Computational
5	The quadrant in Argand plane in which reciprocal of $1 - i$ lies is: (a) First (b) Second (c) Third (d) Fourth	LO1 LO2	Observation, Logical Thinking
	Section (B) 2 marks		
1	Find the solution of $\sqrt{3}x^2$ $-\sqrt{2}x + 3\sqrt{3} = 0$ over complex numbers.	LO1 LO2 LO3	Conceptual Understanding Critical Thinking , Problem Solving,

2	Find the conjugate of $\frac{3-i}{2+i}$.	LO1 LO2	Problem Solving, Conceptual
3	If$a_n = ni^n$, where $= \sqrt{-1}$, then find a_{20} and a_{31}	LO1 LO2	Problem Solving, Computational
	Section (c) 3 marks		
1	If $(x+iy)^{\frac{1}{3}} = a+ib, x, y, a, b \in R.$ Show that: $\frac{x}{a} - \frac{y}{b} = -2(a^2+b^2)$.	LO1 LO2	Logical Thinking, Problem Solving, Computational Logical Conclusion
2	Let $z_1 = 2 - i$, $z_2 = -2 + i$. Find Re $(\frac{z_1 z_2}{z_1})$.	LO1 LO2	Critical Thinking, Problem Solving, Computational
3	Find the square root of –3 + 4i and verify your answer.	LO1 LO2 LO3	Analyses Of Problem, Problem Solving

Answers:

	(SECTION A) MCQ				
1	(d)	**4**	(a)		
2	(b)	**5**	(a)		
3	(d)				
	(SECTION B) 2MARKS				
1	x=$\frac{\sqrt{2} \pm i\sqrt{34}}{2\sqrt{3}}$				
2	1+i				
3	A_{20} =20, A_{31} =-31i				
	(SECTION C) 3 MARKS				
1	proof				
2	$\frac{-2}{5}$	**3**	1+2i, -1-2i		

LINEAR INEQUALITIES

Learning Outcomes: Students will be able to

1. **Solve linear inequalities in one and two variables**
2. **Formulation of inequality**
3. **Represent solutions graphically**

Q.No.	SECTION – A (MCQ - 1 mark)	LOs	Competency
1	If $x^2 > -4$ then the value of x is a)(-2,∞) b) (-2 ,2) c) (2, ∞) d) no solution	LO1	Conceptual understanding
2	If (x+2)/(x-2) >1/2 then x lies in the interval a) (-8,∞) b) (8, ∞) c) (1,8) d) (8,1)	LO1	Problem solving skill
3	The solution of the inequality | x-1| < 2 is a) (1 ,∞) b) (-1,3) c) (1 ,-3) d) (∞, 1)	LO1	Computational skill
4	The solution of |2/(x-4) | > 1 where x is not equal to 4 is a) (2,6) b) (2,4) U (4,6) c) (2,4) U (4,8) d) (-∞,4) U (4,6)	LO1	Analytical thinking skill
5	The interval in which F(x) =(x-1)(x-2)(x-3) is negative is a) x>2 b) 2<x and x<1 c) 2<x<1 and x<3 d) 2<x<3and x<1	LO1 LO3	Mathematical reasoning
	SECTION – B (2 Marks)		
6	Solve 3x+8>2 when x is a real number	LO1	Problem solving skill
7	Solve the inequalities 2x-1 ≤3 and 3x+1 ≥3	LO1 LO3	Computational skill
8	Solve the following inequalities for real x: 2x-1/3 ≥ (3x-2)/4 – (2-x)/5	LO1	Problem solving skill
9	Find the value of x : 5x-3 ≤ 3x+1 when x is a integer	LO1	Computational skill
10	Solve x/4< (5x-2)/3 – (7x-3)/5	LO1	Analytical thinking

	SECTION – C (3 Marks)		
11	Anil obtained 70 and 75 marks in the first unit test. Find the minimum marks he should get in the third test to have an average of at least 60 marks?	LO1 LO2	Formulation of inequality
12	Find all pairs of consecutive odd natural numbers both of which are larger than 10 such that their sum is less than 40?	LO1 LO2	Formulation of inequality, Critical thinking skills
13	The longest side of a triangle is 3 times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm , find the minimum length of the shortest side?	LO1 LO2	Formulation of inequality, Logical thinking skills
14	The water acidity in a pool is considered normal when the average pH reading of three daily measurements is between 7.2 and 7.8. If the first pH reading is 7.48 and 7.85 , find the range of pH value for the third reading that will result in the acidity level being normal.	LO1 LO2	Formulation of inequality, Analytical thinking skills
15	A company manufactures cassettes. Its cost and revenue functions are C(x)= 26000+30x and R(x)=43x respectively, where x is the number of cassettes produced. How many cassettes must be sold by the company to realise some profit?	LO1 LO2	Ability to convert situation mathematically, Problem solving skills
	SECTION – E (case based - 4 Marks)		
16	If a man rides his car at 20 km per hour, he has to spend ₹5 per km on petrol, and if it rides it at 40 km per hour, the petrol costs rise to ₹10 per km .he has ₹150 to spend on petrol and wished to find the maximum distances, he can travel within one hour. (a) Formulate the data in the form of inequalities. (b) Why four wheelers vehicles are better than two wheelers vehicles?	LO1 LO2	Formulation of problem, Analytical thinking skills, Interpreting skills
17	A furniture dealer deals in only two items table and chair. He has ₹25000 to invest and a space to store at most 80 pieces, a table cost him 650 tables and 250 chairs. (a) Formulate the data in the form of inequalities. (b) Which is the best tree for making best furniture?	LO1 LO2	Formulation of problem, Critical thinking skills, Analytical skills

ANSWER KEY

1.	**A**	**9**	**$x > 4$**
2.	**A**	**10**	**35**
3.	**B**	**11**	**(11,13), (13,15)**
4.	**B**	**12**	**Shortest length = 9 cm**
5.	**D**	**13**	**$6.2 \leq x \leq 8.07$**
6.	**$x > -2$**	**14**	**$x > 2000$**
7.	**$2/3 \leq x \leq 2$**	**15**	**$x+2y \leq 80, 2x+y \leq 40, x \geq 0, y \geq 0$**
8.	**$x \geq -28/25$**	**16**	**$650x+250y \leq 25000, x+y \leq 80, x \geq 0, y \geq 0$**
9.	**$x \leq 2$**	**17**	**$x > 4$**

PERMUTAION AND COMBINATION

Learning Outcomes:

1. **Use factorial notation**
2. **Solve problems involving arrangements and selections**

Q.No.	Question	LOs	Competency
	MCQs (One Mark Each)		
1	A password consists of 4 letters of the English alphabet. If repetition of letters is not allowed, how many different passwords can be formed? (a) 26×25×24×23 (b) 26^4 (c) 4! (d) ${}^{26}C_4$	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
2	A committee of 3 students is to be formed out of 6 boys and 4 girls. In how many ways can the committee be formed such that at least one girl is included? (a) 56 (b) 84 (c) 100 (d) 120	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
3	The number of 5-digit numbers that can be formed using digits 1, 2, 3, 4, 5 (without repetition) which are divisible by 4 is: (a) 24 (b) 60 (c) 120 (d) 20	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
4	From a group of 8 men and 6 women, a committee of 5 is to be formed. If the committee must contain more men than women, in how many ways can this be done? (a) 792 (b) 1316 (c) 564 (d) 924	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
5	A box contains 10 different books. In how many ways can 4 books be selected such that two particular books are always included? (a) ${}^8C_2$ (b) ${}^{10}C_4 - {}^8C_4$ (c) ${}^8C_2 + 1$ (d) ${}^{10}C_2$	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
6	In how many ways can the letters of the word *ARRANGE* be arranged so that the two R's are not together? (a) 720 (b) 900 (c) 1080 (d) 1440	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving

