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2025 – 26 II PUC QUESTION BANK

SUBJECT CODE: 35

MATHEMATICS

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II PUC CHAPTERWISE WEIGHTAGE FRAMEWORK

CONTENTS

TIME: 3 HOURS 35 – MATHEMATICS Max Marks: 80

CHAPTER -01
RELATIONS AND FUNCTIONS

MCQ /FB questions.

1. A relation R in a set A, If each element of A is related to every element of A , then R is called
(A) empty relation (B) universal relation (Easy)
(C) Trivial relation (D) function

2. Both the empty relation and the universal relation are (Easy)
(A) empty relations (B) universal relations
(C) Trivial relations. (D) equivalence relations.

3. Let A be the set of all students of a boys school. Then the relation R in A given by
R = {(a, b) : a is sister of b} is (Easy)
(A) empty relation (B) transitive relation
(C) symmetric relation (D) reflexive relation

4. A relation R in the set A is called a reflexive relation, if (Easy)
(A) (a,a) ∈ R, for every a ∈ A
(B) (a,a) ∈ R, at least one a ∈A
(C) (a,b) ∈ R implies that (b, a) ∈ R, for all a, b ∈ A
(D) (a,b) and (b, c) ∈ R implies that (a, c) ∈ R, for all a, b, c ∈ A

5. A relation R in the set {1, 2, 3} given by
R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (1,3)}. Then R is (Average)
(A) reflexive and symmetric (B) reflexive and transitive
(C) reflexive , symmetric and transitive (D) reflexive but neither symmetric nor transitive

6. A relation R in the set {1, 2, 3} given by R = {(1, 2), (2, 1)} is (Easy)
(A) reflexive and symmetric (B) symmetric but not transitive
(C) symmetric and transitive (D)neither symmetric nor transitive.

7. A relation R in the set {1,2,3} given that R = {(1,2), (2,1), (1,1)} is (Average)
(A) transitive but not symmetric (B) symmetric but not transitive
(C) symmetric and transitive (D) neither symmetric nor transitive.

8. Let R be the relation in the set {1, 2, 3, 4} given by
R = {(1, 2), (2, 2), (1, 1), (4,4),(1, 3), (3, 3), (3, 2)}. Choose the correct answer. (Average)
(A) R is reflexive and symmetric but not transitive
(B) R is reflexive and transitive but not symmetric
(C) R is symmetric and transitive but not reflexive
(D) R is an equivalence relation

9. Let R be the relation in the set N given by R = {(a, b) :a = b – 2, b > 6}.
Choose the correct answer. (Average)
(A) (2, 4) ∈R (B) (3, 8) ∈R (C) (6, 8) ∈R (D) (8, 6) ∈R.

10. Consider the non-empty set consisting of children in a family and a relation R defined as aRb if a is brother of b. Then R is (Average)
(A) symmetric but not transitive (B) transitive but not symmetric
(C) neither symmetric nor transitive (D) both symmetric and transitive.

11. If a relation R on the set {1, 2, 3} be defined by R = {(1, 2)}, then R is (Easy)
(A) reflexive (B) transitive (C) symmetric (D) none of these

12. Let L denote the set of all straight lines in a plane. Let a relation R be defined by lRm if and only if l is perpendicular to m ∀l, m ∈L. Then R is (Easy)
(A) reflexive (B) symmetric (C) transitive (D) none of these.

13. Let R be the relation in the set $\{1, 2, 3, 4\}$ given by $R = \{(2,2),\ (1,1),\ (4,4), (3,3)\}$. Choose the correct answer. (Easy)
(A) R is reflexive and symmetric but not transitive
(B) R is reflexive and transitive but not symmetric
(C) R is symmetric and transitive but not reflexive
(D) R is an equivalence relation

14. Let W denote the words in the English dictionary. Define the relation R by
R = {(x, y) ∈ W × W : the words x and y have at least one letter in common}. Then R is (Average)
(A) not reflexive, symmetric and transitive (B) reflexive, symmetric and not transitive
(C) reflexive, symmetric and transitive (D) reflexive, not symmetric and transitive

15. Let S = {1, 2, 3}. Then number of equivalence relations containing (1, 2) is (Average)
(A) 1 (B) 2 (C) 3 (D) 4

16. The number of equivalence relation in the set {1, 2, 3} containing (1, 2) and (2, 1) is (Average)
(A) 5 (B) 2 (C) 4 (D) 3