7	A student has to answer 5 out of 10 questions in an exam. In how many ways can the student choose the questions if he must answer at least 2 from the first 5 questions? (a) 226 (b) 196 (c) 186 (d) 210	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
8	There are 7 men and 4 women. A committee of 5 is to be formed including at least 2 women. The number of possible committees is: (a) 455 (b) 525 (c) 301 (d) 560	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
9	How many 3-digit numbers can be formed using the digits 2, 4, 6, 8, without repetition? (a) 12 (b) 24 (c) 18 (d) 36	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
10	The number of different 5-letter words (meaningful or not) that can be formed from the letters of the word **DELHI** is: (a) 60 (b) 100 (c) 120 (d) 720	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
	Two marks Each		
11	In how many ways can the letters of the word **SCHOOL** be arranged if the vowels always come together?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
12	How many 5-digit numbers divisible by 5 can be formed using the digits 0, 2, 3, 5, 7 without repetition?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
13	From 10 different books, in how many ways can a student select 4 books such that a particular book is **always included**?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
14	From 8 men and 5 women, a committee of 3 members is to be formed. In how many ways can this be done if **at least 1 woman** is included?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving

15	How many permutations of the word **COMPUTER** are possible if all letters are used?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
	Three Marks Each		
16	From 8 boys and 5 girls, a committee of 4 is to be formed. In how many ways can this be done if the committee must include **at least 2 girls**?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
17	How many ways are there to select 3 red balls and 2 green balls from a box containing 7 red and 6 green balls?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
18	How many 5-digit numbers can be formed using digits 1, 2, 3, 4, 5, 6 if no digit is repeated?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
19	In how many ways can the letters of the word **MISSISSIPPI** be arranged?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
20	How many 4-digit even numbers can be formed using the digits 1, 2, 3, 4, 5, 6 without repetition?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
	Five Marks Each		
21	A committee of 5 members is to be formed from 6 men and 5 women. In how many ways can this be done if: (i) the committee has at least 2 women, and (ii) the committee has more men than women.	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
22	Find the number of arrangements of the letters of the word **MATHEMATICS** in which: (i) all vowels occur together (ii) the two M's do not come together.	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving

23	How many 5-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5, 6 without repetition, if: (i) the number is divisible by 2 (ii) the number is greater than 30000.	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
	FOUR MARKS QUESTIONS **(CASE STUDY BASED)**		
24	A school is organizing a seminar where **6 students and 4 teachers** are to be seated in a row of 10 chairs. The following conditions apply: 1. Teachers must sit together as a group. 2. Students are free to sit anywhere. **Answer the following questions:** **Q1.** In how many ways can the teachers sit together as one block? **Q2.** In how many ways can all 10 people be arranged under this condition? **Q3.** If two particular students insist on sitting together, how many arrangements are possible?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving
25	A company requires employees to create a **4-character password** using digits 0–9 (without repetition). The rules are: 1. The password must be an even number. 2. The password must not begin with 0. **Answer the following questions:** **Q1.** How many 4-digit passwords can be formed in total under these conditions? **Q2.** How many such passwords can be formed if the password must begin with 5? **Q3.** What is the probability that a randomly formed password begins with an odd digit?	LO1 LO2	Conceptual knowledge Logical Thinking Analytical thinking Critical Thinking Problem solving

ANSWERS

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	a	2	c	3	a	4	b	5	a	6	b	7	a
8	c	9	b	10	c	11	60	12	42	13	84	14	230
15	40320	16	365	17	525	18	720	19	34650	20	180	21	381 281
22	120960 4082400	23	1260 1440	24	24 120960 34560	25	2296 280 5/9						

Binomial Theorem

Learning Outcomes: Students will be able to

1. **Expand binomial expressions using the theorem**
2. **Find specific terms in binomial expansions**

MCQ Type Questions (1mark each)

Q.No.	Question	LOs	Competencies
1.	If n is even in the expansion of $(a+b)^n$, the middle term is : (a) n^{th} term (b) $(n/2)^{th}$ term (c) $[(n/2)-1]^{th}$ term (d) $[(n/2)+1]^{th}$ term	LO2	Conceptual understanding
2.	The coefficient of x^3y^4 in $(2x+3y^2)^5$ is (a) 360 (b) 720 (c) 240 (d) 1080	LO1 LO2	Problem solving ability
3.	The fourth term in the expansion of $(x - 2y)^{12}$ is (a) $-1760\ x^9y^3$ (b) $-1670\ x^9y^3$ (c) $-7160\ x^9y^3$ (d) $-1607\ x^9y^3$	LO2	Problem solving ability, solve numerically
4.	If the fourth term of the binomial expansion of $(px+(1/x))^n$ is 5/2 then a)n = 6, p = 6 b)n = 8, p = 6 c)n = 8, p = ½ c)n = 6, p = 1/2	LO2	Analyze pattern, logical reasoning
5.	If n is the positive integer, then $2^{3n} – 7n – 1$ is divisible by a)7 b)10 c)49 d)81	LO1	Analyze pattern, logical reasonin

2 marks Questions

1.	Evaluate $(101)^4$ using the binomial theorem.	LO1	Problem solving ability, analyze pattern, logical reasoning
2.	Write the general term in the expansion of $(a^2 – b)^6$.	LO1 LO2	Computational skill, Problem solving ability,

3.	Find the 4^{th} term in $(3x - y)^7$.	LO1 LO2	Problem solving ability, solving algebraic expansion

3 Marks Questions

1.	Expand the expansion (1 – 2x)5 using binomial theorem.	Computational skill -- accuratelyhandlelongalgebraicexpansion
2.	Find the term or coefficient of x which is independent of x in the expansion $\left(x + \frac{1}{x}\right)^{10}$.	Encourage problem solving, logical reasoning
3.	Find $\left(\sqrt{2} + 1\right)^5 + \left(\sqrt{2} - 1\right)^5$.	Analyze pattern, logical reasoning, accurately handle long algebraic expansion

Answers

MCQ

1	d	2	b	3	a	4	d	5	c

2marks questions

1	104060401	2	$^6Cr\ a^{(12-r)}\ (-b)^r$	3	$-2835x^4y^3$

3marks questions

1	$1-10x+40x^2-80x^3+80x^4-32x^5$
2	6^{th} term, 252
3	$58\sqrt{2}$

Sequences and Series

Learning Outcomes : Students will be able to

1. **Identify and differentiate AP and GP**
2. **Derive and use formulas for nth term and sum**
3. **Apply sequences in solving problems**

Q.NO	Question	LOs	Competency
	MCQ (1Mark Each)		
1	The 8th term of the GP: 2, 6, 18, … is: a) 4374 b) 4376 c) 4378 d) 4380	**LO1** **LO2**	CONCEPTUAL UNDEDRSTANDING
2	If the 3rd term of a GP is 9 and the 6th term is 729, then the common ratio is: a) 2 b) 3 c) 6 d) 9	**LO1** **LO2**	COMPUTATIONAL SKILLS
3	The sum of first 15 natural numbers is: a) 105 b) 110 c) 120 d) 125	**LO1** **LO2**	COMPUTATIONAL SKILLS
4	The sum of first 10 terms of the GP: 1, 2, 4, 8, … is: a) 1023 b) 1024 c) 2046 d) 2047	**LO1** **LO2**	PROBLEM SOLVING
5	The sum of first 5 terms of the series: 2 + 22 + 222 + 2222 + … is: a) 24690 b) 24680 c) 24670 d) 24660	**LO1** **LO2**	ANALYTICAL SKILLS
6	The sum of infinite terms of a GP is 20 and the sum of the squares of the terms is 100. The first term is: a) 8 b) 10 c) 12 d) 16	**LO1** **LO2**	PROBLEM SOLVING
7	If the first, third, and ninth terms of a GP are x, y, z respectively, then the relation between them is: a) $y^2 = xz$ b) $y^3 = xz^2$ c) $y^2 = xz^2$ d) $y^3 = x^2z$	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION AND CRITICAL THINKING
8	If the sum of an infinite GP is 6 and the sum of the squares of its terms is 12, then the common ratio is: a) 1/2 b) 1/3 c) $\sqrt{2}/2$ d) $\sqrt{3}/2$	**LO1** **LO2** **LO3**	COMPUTATIONAL SKILLS
9	The sum of first 8 terms of a GP is 510 and the common ratio is 2. The first term is: a) 2 b) 4 c) 6 d) 10	**LO1** **LO2**	UNDERSTANDING OF FORMULA