17. Let S = {1, 2, 3}. Then number of relations containing (1, 2) and (1, 3) which are reflexive and symmetric but not transitive is (Average)
(A) 1 (B) 2 (C) 3 (D) 4

18. If a relation R on the set {1, 2, 3} be defined by R = {(1, 1)}, then R is (Easy)
(A) symmetric but not transitive (B) transitive but not symmetric
(C) symmetric and transitive (D) neither symmetric nor transitive

19. Let R be a relation on the set N of natural numbers defined by nRm if n divides m.
Then R is (Average)
(A) Reflexive and symmetric (B) Transitive and symmetric
(C) Equivalence (D) Reflexive, transitive but not symmetric

20. Let T be the set of all triangles in the Euclidean plane, and let a relation R on T be defined as aRb if a is congruent to $b \ \forall \ a, b \in T$. Then R is (Easy)
(A) reflexive but not transitive (B) transitive but not symmetric
(C) equivalence (D) symmetric but not reflexive

21. Let $A = \{2,3,4,5\}$ & $B = \{36,45,49,60,77,90\}$ and let R be the relation 'is factor of' from A to B
Then the range of R is the set (Average)
(A) $\{60\}$ (B) { 36,45,60,90 } (C) $\{49,77\}$ (D) $\{49,60,77\}$

22. The maximum number of equivalence relation on the set $A = \{1,2,3\}$ is (Average)
(A) 1 (B) 2 (C) 3 (D) 5

23. Let us define a relation R in R as aRb if $a \geq b$. Then R is (Average)
(A) an equivalence relation (B) reflexive, transitive but not symmetric
(C) symmetric, transitive but not reflexive (D) neither transitive nor reflexive but symmetric

24. A relation R in set A = {1,2,3} is defined as R = {(1, 1), (1, 2), (2, 2), (3, 3)}. Which of the following ordered pair in R shall be removed to make it an equivalence relation in A? (Easy)
(A) (1, 1) (B) (1, 2) (C) (2, 2) (D) (3, 3)

25. Let $A = \{1,2,3\}$ and consider the relation R = {(1, 1), (2, 2), (1, 2), (2, 3), (3, 3)}.
Then R is (Easy)
(A) reflexive but not symmetric (B) reflexive but not transitive
(C) symmetric and transitive (D) neither symmetric, nor transitive

26. If a relation R on the set {1, 2, 3} be defined by R = {(1,1),(2,2)}, then R is (Easy)
(A) symmetric but not transitive (B) transitive but not symmetric
(C) symmetric and transitive (D) neither symmetric nor transitive

27. Let f :R→ R be defined by f(x) = x^4, x ∈R. Then (Average)
(A) f is one-one but not onto (B) f is one-one and onto
(C) f is many-one onto (D) f is neither one-one nor onto

28. Let f :R→ R be defined by f(x) = 3x, x ∈R. Then (Average)
(A) f is one-one but not onto (B) f is one-one and onto
(C) f is many-one onto (D) f is neither one-one nor onto

29. Let f : R→ R be defined by f(x) = x^3, x ∈R. Then (Average)
(A) f is one-one but not onto (B) f is one-one and onto
(C) f is many-one onto (D) f is neither one-one nor onto

30. Let f :R→ R be defined by f(x) = $\frac{1}{x}$, x ∈R. Then f is (Easy)
(A) one-one (B) onto (C) bijective (D) f is not defined.

31. Let $f: R \to R$ defined by $f(x) = 2x + 6$ which is a bijective mapping then $f^{-1}(x)$ is given by (Average)

(A) $\frac{x}{2} - 3$ (B) $2x + 6$ (C) $x - 3$ (D) $6x + 2$

32. If the set A contains 5 elements and the set B contains 6 elements, then the number of one-one and onto mappings from A to B is (Average)

(A) 720 (B) 120 (C) 0 (D) 30

33. Let A = {1, 2, 3, …n} and B = {a, b}. Then the number of surjections from A into B is (Average)

(A) ${}^nP_2$ (B) $2^n - 2$ (C) $2^n - 1$ (D) 2^n

34. If the set A contains 5 elements and the set B contains 6 elements, then the number of one-one mappings from A to B is (Easy)