10	If three numbers are in GP, and their sum is 14 and product is 64, then the numbers are: a) 2, 4, 8 b) 4, 4, 6 c) 2, 6, 6 d) 1, 4, 9	**LO1** **LO2** **LO3**	CONCEPTUAL UNDERSATANDING
2 Marks Each			
1	Three numbers in GP have sum 14 and product 64. Find the numbers.	**LO1** **LO2** **LO3**	ANALYTICAL SKILLS
2	Two positive numbers have AM = 13 and GM = 12, and they are consecutive terms of a GP. Find the numbers.	**LO1** **LO2** **LO3**	COMPUTATIONAL SKILLS
3	For a GP with a = 1 and r = 2, if $S_n = 511$, find n.	**LO1** **LO2**	ABILITY TO APPLY FORMULA
4	The geometric mean of two positive numbers is 24. If the smaller is 6, find the larger.	**LO1** **LO2** **LO3**	ANALYTICAL THINKING
5	Let the first term of a GP be 1 and the common ratio be r.If the sum of the first 6 terms is equal to 9 times the sum of the next 6 terms, find r.	**LO1** **LO2** **LO3**	CRITICAL THINKING
3 Marks Each			
1	If in a GP, $T_3 = 12$, $T_8 = 384$, find a, r and S_{10}.	**LO1** **LO2**	ABILITY TO APPLY FORMULA
2	If $S_{2n} = 5S_n$ for a GP, find r^n.	**LO1** **LO2**	COMPUTATIONAL SKILLS
3	If the 2nd, 4th, and 6th terms of a GP are x, y, z, show that $y^2 = xz$.	**LO1** **LO2**	ANALYTICAL SKILLS
4	A ball is dropped from a height of 80 m. It rebounds each time to 3/4 of its previous height. Find the total distance travelled by the ball before it comes to rest.	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,ANALYTICAL SKILLS
5	A person saves ₹500 in the first month, ₹1000 in the second month, ₹2000 in the third month and so on. Find his total savings in 12 months.	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,COMPUTATIONAL SKILLS
5 Marks Each			
1	A man repays a loan of ₹65,535 by paying ₹1 in the first month, ₹2 in the second month, ₹4 in the third month and so on. Find the number of instalments	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,ANALYTICAL SKILLS
2	A pendulum makes 60 oscillations in the first minute, 54 in the second, 48 in the third, and so on. In how many minutes will it cease?	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,COMPUTATIONAL SKILLS
3	A cinema hall has 30 rows, the first row has 20 seats, and each subsequent row has 2 more seats than the previous one. Find the total number of seats.	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,PROBLEM SOLVING

4	A contract worker is promised ₹5 on the first day, ₹15 on the second day, ₹45 on the third day, and so on. Find his total earnings after 10 days.	**LO1** **LO2** **LO3**	FORMULATION OF EQUATION ,PROBLEM SOLVING
Case Study Questions			
1	**Savings Plan** Riya decides to save money every month. She saves ₹100 in the first month, ₹200 in the second, ₹400 in the third, and so on. This forms a GP. (a) Write the 6th term of this GP. (b) Find the total amount she saves in the first 6 months. (c) How much will she save in the 10th month? (d) What is the total saving in the first 12 months?	**LO1** **LO2** **LO3**	ABILITY TO APPLY FORMULA, FORMULATION OF EQUATION ,PROBLEM SOLVING
2	**Bouncing Ball** A ball is dropped from a height of 80 m. Each time it rebounds to 3/4 of the previous height. This sequence of heights forms a GP. (a) What is the height after the 2nd rebound? (b) What is the height after the 5th rebound? (c) Find the total distance travelled by the ball before it comes to rest. (d) After how many rebounds will the ball rise to 3less than 10 m?	**LO1** **LO2** **LO3**	ABILITY TO APPLY FORMULA, FORMULATION OF EQUATION ,PROBLEM SOLVING
3	**Theatre Seating** A theatre has 20 seats in the first row, 40 in the second, 80 in the third, and so on. The seating arrangement follows a GP. (a) How many seats are in the 6th row? (b) Find the total number of seats in the first 6 rows. c) If the theatre has 10 rows, find the total number of seats. (d) Which row has 1280 seats?	**LO1** **LO2** **LO3**	ABILITY TO APPLY FORMULA, FORMULATION OF EQUATION ,PROBLEM SOLVING
4	**Loan Repayment** A person borrows ₹8191 and agrees to repay in instalments where the first instalment is ₹1, the second is ₹2, and the third is ₹4, and so on. The repayments form a GP. (a) What will be the 10th instalment? (b) Find the total repayment after 13 instalments. (c) After how many instalments will the loan be fully paid? (d) If the borrower pays for 14 instalments, how much extra does he pay?	**LO1** **LO2** **LO3**	ABILITY TO APPLY FORMULA, FORMULATION OF EQUATION ,PROBLEM SOLVING

5	**Population Growth** The population of a city is 1, 00,000 and it increases every year at 10%. This growth follows a GP. (a) Find the population after 1 year. (b) Find the population after 3 years. c) After how many years will the population become more than 2,00,000? (d) Find the population after 10 years.	**LO1** **LO2** **LO3**	ABILITY TO APPLY FORMULA, FORMULATION OF EQUATION ,PROBLEM SOLVING

ANSWER KEY

MCQs

1. : a) 4374 2.: b) 3 3.: c) 120 4.: a) 1023 5.: a) 24690

6.: a) 8 7.: b) $y^3 = xz^2$ 8.: c) $\sqrt{2}/2$ 9.: b) 2 10: a) 2, 4, 8

2 marks questions

1.: 2, 4, 8 2. : 8 and 18 3.: n = 9 4.: 96 5.: r= $\sqrt[3]{\frac{1}{3}}$

3 marks questions

1.: a = 3, r = 2, $S_{10} = 3069$ 2.: $r^n = 4$ 4.: Total distance = 560 m

5.: Total savings = ₹20,47,000

5 marks questions

1.: 16 2. : 11 minutes 3.: Total seats = 1290 4.: Total = ₹49205

Case Study Questions

1. (a): $T_6 = 3200$ (b) : Sum = ₹6300

   (c) : T_{10} = ₹51200 (d): Sum = ₹409500

2. (a): 45 m (b) : ≈ 18.98 m

   (c) : 560 m (d) : After 7 rebounds

3. (a): 640 seats (b): 1260 seats

   (c) : 20460 seats (d) : 8th row

4. (a): ₹512 (b) : ₹8191

   (c) : 13 instalments (d) : ₹8192 extra

5. (a): 1,10,000 (b) : ≈ 1,33,100

   (c) : 8 years (d) : ≈ 2,59,374

STRAIGHT LINE

Learning Outcomes: Students will be able to

1. **Write equations of lines in various forms**
2. **Solve problems using concepts of slope and distance**
3. **Understand family of lines and angle between lines**

MCQ (MULTIPLE CHOICE QUESTION)

Q.NO	QUESTIONS	LOs	COMPETENCY
Q.1	For specifying a straight line ,how many geometrical parameters should be known? (a) 1 (b) 2 (c) 3 (d) 4	LO1	Knowledge (Straight line concepts), Skill (Problem solving, reasoning), Value (Accuracy, persistence)
Q.2	Two lines $ax + by = c \; and \; a'x + b'y = c'$ are perpendicular if (a)$aa' + bb' = 0$ (b)$ab' = a'b$ (c) $ab + a'b' = 0$ (d) $ab' + a'b = 0$	LO1 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.3	The equation of a line passing through (1,2) and perpendicular to the line $x + y + 1 = 0$ is (a) $y - x + 1 = 0$ (b)$y - x - 1 = 0$ (c)$y - x + 2 = 0$ (d)$y - x - 2 = 0$	LO1 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.4	The intercept cut off by a line from y-axis is twice than that from x-axis, and the line passes through the point(1,20.The equation of the line is (a)$2x + y = 4$ (b) $2x + y + 4 = 0$ (c) $2x - y = 4$ (d) $2x - y + 4 = 0$	LO1 LO2	Knowledge of concepts), Algebraic manipulation, derivation skill, Clarity, persistence, accuracy
Q.5	If the line $\frac{x}{a} + \frac{y}{b} = 1$ passes through the point (2,-3) and (4,-5) ,then (a,b) is (a) (1,1) (b) (-1,1) (c) (1,-1) (d) (-1,-1)	LO1 LO2 LO3	Knowledge of concepts Problem solving, reasoning Accuracy, persistence
Q.6	The coordinates of the foot of perpendicular from the point(2,3) on the line $y = 3x + 4$ are (a) $(\frac{37}{10}, -\frac{1}{10})$ (b) $(-\frac{1}{10}, \frac{37}{10})$ (c) $(\frac{10}{37}, -10)$ (d)$(\frac{2}{3}, -\frac{1}{3})$	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)

Q.7	The distance of the point P(1,-3) from the line $2y - 3x = 4$ is (a) 13 (b) $\frac{7}{\sqrt{13}}$ (c) $\sqrt{13}$ (d) none of these	LO1 LO2	Knowledge (Distance formula, properties of lines), Skill (Application, computation), Value (Precision, logical clarity)
Q.8	The distance of the point of intersection of the lines $2x - 3y + 5$ *and* $3x + 4y = 0$ *from the line* $5x - 2y = 0$ *is* (a)$\frac{130}{17\sqrt{29}}$ (b)$\frac{13}{7\sqrt{29}}$ (c) $\frac{130}{7}$ (d) none of these	LO1 LO2	Knowledge (Distance formula, properties of lines), Skill (Application, computation), Value (Precision, logical clarity)
In the following questions, a statement of assertion(A) is followed by a statement of reason(R). Mark the correct choice as: (a)Both assertion(A) and Reason (R) are true and reason (R) is the correct explanation of assertion(A) (b) Both assertion(A) and Reason (R) are true and but reason (R) is not the correct explanation of assertion(A) (c) Assertion (A) is true, but reason (R) is false. (d) Assertion (A) is false, but reason (R) is true.			
Q.9	Assertion(A) : The distance between the parallel lines $3x - 4y + 9 = 0$ and $6x - 8y - 15 = 0$ is $\frac{33}{10}$ Reason (R)Distance between the parallel lines $Ax + By + C_1 = 0$ and $Ax + By + C_2 = 0$, is given by $d = \frac{\lvert C_1 - C_2 \rvert}{\sqrt{A^2 + B^2}}$	LO1 LO2	Knowledge (Distance formula, properties of lines), Application, computation, Precision, logical clarity
Q.10	Assertion(A): If A(-2,-1) ,B(4,0), C(3,3) and D(-3,2) are the vertices of a parallelogram, then midpoint of AC= midpoint of BD Reason(R): The points A,B and C are collinear .Area of ΔABC=0	LO1 LO2	Knowledge (Geometry & coordinate geometry), Application, visualization, Systematic reasoning, accuracy
Answers Q.1(b) , Q.2(a) , Q.3(b), Q.4(a), Q.5(d), Q6(b), Q.7(c), Q.8(a) , Q.9(a), Q.10(b)			

Two Marks Questions

Q.NO.	QUESTIONS	LOs	COMPETENCY
Q.11	Find the equation of the perpendicular bisector of the line segment joining the points A(2,3) and B(6,-5)	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Problem solving, calculation, Logical reasoning, accuracy
Q.12	Find the slope of a line ,which passes through the origin , and the midpoint of the line segment joining the points P(0,-4) and Q(8,0)	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Problem solving, calculation, Logical reasoning, accuracy
Q.13	Without using Pythagoras theorem, Show that the points A(4,4),B(3,5) and C(-1,-1) are the vertices of a right angled triangle.	LO1 LO2	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.14	Find the equation of the line intersecting the X-axis at a distance of 3 units to the left of the origin with slope -2	LO1 LO2	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.15	Find the distance of the point (-1,1) from the line $12(x+6)=5(y-2)$	LO1 LO2	Knowledge (Distance formula, properties of lines, coordinates), Skill (Application, computation), Value (Precision, logical clarity)
Answers: Q.11 ($x-2y-6=0$) Q.12 -1/2 Q.13 Show slope of AB × Slope of AC=-1 Q.14 $2x+y+6=0$ Q.15 5 unis			

Three marks Questions

Q.NO.	QUESTIONS	LOs	COMPETENCY
Q.16	Find the equation of the line passing through $(2\ ,\ 2\sqrt{3})$ and inclined with x-axis at an angle of 75°	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.17	Determine angle B of the triangle with vertices A(-2,1), B(2,3) and C(-2,-4).	LO1 LO2 LO3	Conceptual Knowledge Problem solving, calculation Logical reasoning,

Q.18	The slope of a line is double the slope of another line. If tangent of the angle between them is $\frac{1}{3}$. Find the slope of the line.	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)
Q.19	Find the image of the point (3,8) with respect to the line $x + 3y = 7$ assuming the line to be a plane mirror.	LO1 LO2 LO3	Knowledge (Graphs & transformations), Skill (Visualization, interpretation), Value (Critical thinking, clarity of reasoning)
Q.20	Find the equation of the line passing through the point (2,2) and cutting off intercepts on the axes whose sum is 9.	LO1	Knowledge (Equation of line concepts), Skill (Algebraic manipulation, derivation), Value (Clarity, persistence, accuracy)

Answers:

Q.16 $(\sqrt{3}+1)x - (\sqrt{3}-1)y = 4(\sqrt{3}-1)$ Q.17 $\theta = tan^{-1}(\frac{2}{3})$

Q.18 (1 and 2) or(½ and 1) Q.19 (-1,-4)

Q.20 $2x + y = 6 \ or \ x + 2y = 6$

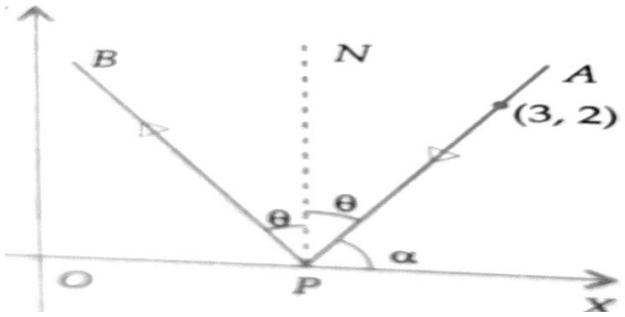
Five marks Questions(21-23)

Q.NO.	QUESTIONS	LOs	COMPETENCY
Q.21	The vertices of a triangle are A(6,0) ,B(0,6) and C(6,6). Find the distance between its circumcentre and centroid.	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Problem solving, calculation, Logical reasoning
Q.22	Draw a quadrilateral in the cartesian Plane , whose vertices are (-4,5), (0,7), (5, -5) and (-4, -2) .Also find its area.	LO1 LO2 LO3	Knowledge (Geometry & coordinate geometry), Application, visualization, Systematic reasoning, accuracy
Q.23	A person standing at the junction (crossing) of the two straight path represented by the equation $2x - 3y + 4 = 0$ and $3x + 4y - 5 = 0$ wants to reach the path whose equation is $6x - 7y + 8 = 0$ in the least time . Find equation of path that he should follow.	LO1 LO2 LO3	Knowledge (Equation of line concepts), Algebraic manipulation, derivation, persistence, accuracy

Answers:

Q.21 $\sqrt{2}$ units Q.22 121/2 sq.units. Q.23 $119x + 102y = 125$

Case base study Questions(24-25)

Q.NO.	QUESTIONS	LOs	COMPETENCY
Q.24	Find the value of K for which the line $(k-3)x-(4-k^2)y+k^2-7k+6=0\ is$ (i) Parallel to X-axis, (ii) Parallel to Y-axis (iii) Passing through the origin.	LO1 LO2	Knowledge (Straight line concepts), Skill (Problem solving, reasoning), Value (Accuracy, persistence)
Q.25	A ray of light is thrown from the point (3,2) parallel to the line $4x-3y+6=0$ upon reaching the x-axis , the ray is reflected from it .Based on the above information, answer the following questions:  (i)Find the equation of the line containing the ray of light. (ii)Find the coordinates of the point where the ray of the light strike the x-axis. (iii)Find the equation of the line perpendicular to x-axis at the point where the ray of light strike it . (iv)Find the equation of the line containing the reflected ray.	LO1 LO2 LO3	Knowledge (Slopes & angles of lines), Skill (Problem solving, calculation), Value (Logical reasoning, accuracy)

Answers:

Q.24 (i) k=3 (ii) k = ± 2 (iii) 1 or 6

Q.25 (i) $4x-3y-6=0$ $(ii)P\left(\frac{3}{2},0\right)(iii)2x-3=0$ $(iv)4x+3y-6=0$

CONIC SECTIONS

Learning Outcomes: Students will be able to

1. **Identify and derive standard equations of conics**
2. **Solve problems involving circle, parabola, ellipse, hyperbola**