(A) 720 (B) 120 (C) 0 (D) 30

35. A contains 5 elements and the set B contains 6 elements, then the number of onto mappings from A to B is (Easy)

(A) 720 (B) 120 (C) 0 (D) 30

36. Let N be the set of natural numbers and the function $f: N \to N$ be defined by $f(n) = 2n + 3 \forall n \in N$. Then f is (Easy)

(A) surjective (B) Injective (C) bijective (D) Many to one

37. Which of the following functions from Z into Z are bijections? (Average)

(A) $f(x) = x^3$ (B) $f(x) = x + 2$ (C) $f(x) = 2x + 1$ (D) $f(x) = x^2 + 1$

38. Let $f: R \to R$ be defined by $f(x) = 3x - 4$. Is invertible. Then $f^{-1}(x)$ is given by (Average)

(A) $\frac{x+4}{3}$ (B) $\frac{x}{3} - 4$ (C) $3x + 4$ (D) $x + \frac{4}{3}$

39. Let S = {a, b, c} and T = {1, 2, 3} then which of the following functions f from S to T, f^{-1} exists. (Easy)

(A) f = {(a, 3), (b, 2), (c, 1)} (B) f = {(a, 1), (b, 1), (c, 1)}
(C) f = {(a, 2), (b, 1), (c, 1)} (D) f = {(a, 1), (b, 2), (c, 1)}

40. Find the number of all one-one functions from set A = {1, 2, 3,4} to itself. (Easy)

(A) 8 (B) 24 (C) 16 (D) 256

41. **Statement 1 :** A relation R = { (1,1),(1,2),(2,1) } defined on the set A = { 1,2,3 } is transitive.
Statement 2 : A relation R on the set A is transitive if (a, b) and (b, c) ∈ R, then(a, c) ∈ R $\forall a, b, c \in A$ (Average)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is true

42. Let f :{1, 2, 3} → {1,2,3} is a function,
Statement 1: If f is one-one, then f must be onto.
Statement 2: If f is onto, then f must be one-one. Choose the correct answer. (Easy)

A) Statement 1 is true, and Statement 2 is false
B) Statement 1 is false, and Statement 2 is true
C) Statement 1 is true, and Statement 2 is true
D) Statement 1 is false, and Statement 2 is false

43. **Statement 1:** Let $f: R \to R$ be defined by $f(x) = 3x$ is bijective. (Average)
Statement 2: A function $f: A \to B$ is a bijective function if f is one-one and onto

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

44. Statement 1: Consider the set A = {1,2,3} and R be the smallest equivalence relation on A, then R is an identity relation. (Average)
Statement 2: R is an equivalence relation, then R is reflexive, symmetric and transitive.
A) Statement 1 is true and Statement 2 is false
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

45. Assertion (A): In set A = {1, 2, 3} a relation R defined as R = {(1, 1), (2, 2)} is reflexive.
Reason (R): A relation R is reflexive in set A if (a, a) $\in$ R for all a $\in$ A (Easy)
A) A is false and R is true
B) A is true and R is true
C) A is true and R is false
D) A is false and R is false

46. Assertion (A): In set A = {1, 2, 3} relation R in set A, given as R = {(1, 2)} is transitive.
Reason (R): A singleton relation is transitive. (Easy)
A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true

47. Assertion (A): If n (A) =3, then the number of reflexive relations on A is 3 (Easy)
Reason(R) : A relation R on the set A is reflexive if (a, a) ∈ R, ∀a∈ A.
A) A is false and R is true
B) A is true and R is false
C) A is true and R is true
D) A is false and R is false

48. Assertion (A): A relation R = { (a,a), (b,b), (b,c), (c,c) } defined on the set A = {a,b,c} is symmetric
Reason(R): A relation R on the set A is symmetric if (a, b) ∈ R ⟹ (b, a) ∈ R (Easy)
A) A is true and R is true
B) A is false and R is true
C) A is true and R is false
D) A is false and R is false

49. Statement 1 : The function f : R→R defined as $f(x)=\begin{cases} 0\ , if\ \ x\ is\ rational \\ 1\ ,if\ \ x\ is\ irrational \end{cases}$ is bijective
Statement 2: A function is said to be bijective if it is both one-one and onto (Difficult)
A) Statement 1 is true, and Statement 2 is false
B) Statement 1 is false, and Statement 2 is true
C) Statement 1 is true, and Statement 2 is true
D) Statement 1 is false, and Statement 2 is false