Q.No.	SECTION – A (MCQ - 1 mark)	LOs	Competencies
1	The circle $x^2 + y^2 + 2gx + 2fy + c = 0$ does not intersect x axis if a) $g^2 < c$ b) $g^2 > c$ c) $g^2 > 2c$ d) $g^2 < 2c$	LO1	Knowledge of Coordinate geometry, Analysing, critical thinking
2	**The centre of the circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$ is** a) (-2,3) b) (1,-3/2) c) (-4,6) d) (4,-6)	LO1 LO2	Conceptual understanding of circle
3	Which of the following points lie on the parabola $x^2 = 4ay$? a)$x= at^2$, $y= 2at$ b) $x= 2at^2$, $y= at^2$ c) $x= 2at^2$, $y=at$ d) $x=2at$, $y= at^2$	LO1 LO2	Conceptual knowledge of conic, graphical interpretation, logical thinking of parameters
4	The equation of the circle drawn with the two foci of the ellipse $x^2/a^2 + y^2/b^2 = 1$ as end points of a diameter is? a) $x^2 + y^2 = a^2 + b^2$ b) $x^2 + y^2 = a^2$ c) $x^2 + y^2 = 2a^2$ d) $x^2 + y^2 = a^2 - b^2$	LO1 LO2	Understanding of equation of conics, analysing, visualising
5	If the length of major axis of an ellipse is three times the length of minor axis , then its eccentricity is (a) 1/3 (b) $1/\sqrt{3}$ (c) $1/\sqrt{2}$ (d) $2\sqrt{2}/3$	LO1 LO2	Understanding of properties of the conic
6	The difference of focal distances of any point on the hyperbola is equal to (a) length of conjugate axis (b) eccentricity (c) length of transverse axis (d)length of latus rectum	LO2	Conceptual understanding, graphical visualising
7	The coordinates of foci of the hyperbola $9x^2 - 16y^2 = 144$ are a)$(\pm 4, 0)$ b) $(\pm 5, 0)$ c) $(0, \pm 4)$ d) $(0, \pm 5)$	LO1 LO2	Conceptual understanding, computation
8	The eccentricity of the conic $9x^2 + 25y^2 = 225$ is a)2/5 b) 4/5 c) 1/3 d) 1/5	LO1 LO2	Conceptual understanding, computation
9	The equation of diameter of the circle $x^2 + y^2 - 2x + 4y = 0$, which passes through origin is a) x+2y=0 b) x-2y=0 c) 2x+y=0 d) 2x-y=0	LO1 LO2	Conceptual understanding of conics & straight lines, critical thinking, graphical visualization
10	The line 2x-y+4=0 cuts the parabola $y^2=8x$ at points P and Q. The midpoint of line segment PQ is a) (1,2) b) (1,-2) c) (-1,2) d) (-1,-2)	LO1 LO2	Conceptual understanding, Problem Solving, computational skills
	SECTION – B (2 Marks)		
11	If the line $y= \sqrt{3}x + k$ touches the circle $x^2 + y^2 = 16$ find the value of k	LO1 LO2	Comprehending the problem, visualising, evaluating

12	At what point on the parabola $x^2 = 9y$ is the abscissa three times the ordinate?	LO1 LO2	Knowledge of Cartesian geometry & conics
13	Find the eccentricity of the ellipse whose length of latus rectum is a) half the length of its minor axis b) half the length of its major axis	LO1 LO2	Conceptual understanding of conics, visualising, logical thinking
SECTION – C (3 Marks)			
14	Find the equation of the circle passing through points(2,3) and (4,5) and whose centre lies on the line $y - 4x + 3 = 0$	LO1 LO2	Conceptual understanding, comprehending the problem, derivation
15	Find the length of the chord of the parabola $y^2 = 4ax$ which passes through the vertex and is inclined to the axis at an angle $\pi/4$	LO1 LO2	Knowledge of conics, concept of line, critical thinking, problem solving
16	Find the equation of the ellipse (referred to its axes as x-axis an y-axis) which passes through (-3,1) and has eccentricity $\sqrt{\frac{2}{5}}$	LO1 LO2	Conceptual understanding of conics, relating parameters
17	Find the equation of the hyperbola having vertices $(0, \pm 2)$ and eccentricity 5/3	LO1 LO2	Conceptual understanding of the conic, relating parameters
SECTION – D (5 Marks)			
18	Prove that the radii of the circles $x^2 + y^2 = 1$, $x^2 + y^2 - 2x - 6y - 6 = 0$ and $x^2 + y^2 - 4x - 12y - 9 = 0$ are in AP	LO1 LO2	Conceptual understanding of conics & AP, establishing relationship
19	Find the equation of the hyperbola having foci $(\pm 2, 0)$ and eccentricity $\frac{3}{2}$	LO1 LO2	Conceptual understanding of conics, relating parameters
20	Find the equation of an ellipse in standard form if its foci are $(\pm 4,0)$ and length of latus rectum is 20/3 units.	LO1 LO2	Conceptual understanding of conics, relating parameters
SECTION – E (case based - 4 Marks)			
21	An arch in the form of a semi ellipse is 50 ft widest at the base and its greatest height is 20 ft. Consider its base as x axis and centre of base as origin. a) Consider its base as x axis and centre of base as origin and write the equation of the ellipse representing the given arch. b) Find its width at a height of 10 ft from the base.	LO1 LO2	Conceptual knowledge of conics, critical thinking, visualizing, problem solving, attention to detail
22	The girder of a railway bridge is a parabola , with its vertex at the highest point, 10 feet above its ends. If its span is 100 feet, a) Write the equation of parabola b) find the height at a point 20 feet away from the mid point on the base line	LO1 LO2	Conceptual knowledge of conics, critical thinking, visualizing, problem solving, attention to detail

ANSWERS

Q. No.	Answer	Q. No.	Answer
1	A	12	(3,1)
2	B	13	$\sqrt{3}/2$, $1/\sqrt{2}$
3	D	14	$X^2 + y^2 - 4x - 10y + 25 = 0$
4	D	15	$4\sqrt{2}$ a units
5	D	16	$3x^2 + 5y^2 = 32$
6	C	17	$X^2/49 + 9y^2/343 = 1$
7	B	18	----
8	B	19	$X^2/4 - y^2/5 = 4/9$
9	C	20	$X^2/36 + y^2/20 = 1$
10	C	21	$30\sqrt{2}$
11	$\pm$ 8	22	$Y^2 = 250x$, 8.4 ft

INTRODUCTION TO THREE DIMENSIONAL GEOMETRY

Learning Outcomes: Students will be able to

1. Understand coordinates in 3D space

2. Use distance and section formulas

Q.NO.	MCQ(One Mark)	LOs	Competency
1	The given point (-1 ,5,-3) lies in the octant : (i) I (ii) VII (iii) III (iv) VI	LO1	1. Conceptual Understanding 2.Mathematical reasoning 3.Crical thinking
2	If A is the foot of perpendicular of point P(3,4,5) on x-axis , then the coordinate of point A is (i) (-3,4,5) (ii)(3,0,0) (iii) (0,4,0) (iv)(0,0,5)	LO1 LO2	1. Conceptual Understanding 2. geometrical interpretation. 3. Analytical thinking.
3	The coordinate of a point on zx-plane are of the form (i)(x,0,0) (ii)(0,y,0,) (iii)(x,0,z) (iv)(0,0,z)	LO1	1. Conceptual Understanding 2.Mathematical reasoning 3. Logical thinking
4	The length of the perpendicular drawn from the point P(3,4,5) on y-axis is (i) 10 (ii) $\sqrt{34}$ (iii) $\sqrt{113}$ (iv) $5\sqrt{2}$	LO1 LO2	1. Conceptual Understanding. 2. Mathematical reasoning. 3.Problem solving approach.
5	Image of point P(-2,3,4) in yz-plane is (i) (2,3,4) (ii) (2,-3,4) (iii) (-2,-3,-4) (iv)(2,3,-4)	LO1	1. Conceptual Understanding 2. Applying transformation rule. 3.Clarity.