50. Statement 1 : A function $f: A \to B$, can not be an onto function if $n\ (A) < n\ (B)$.
Statement 2: A function f is onto if every element of co-domain has at least one pre-image in the domain (Easy)
A) Statement 1 is true and Statement 2 is false
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

51. Consider the set A containing 3 elements. Then, the total number of injective functions from A onto itself is _________ (Easy)

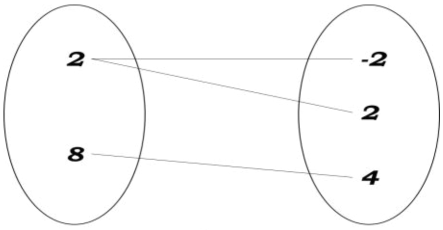
52. Set A has 3 elements, and set B has 4 elements. Then the number of injective mappings that can be defined from A to B is_________ (Average)

53. Let A={1,2,3} and B={a, b}. Then the number of surjections from A into B is_______ (Average)

54. The number of equivalence relations containing (2,1) on the set $A=\{1,2,3\}$ is_______(Easy)

55. A contains 4 elements and the set B contains 5 elements, then the number of onto mappings from A to B is______ (Easy)

56. If f: {2,8} →{-2,2,4} ,for the following figure f is (Easy)

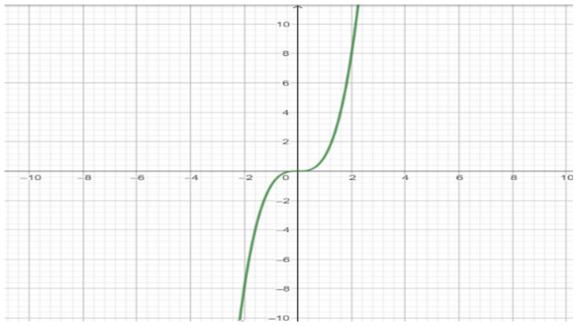


$y^2 = 2x$

(A) f is one-one but not onto (B) f is one-one and onto
(C) f is neither one-one nor onto (D) f is not a function

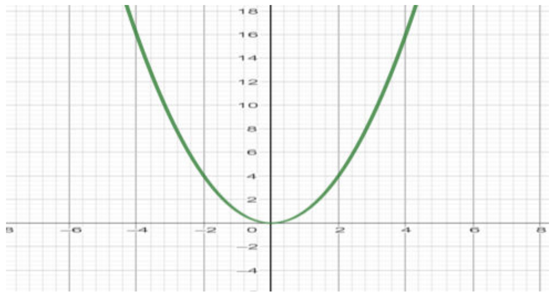
57. If f : R → R, then graph of the function is (Average)

(A) f is one-one but not onto
(B) f is one-one and onto
(C) f is neither one-one nor onto
(D) f is onto but not one-one



58. If f : R → R, then graph of the function is (Average)

(A) f is one-one but not onto
(B) f is one-one and onto
(C) f is neither one-one nor onto
(D) f is onto but not one-one



59. The maximum number of equivalence relations on the set A = {1, 2 } is ------ (Easy)

60. Given set A ={1, 2, 3} and a relation R = {(3, 1),(1, 3),(3,3)}, the relation R will be (Average)
(A) reflexive if (1, 1) is added (B) symmetric if (2, 3) is added
(C) transitive if (1, 1) is added (D) symmetric if (3, 2) is added.

61. Let X = {-1, 0, 1}, Y = {0, 2} and a function f : X → Y defined by $y = 2x^4$, is (Average)
(A) one-one and onto (B) one-one into (C) many-one onto (D) many-one into.

62. Let A be the set of all 100 students of Class XII in a college. Let f : A → N be function defined by f (x)= roll number of the student Class XII. (Easy)
(A) f is neither one-one nor onto. (B) f is one-one but not onto
(C) f is not one-one but onto (D) f is bijective .