(TWO MARKS)			
6	Show that the triangle ABC with vertices A(0,4,1),(2,3,-1) and (4,5,0) is right angled triangle.	LO1 LO2	1. Logical thinking. 2. Conceptual Understanding 3.Analytical reasoning
7	Find the equation of the set of points which are equidistant from the points (1, 2, 3) and (3, 2, –1).	LO1 LO2	1. Conceptual Understanding 2. Logical thinking 3.critical thinking Computational skill
8	Show that the points A(3,2,-4),B(9,8,-10) and C(5,4,-6) are collinear.	LO1 LO2	1. Conceptual Understanding 2 . Logical Thinking. 3.critical thinking.
9	Find the point on y-axis which is at a distance of $\sqrt{10}$ units from the point (1,2,3).	LO1 LO2LO1 LO2	1. Logical Thinking. 2.Conceptual Understanding. 3.Problem solving
10	Verify that the points A (0, 7, –10), B(1, 6, –6) and C(4, 9, –6) are the vertices of an isosceles triangle.		1. Conceptual Understanding. 2. Computational Skill. 3.Problem solving
(THREE MARKS)			
11	A cube of side 5 has one vertex at the point (1,0,-1), and the three edges from this vertex are respectively, parallel to the negative x and y axes and positive z- axis. Find the coordinate of the other vertices of the cube.	LO1 LO2	1.Concetual Understanding 2. Problem solving. 3. creativity, and clarity in geometric imagination.
12	Find the locus of the point, the sum of whose distances from the points A(4,0,0) and B(-4,0,0) is equal to 10.	LO1 LO2	1. Ability to use distance formula. 2.Skill to drive locus equation. 3.Problem solving approach.
13	Show that the points A(1,2,3), B(-1,-2,-1), C(2,3,2) and D(4,7,6) are the vertices of a parallelogram ABCD, but not a rectangle.	LO1 LO2	1. Logical Thinking 2. Conceptual understanding. 3.Critical evaluation, logical proof.
14	Show that if $x^2 + y^2 = 1$, then the point $(x, y\sqrt{1 - x^2 - y^2})$ is at a distance 1unit from the origin.	LO1 LO2LO1 LO2	1. Logical Thinking 2. Computational Skill. 3. Generalization ability, clarity of proof.
15	If A and B be the points (3, 4, 5) and (–1, 3, –		1. Ability to use

	7), respectively, find the equation of the set of points P such that $PA^2 + PB^2 = k^2$, where k is a constant		distance formula 2. Computational Skill. 3. structured problem solving.

Answer

1. (iv), 2(ii), 3.(iii) 4. (ii) 5.(i) 7. $x - 2z = 0$

9.(0,2,0) 10. (0,2,0) and (0,-6,0)

11.The coordinates of the other seven vertices of the cube are found by adding or subtracting the side length of 5 along the respective axes from the initial vertex (1,0,−1). The edges are parallel to the negative x-axis, negative y-axis, and positive z-axis.

Here are the coordinates of the other vertices:

- (−4, 0, −1): This vertex is 5 units from the initial vertex along the negative x-axis.
- (1, −5, −1): This vertex is 5 units from the initial vertex along the negative y-axis.
- (1, 0, 4): This vertex is 5 units from the initial vertex along the positive z-axis.
- (−4, −5, −1): This vertex is 5 units from the initial vertex along both the negative x- and y-axes.
- (−4,0,4): This vertex is 5 units from the initial vertex along both the negative x- and positive z-axes.
- (1, −5, 4): This vertex is 5 units from the initial vertex along both the negative y- and positive z-axes.
- (−4, −5, 4): This vertex is 5 units from the initial vertex along all three specified axes.

12. $9x^2 + 25y^2 + 25z^2 - 225 = 0$ 15. $x^2 + y^2 + z^2 - 2x - 7y + 2z = \frac{k^2 - 109}{2}$

LIMITS AND DERIVATIVES

Learning Outcomes: Students will be able to

1. **Understand and find limits algebraically**
2. **Define derivatives from first principles**
3. **Find the derivative algebraically and interpret geometrically**

MCQ(1 MARK EACH)			
S. NO.	**QUESTIONS**	**LOs**	**MARKS**
Q1.	If y = $\frac{1+\frac{1}{x}}{1-\frac{1}{x^2}}$ then $\frac{dy}{dx}$ is (a) $\frac{-4x}{(x^2-1)^2}$ (b) $\frac{-4x}{x^2-1}$ (c) $\frac{1-x^2}{4x}$ (d) $\frac{4x}{x^2-1}$	LO1	Conceptual Accuracy, logical reasoning.
Q2.	$\lim_{X \to \pi} \frac{\sin x}{\pi - x}$ (a) 1 (b) 2 (c) - 1 (d) – 2	LO1	Conceptual, logical, precision in applying concepts.
Q3.	$\lim_{x \to \frac{\pi}{4}} \frac{sec^2 x-2}{\tan x-1}$ is (a) 3 (b) 1 (c) 0 (d) 2	LO1	Conceptual, logical application, speed and correctness.
Q4.	If y = $\sqrt{x} + \frac{1}{\sqrt{x}}$ then $\frac{dy}{dx}$ at x = 1 is (a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) 0	LO3	Conceptual, logical, careful calculation and accuracy.
Q5.	If y = $\frac{\sin x+\cos x}{\sin x-\cos x}$ then $\frac{dy}{dx}$ at x = 0 is (a) – 2 (b) 0 (c) $\frac{1}{2}$ (d) does not exist	LO3	Conceptual, logical and critical thinking
Q6.	If f(x) = $\frac{x-4}{2\sqrt{x}}$ then f'' (1) is (a) $\frac{5}{4}$ (b) $\frac{4}{5}$ (c) 1 (d) 0	LO3	Conceptual, logical and critical thinking decision making

Q7.	$\lim_{x \to 0} \frac{\tan 2x - x}{3x - \sin x}$ is (a) 2 (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) $\frac{1}{4}$	LO1	Conceptual, logical and critical thinking
Q8.	$\lim_{\theta \to 0} \frac{1-\cos 4\theta}{1-\cos 6\theta}$ is (a) $\frac{4}{9}$ (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) – 1	LO1	Conceptual, logical and critical thinking decision making
Q9.	$\lim_{x \to 0} \frac{(1+x)^n - 1}{x}$ is (a) n (b) 1 (c) - n (d) 0	LO1	Conceptual, logical and critical thinking decision making Generalization ability.
Q10.	If $f(x) = \frac{\tan x}{x - \pi}$ then $\lim_{x \to \pi} f(x)$ is (a) 0 (b) 1 (c) -1 (d) none of these	LO1	Conceptual, logical thinking decision making application and critical thinking.

2 MARKS EACH.			
S. NO.	**QUESTIONS**		**MARKS**
Q11.	Evaluate the following limit: $\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$	LO1	Conceptual, logical and critical thinking decision making manipulation, persistence in multi-step problem solving.
Q12.	Find all the possible values of 'a', if $\lim_{x \to a} \frac{x^9 - a^9}{x - a} = \lim_{x \to 5} (4 + x)$	LO1	Application, solving algebraic equations, logical consistency and systematic approach.

Q13.	If $\lim_{\theta \to 0} k\ \theta\ cosec\ \theta = \lim_{\theta \to 0} \theta\ cosec\ k\ \theta$, prove that k = $\pm$ 1	LO1	Understanding relationship, proof writing with steps, clarity.
Q14.	Evaluate the following limit: $\lim_{x \to 0} \frac{\sin ax}{\sin bx}, a, b\ \neq 0.$	LO1	Concept, manipulating equations, substitution, application and care in stepwise simplification.
Q15.	If $\lim_{\lim x \to a} \frac{x^7 + a^7}{x + a}$ = 7, find the value of 'a'.	LO1	Condition based problem involving constant, equating with given value logical analysis for exact value.

Q. NO. 16 TO 20 CARRY 3 MARKS EACH.			
S. NO.	**QUESTIONS**		**MARKS**
Q16.	Evaluate : $\lim_{x \to 0} \frac{(cosec\ 2x - \cot 2x)}{x}$	LO1	Knowledge, computational skill and accuracy.
Q17.	For the function 'f', given by$f\ (x) = x^{\ 2} - 6x + 8$, prove that $f'(5) - 3\ f'\ (2) = f'\ (8)$.	LO3	Knowledge, justification and presentation.
Q18.	Evaluate : $\lim_{x \to a} \frac{x^{\frac{5}{2}} - a^{\frac{5}{2}}}{\sqrt{x} - \sqrt{a}}.$	LO1	Concept, computational skill and simplification.
Q19.	If y = x sin x, prove that: $\frac{1}{y}\frac{dy}{dx} - \frac{1}{x} = \cot x.$	LO3	Concept, problem solving, accuracy and logical thinking.