63. **Statement 1 :** If R and S are two equivalence relations on a set A, then R ∩ S is also an Equivalence relation on A. (Difficult)
Statement 2 : The union of two equivalence relations on a set is not necessarily an equivalence relation on the set.
Statement 3 : The inverse of an equivalence relation is an equivalence relation.
(A) All 3 Statements are true (B) 1 and 2 Statements are true but 3 false
(C) All 3 Statements are false (D) 1 and 3 Statements are true but 2 false

64. The number of bijective functions from set A to itself is 120, then A contains __________ elements. (Average)

65. Let R be an equivalence relation on a finite set A having n elements. Then, the number of ordered pair in R is (Average)
(A) <n (B) >or= n (C) < or =n (D) >n

Two Mark Questions.

1. Define a reflexive relation and give an example of it. (Easy)
2. Define a symmetric relation and give an example of it. (Easy)
3. Define a transitive relation and give an example of it. (Easy)
4. Define an equivalence relation and give an example of it. (Easy)
5. Show that the relation R in the set {1, 2, 3} given by R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)} is reflexive but neither symmetric nor transitive. (Average)
6. Show that the relation R in the set {1, 2, 3} given by R = {(1, 2), (2, 1)} is symmetric but neither reflexive nor transitive. (Average)
7. Show that the function $f : \mathbf{N} \rightarrow \mathbf{N}$, given by f (1) = f (2) = 1 and f (x) = x – 1, for every x > 2, is onto but not one- one. (Average)
8. Show that an onto function f : {1, 2, 3} →{1, 2, 3} is always one-one. (Average)
9. Show that one-one function f : {1, 2, 3} →{1, 2, 3} is always onto. (Average)
10. Let A = {1, 2, 3}, B = {4, 5, 6, 7} and f = {(1, 4), (2, 5), (3, 6)} be a function from A to B. Show that f is one-one. (Average)
11. Show that the Signum Function $f : \mathbf{R} \rightarrow \mathbf{R}$, is neither one-one nor onto. (Average)
12. Let f : {2, 3, 4, 5}→{3, 4, 5, 9}and g : {3, 4, 5, 9}→{7, 11, 15} be functions defined as f (2) = 3, f(3) = 4, f (4) = f (5) = 5 and g (3) = g (4) = 7 and g(5) = g (9) = 11. Find gof. (Average)
13. If $f : R \rightarrow R$ is defined by f(x) = 3x – 2. Show that f is one-one. (Average)
14. If $f : N \rightarrow N$ given by $f(x) = x^2$ check whether f is one-one. Justify your answer. (Average)
15. If $f : Z \rightarrow Z$ given by $f(x) = x^2$ check whether f is one-one and onto. (Average)
16. If $f : N \rightarrow N$ given by $f(x) = x^3$ check whether f is one-one and onto. (Average)
17. If $f : Z \rightarrow Z$ given by $f(x) = x^3$ check whether f is one-one and onto. (Average)
18. Show that the function $f : N \rightarrow N$, given by f(x) = 2x is one-one but not onto. (Average)
19. Show that the function given by f(1) = f(2) = 1 and f(x) = x – 1, for every x > 2, is onto but not one-one. (Average)
20. If $f : R \rightarrow R$ given by $f(x) = 3x$ check whether f is one-one and onto (Average)
21. Prove that $f : R \rightarrow R$ given by $f(x) = x^3$ is onto. (Average)
22. Let $f : \{2, 3, 4, 5\} \rightarrow \{3, 4, 5, 9\}$ and $g : \{3, 4, 5, 9\} \rightarrow \{7, 11, 15\}$ be functions defined f(2) = 3, f(3) = 4, f(4) = f(5) = 5 and g(3) = g(4) = 7 and g(5) = g(9) = 11. Find gof. (Average)
23. Let $f:\{1, 3, 4\} \rightarrow \{1, 2, 5\}$ and $g:\{1, 2, 5\} \rightarrow \{1, 3\}$ given by f = {1, 2), (3, 5), (4, 1)} and g = {(1, 3), (2, 3), (5, 1)} write down gof. (Average)
24. Determine, with justification whether the function $f : \{1, 2, 3, 4\} \rightarrow \{10\}$ with $f = \{(1, 10), (2, 10), (3, 10), (4, 10)\}$ has an inverse function? (Easy)
25. Determine, with justification whether the function $g = \{5, 6, 7, 8\} \rightarrow \{1, 2, 3, 4\}$ with $g = \{(5, 4), (6, 3), (7, 4), (8, 2)\}$ has an inverse function? (Easy)
26. Determine, with justification whether the function $h : \{2, 3, 4, 5\} \rightarrow \{7, 9, 11, 13\}$ with $h = \{(2, 7), (3, 9), (4, 11), (5, 13)\}$ has an inverse function? (Easy)

Three Mark Questions.