Q20.	Find the derivative of $\frac{1}{ax^2+b}$ with respect to x by first principle.	LO1 LO2	Knowledge, application and perseverance.

Q. NO. 21 TO 23 CARRY 5 MARKS EACH.			
S. NO.	**QUESTIONS**		**MARKS**
Q21.	Evaluate the following limit: $\lim_{x \to 1} \left[\frac{x-2}{x^2-x} - \frac{1}{x^3-3x^2+2x}\right]$	LO1	Knowledge, evaluation and logical endurance.
Q22.	If $f(x) = \begin{cases} mx^2 + n, & x < 0 \\ nx + m, & 0 \leq x \leq 1 \\ n\,x^3 + m, & x > 1 \end{cases}$. For what integers 'm' and 'n' does both $\lim_{x \to 0} f(x)$ and $\lim_{x \to 1} f(x)$ exists?	LO1	Condition for existence, systematical approach, problem solving, precision.
Q23.	Find the derivative of $f(x) = \sqrt{\cos x}$, using first principle.	LO1 LO2	Fundamental ideas, application and critical thinking.

ANSWERS

Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans
1	a	2	C	3	a	4	d	5	c
6	a	7	B	8	a	9	a	10	b

Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans
11	1	12	a = $\pm$ 1	14	$\frac{a}{b}$	15	a = $\pm$ 1	16	1	18	5 a^2
20	$\frac{-2ax}{(ax^2+b)^2}$			21	2	22	n = m	23	$\frac{-\sin x}{2\sqrt{\cos x}}$		

STATISTICS

Learning Outcomes: Students will be able to

1. **Calculate and interpret central tendency and measure of dispersion**
2. **Solve problems using variance and standard deviation**

Q.No.	Question	LOs	Competency
	MCQ (ONE MARK EACH)		
1	The mean deviation about the mean of the set of first n natural numbers when n is an even number $a.\ \frac{n}{2}$ $b.\ \frac{n}{4}$ $c.\ \frac{n}{6}$ $d.\frac{n}{8}$	**LO1**	Conceptual Understanding of number system, Data interpretation Computational skills
2	$If\ x_1, x_2, x_3\ \ldots\ldots\ldots x_n$ *be the observations with mean* m *and standard deviation* s *then , the standard deviation of the observations* $kx_1, kx_2, kx_3\ \ldots\ldots\ldots and\ kx_n\ is$ $a.k+s$ $b.\frac{s}{k}$ $c.ks$ $d.\ s$	**LO1** **LO2**	Conceptual understanding Problem solving, Critical thinking, Computational ability
3	$If\ the\ mean\ deviation\ of\ numbers$ $1, 1+d, 1+2d, \ldots\ldots\ldots, 1+100d\ from\ their\ mean\ is\ 255,$ $then\ d\ is$ equal to $a.$ 10.0 $b.$ 20.0 $c.$ 10.1 $d.$ 20.2	**LO1**	Conceptual understanding Problem Solving, Analytical thinking
4	$Assertion$ $: If\ y_i = -2x_i + 3\ and\ \sigma_x = 4\ , then\ \sigma_y = 8$ $Reason:$ $If\ y_i = ax_i + b\ , then\ \sigma_y = \lvert a\rvert\sigma_x$	**LO1** **LO2**	Comprehensive Understanding, Critical thinking Analysis of data
5	$Assertion: The\ variance\ of\ first\ 10\ natural\ number\ is\ \frac{33}{4}.$ $Reason:\ \ The\ variance\ of\ first\ n\ natural\ number\ is\ \frac{n^2-1}{12}$	**LO1** **LO2**	Conceptual understanding Problem Solving Inductive analysis Decision-making

<table>
<tr><td></td><td>TWO MARKS QUESTIONS</td><td></td><td></td></tr>
<tr><td>6</td><td>The mean of 100 observations is 50 and their standard deviation is 5. Find the sum of the squares of all observations.</td><td>LO1
LO2</td><td>Conceptual understanding
Problem Solving,
Computational ability
Analytical skills</td></tr>
<tr><td>7</td><td>Find the variance of the first n natural numbers .</td><td>LO1
LO2</td><td>Conceptual understanding of number system,
problem solving
critical thinking</td></tr>
<tr><td>8</td><td>If for the following frequency distribution, variance is 160 and A is positive integer, find the value of A.
<table>
<tr><td>X</td><td>A</td><td>2A</td><td>3A</td><td>4A</td><td>5A</td><td>6A</td></tr>
<tr><td>F</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>LO1
LO2</td><td>Conceptual understanding
problem solving
critical thinking
computational skills
precision</td></tr>
<tr><td></td><td>THREE MARKS QUESTIONS</td><td></td><td></td></tr>
<tr><td>9</td><td>There are 60 students in a class. The following is the frequency distribution of the marks obtained by the students in a test:
<table>
<tr><td>Marks</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>frequency</td><td>x-2</td><td>X</td><td>x^2</td><td>$(x+1)^2$</td><td>2x</td><td>x-</td></tr>
</table>
where x is a positive integer. Determine the mean and standard deviation of the marks.</td><td>LO1
LO2</td><td>Conceptual understanding ,
problem solving
critical thinking
computational skills
accuracy</td></tr>
<tr><td>10</td><td>The mean and variance of 15 observations are 3.8 and 4 respectively. If each observation is increased by 11, then find the new mean and new variance of the resulting observations.</td><td>LO1
LO2</td><td>Conceptual understanding,
problem solving
Analytical thinking
Critical Thinking</td></tr>
<tr><td>11</td><td>The mean and standard deviation of 6 observations are 8 and 4 respectively. If each observation is multiplied by 3 then find the new mean and standard deviation of resulting observations.</td><td>LO1
LO2</td><td>Conceptual understanding,
problem solving
Analytical thinking</td></tr>
</table>

<table>
<tr><td></td><td>FIVE MARKS QUESTIONS</td><td></td><td></td></tr>
<tr><td>12</td><td>For a group of 200 candidate, the mean and standard deviation were found to be 40 and 15 respectively. Later on it was found that the score 43 was misread as 34. Find the correct mean and standard deviation</td><td>LO1
LO2</td><td>Conceptual understanding
problem solving
critical thinking
Analytical thinking
computational skill
precision</td></tr>
<tr><td>13</td><td>The mean and variance of 7 observations are 8 and 16 respectively. If five of them are 2, 4, 10, 12, 14. Find the remaining two observations.</td><td>LO1
LO2</td><td>Conceptual understanding
problem solving
critical thinking
Analytical thinking
computational skill
precision</td></tr>
<tr><td></td><td>FOUR MARKS QUESTIONS(CASE STUDY BASED)</td><td></td><td></td></tr>
<tr><td>14</td><td>The marks of students of class XI in mathematics class test (out of 20) are given:
<table>
<tr><td>Marks(x_i)</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td><td>17</td></tr>
<tr><td>Number of students((f_i)</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>8</td></tr>
</table>
On the basis of above information, answer the following $questions$
1. Find the total number of students in the class.
2. What will be the cumulative frequency corresponding to mark 11?
3. Find the median (M) of the given data .
4. What is the value of mean deviation from median of given data?</td><td>LO1</td><td>comprehensive understanding
Conceptual understanding , problem solving
critical thinking
decision-making</td></tr>
<tr><td>15</td><td>Let x_i and y_i are two data such that $y_i = a + b\,x_i$. If $\bar{x}$, $\bar{y}$ are the mean and σ_x and $\sigma_y$are standard deviations for the given data x_i and y_i then we have
$\bar{y} = a\bar{x} + b \; and \; \sigma_y = |a|\sigma_x$
On the basis of above information , answer the following $questions$
1. $if \;\; y_i = 4x_i - 3 \;\; and \; \overline{x} \; is \; 10 \, , then \; \bar{y} \;\; =$
a. 40 b. 7 c. 37 d.43
2. $if \;\; y_i = b + ax_i \;\; , \;\; then$
$a. var(Y) \;\; = \;\; a^2 Var(X) \qquad b. var(X) \;\; = \;\; a^2 Var(Y)$
$c. \;\; var(Y) \;\; = \;\; Var(X) + b \qquad d. \;\; none \; of \; these$</td><td>LO1
LO2</td><td>comprehensive understanding
Conceptual understanding of central tendency and measure of dispersion,
problem solving
critical thinking
analytical thinking</td></tr>
</table>

	3. $if\, y_i = 10 + x_i \;\; ,then$ $a.\ \bar{y} = \bar{x}$ $\quad$ $b.\ \bar{y} = 3\bar{x} + 2$ $c.\ \bar{y} = \bar{x} - 2$ $\quad$ $d.none\ of\ these$ 4. $if\ y_i = \frac{b+ax_i}{c} \;\; ,then\ \sigma_y =$ $a.\ \frac{a\sigma_x + b}{c}$ $\quad$ $b.\ \frac{a}{c}\sigma_x$ $c.\ \left\|\frac{a}{c}\right\|\sigma_x$ $\quad$ $d.none\ of\ these$		precision accuracy

Answer key

1.	B.	9	MEAN =2.8 S.D =1.12
2	C.	10	Mean =14.8 s.d =4
3	C	11	Mean =24 s,d 12
4	A	12	Correct mean =40.045 correct s.d =14.995
5	A	13	Remaining two observations: 6 and8
6	252500	14	1 .50 2. 20 3. 13 4. 2.72
7	$\frac{n^2-1}{12}$	15	1. a 2. a 3 . d 4. C
8	A=7		

PROBABILITY

Learning Outcomes: Students will be able to

1. **Understand classical probability.**
2. **Calculate probabilities of simple and compound events.**

Q. No.	SECTION-A (MCQ) (1 MARK EACH)	LOs	COMPETENCIES
1	What is the total number of elements in sample spaces when a coin is tossed and a die is thrown? a)12 b)10 c)11 d)13	LO1	1-Conceptual Understanding 2-ability to recall basic facts
2	A bag contains 5 brown and 4 white socks. Ram pulls out two socks. What is the probability that both the socks are of the same colour? a)$\frac{4}{5}$ b)$\frac{4}{9}$ c)$\frac{4}{3}$ d)$\frac{4}{7}$	LO1	Conceptual understanding and mathematical formulation
3	What is the probability of selecting a vowel in the word "ZIET"? a)1 b)2 c) 0.5 d)None of the above	LO1	Ability to interpret and conceptual understanding
4	An urn contains 6 balls of which two are red and four are black. Two balls are drawn at random. What is the probability that they are of different colours? a) $\frac{4}{15}$ b) $\frac{2}{15}$ c)$\frac{1}{15}$ d) $\frac{8}{15}$	LO1 LO2	Conceptual understanding and mathematical formulation
5	A card is drawn from a deck of 52 cards. What is the probability of getting a king or a heart or a red. a)1/13 b) 5/13 c) 5/7 d) 7/13	LO1 LO2	Conceptual understanding analytical thinking
6	A coin is tossed twice, what is probability that at least one tail occurs a)1/4 b)2/5 c) 3/4 d) 4/ 5	LO1 LO2	Conceptual understanding and mathematical formulation
7	Three identical dice are rolled. What is the probability that the same number will appear on each of them a) 1/6 b)1/36 c)1/18 d)3/28	LO1	Conceptual understanding ,Analytical and reasoning skill logical thinking
8	A bag contains 5 brown and 4 white socs. Ram pulls out two socks. What is the probability that both the socks are of the same colour? A)9/20 b)2/9 c)3/20 d)4/9	LO1 LO2	Conceptual understanding ,problem solving

	ASSERTION-REASON BASED QUESTIONS In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.		
9	Assertion: The probability of a sure event is 1. Reason: Let E be an event. Then, $0 \leq P(E) \leq 1$	LO1 LO2	Conceptual understanding Analysing ,decision making,
10	Assertion: In rolling a dice, event A = {1, 3, 5} and event B = {2, 4} are mutually exclusive events. Reason: In a sample space, two events are mutually exclusive if they do not occur at the same time.	LO1 LO2	Comprehensive understanding and analytical thinking
	SECTION-B (2 MARKS EACH)		
11	If the letters of the word ALGORITHM are arranged at random in a row what is the probability the letters GOR must remain together as a unit?	LO1 LO2	Logical Reasoning and Analytical thinking
12	A letter is chosen at random from the word 'ASSASSINATION'. Find the probability that letter is a consonant?	LO1 LO2	Conceptual understanding, Logical Reasoning and Analytical thinking
13	4 cards are drawn from a well snuffled deck of 52 cards what is the probability of obtaining 3 diamonds and one spade ?	LO1 LO2	Conceptual understanding Problem solving
14	From a deck of 52 cards four cards are accidently dropped. Find the chance that the missing cards should be one from each type.	LO1 LO2	Conceptual understanding, Reasoning and Analytical thinking
15	What is the probability that an ordinary year has 53 Sundays?	LO1	Conceptual understanding & Logical thinking

	SECTION-C(3 MARKS EACH)		
16	A book contains 100 pages. A page is chosen at random. What is the chance that the sum of the digit on the page is equal to 9?	LO1	Conceptual understanding, logical thinking, Problem solving
17	In a single throw of two dice, find the prob. that neither a doublet nor a total of 10 will appear.	LO1 LO2	Analytical thinking
18	What probability that randomly chosen two-digit positive integer is multiple of 3?	LO1	Analytical and critical thinking
19	A bag contains 5 red, 6 white and 7 black balls. Two balls are drawn at random. What is the probability that both balls are red or both are black?	LO1 LO2	Conceptual understanding ,Procedural skill
20	In a town, there are 6000 people of which 1200 are over 50 years old and 2000 are females. It is said that 30% of females are over 50 years. Find the probability that an individual chosen randomly from the town is either female or over 50 years.	LO1 LO2	Conceptual understanding Problem solving
	SECTION-D (5 MARKS EACH)		
21	In a class of 60 students, 30 opted for NCC, 32 opted for NSS, 24 opted for both NCC and NSS. If one of these students is selected at random. Find the probability that (i) The student opted for NCC or NSS. (ii) The student has opted neither NCC nor NSS. (iii) The student has opted NSS but not NCC	LO1 LO2	Analytical thinking, problem solving
22	There are 20 cards that are numbered from 1 to 20. If a card is withdrawn randomly, then find the probability that a number on the card will be: (i) Multiple of 4 (ii) Even number (iii) Not divided by 5 (iv) Prime Number	LO1 LO2	Higher order thinking skill, procedural thinking
23	In a school, the probability that a student passes in Mathematics is 0.7, in English is 0.8, and in both is 0.6. Find the probability that a student chosen at random: a) Passes in at least one subject. b) Passes in Mathematics but not in English. c) Fails in both subjects.	LO1 LO2	Higher order thinking skill and analytical thinking

	SECTION-E (CASE STUDY BASED) (4 MARKS EACH)		
24	Two students Rohan and Soham appeared in an examination. The probability that Rohan will qualify the examination is 0.05 and that Soham will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Based on the above information, answer the following questions? (i) Find the probability that both Rohan and Soham will not qualify the examination. (ii) Find the probability that at least one of them will not qualify the examination. (iii) only one of them will qualify the exam	LO1 LO2	Conceptual understanding Problem solving skill ,Analytical reasoning ,
25	A cricket coach has 15 players, out of which 6 are bowlers, 5 are batsmen, and 4 are all-rounder. He has to select 3 players randomly? 1. What is the probability that all 3 selected are bowlers? 2. What is the probability that at least one all-rounder is selected? 3. What is the probability that exactly one batsman is selected? 4. What is the probability that all selected players are of different categories? 5. What is the probability that none of the selected players is an all-rounder?	LO1 LO2	Conceptual understanding Problem solving skill Analytical reasoning

ANSWERS

Q No.	**SECTION-A**		**SECTION-C**
1	A	16	1/10
2	B	17	7/9
3	C	18	1/3
4	D	19	31/153
5	D	20	13/20
6	C		**SECTION-D**
7	B	21	i. 19/30 ii 11/30 iii.4/30
8	D	22	i) ¼ (ii) ½ (iii) 4/5 (iv) 2/5
9	B	23	0.9 b)0.1 c)0.1
10	A		**SECTION-E**
	SECTION-B	24	i) 0.87 ii)0.98 iii)0.11
11	1/72	25	1)4/91 2)58/91 3)45/91 4)24/91 5)33/91
12	7/13		
13	286/20825		
14	2197/20825		
15	1/7		