1. A relation R on the set A = {1, 2, 3......14} is defined as R = {(x, y) : 3x – y =0}. Determine whether R is reflexive, symmetric and transitive. (Difficult)
2. A relation R in the set N of natural number defined as R = {(x, y) : y = x + 5 and x < 4}. Determine whether R is reflexive, symmetric and transitive. (Difficult)
3. A relation 'R' is defined on the set A = {1, 2, 3, 4, 5} as R = {(x, y) : y is divisible by x}. Determine whether R is reflexive, symmetric, transitive. (Difficult)
4. Check whether the relation R defined in the set $\{1, 2, 3, 4, 5, 6\}$ as $R = \{(a, b): b = a + 1\}$is reflexive, symmetric or transitive. (Difficult)

5. Let f : X →Y be a function. Define a relation R in X given by
R = {(a, b): f(a) = f(b)}. Examine whether R is an equivalence relation or not. (Difficult)

6. Relation R in the set **Z** of all integers is defined as R = {(x, y) : x – y is an integer}.
Determine whether R is reflexive, symmetric and transitive. (Difficult)

7. Determine whether R, in the set A of human beings in a town at a particular time is given by
R = {(x, y) : x and y work at the same place} (Difficult)

8. Show that the relation R in **R,** the set of reals defined as $R=\{(a,b): a \le b\}$ is reflexive and transitive but not symmetric. (Average)

9. Show that the relation R on the set of real numbers R is defined by $R=\{(a,b): a \le b^2\}$ is neither reflexive nor symmetric nor transitive. (Average)

10. Check whether the relation R in **R** the set of real numbers defined as
$R=\{(a,b): a \le b^3\}$ is reflexive, symmetric and transitive. (Average)

11. Show the relation R in the set Z of integers given by R = {(a, b) : 2 divides (a – b)} is an equivalence relation. (Average)

12. Show the relation R in the set Z of integers given by R = {(a, b) : (a – b) is divisible by 2} is an equivalence relation. (Average)

13. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a-b| is even} is an equivalence relation. (Average)

14. Show that the relation R on the set A of point on coordinate plane given by
R = {(P, Q) distance OP = OQ, where O is origin is an equivalence relation. (Average)

15. Show that the relation R on the set $A=\{x \in Z: 0 \le x \le 12\}$ given by
R = {(a,b): $|a-b|$ is a multiple of 4 } is an equivalence relation. (Average)

16. Show that the relation R on the set $A=\{x \in Z: 0 \le x \le 12\}$ given by
R = {(a,b) : a=b } is an equivalence relation. (Average)

17. Let T be the set of triangles with R – a relation in T given by
R = {(T_1, T_2) : T_1 is congruent to T_2} Show that R is an equivalence relation. (Average)

18. Let L be the set of all lines in a plane and R be the relation in L defined as R = {(L_1, L_2) : L_1 is perpendicular to L_2}. Show that R is symmetric but neither reflexive nor transitive. (Average)

19. Let L be the set of all lines in the XY plane and R is the relation on L by
R = {(l_1, l_2) :l_1 is parallel to l_2}. Show that R is an equivalence relation.
Find the set of all lines related to the line y = 2x + 4. (Average)

20. Show that the relation R defined in the set A of polygons as
R = {(P_1, P_2) : P_1 and P_2 have same number of side} is an equivalence relation. (Average)

21. If R_1 and R_2 are two equivalence relations on a set, is $R_1 \cup R_2$ also an equivalence relation? Justify your answer. (Difficult)

22. If R_1 and R_2 are two equivalence relations on a set, then prove that $R_1 \cap R_2$ is also an equivalence relation. (Difficult)

23. Find gof and fog if $f : R \to R$ and $g : R \to R$ are given by f(x) = cos x and g(x) = $3x^2$.
Show that gof ≠ fog. (Average)

24. If f & g are functions from $f: R \to R$ defined by $f(x) = \sin x$ and $g(x) = x^2$ Show that gof ≠ fog. (Average)

25. Show that the modulus function $f : R \to R$ given by f(x) = | x | is neither one-one nor onto. (Average)

26. Prove that the greatest integer function $f : R \to R$ given by f(x) = [x] is neither one-one nor onto (Average)

27. Show that the function $f: \mathbf{R_0} \to \mathbf{R_0}$, given by $f(x) = \frac{1}{x}$ is one-one and onto, where $\mathbf{R_0}$ is the set of all non-zero real numbers. Is the result true, if the domain $\mathbf{R_0}$ is replaced by $\mathbf{N}$ with co-domain being same as $\mathbf{R_0}$*? (Average)

28. Let A and B be sets. Show that $f: A \times B \to B \times A$ such that $f(a, b) = (b, a)$ is bijective function. (Average)

29. If $f: R \to R$ given by $f(x) = x^2$ check whether f is one-one and onto. Justify our answer. (Average)

30. If $f: R \to R$ is defined by $f(x) = 1 + x^2$, then show that f is neither 1-1 nor onto. (Average)

31. Show that the Signum function $f: R \to R$ defined by $f(x) = \begin{cases} \frac{|x|}{x} & , x \neq 0 \\ 0 & , x = 0 \end{cases}$ is neither one-one nor onto. Justify your answer. (Average)

Five Mark Questions

1. Let $f: N \to Y$ be a function defined as $f(x) = 4x + 3$, where, $Y = \{y \in N: y = 4x + 3$ for some $x \in N\}$. Show that f is invertible. Find the inverse. (Average)

OR

Consider $f: R \to R$ given by $f(x) = 4x + 3$. Show that f is invertible. Find the inverse of f.

2. Consider $f: R \to R$ given by $f(x) = 3 - 4x$. Show that f is invertible. Find the inverse of f. (Average)

3. Consider $f: R \to R$ given by $f(x) = 10x + 7$. Show that f is invertible. Find the inverse of f. (Average)

4. If $A = R - (3)$ and $B = R - \{1\}$ and $f: A \to B$ is a function defined by $f(x) = \left(\frac{x-2}{x-3}\right)$ is f one-one and onto? Justify your answer (Average)

ADDITIONAL QUESTIONS:

5. Consider $f: R_+ \to [4, \infty)$ given by $f(x) = x^2 + 4$. Show that f is invertible with the inverse f^{-1} of f given by $f^{-1}(y) = \sqrt{y - 4}$, where R_+ is the set of all non-negative real numbers. (Average)

6. Let $f: N \to N$ defined by $f(n) = \begin{cases} \frac{n+1}{2} & \text{if } n \text{ is odd} \\ \frac{n}{2} & \text{if } n \text{ is even} \end{cases}$ State whether f is bijective. Justify your answer. (Average)

7. Let $f: R - \left\{-\frac{4}{3}\right\} \to R$ be a function defined by define $f(x) = \frac{4x}{3x+4}$.

Find the inverse of the function $f: R - \left\{-\frac{4}{3}\right\} \to$ Range of f. (Average)

CHAPTER -02
INVERSE TRIGONOMETRIC FUNCTIONS

MCQ /FB questions.

1. The principal value branch of $\sin^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $[0,\pi]$ (C) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (D) $[-1,1]$

2. The domain of $f(x)=\sin^{-1}x$. (Easy)
(A) $(-1,1)$ (B) $[0,\pi]$ (C) $(-\infty,\infty)$ (D) $[-1,1]$

3. The principal value branch of $\cos^{-1}x$. (Easy)
(A) $[-1,1]$ (B) $(0,\pi)$ (C) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (D) $[0,\pi]$

4. The domain of $\cos^{-1}x$ (Easy)
(A) $(-1,1)$ (B) $[0,\pi]$ (C) $(0,\pi)$ (D) $[-1,1]$

5. The principal value branch of $\tan^{-1}x$ (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $(0,\pi)$ (C) $[-\infty,\infty]$ (D) $(-\infty,\infty)$

6. The domain of $\tan^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $(0,\pi)$ (C) $(-\infty,\infty)$ (D) $[-1,1]$

7. The domain of $\cot^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $(0,\pi)$ (C) $(-\infty,\infty)$ (D) $[-1,1]$

8. The principal value branch of $\cot^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $(0,\pi)$ (C) $(-\infty,\infty)$ (D) $[0,\pi]$

9. The range of $\sec^{-1}x$ is (Easy)
(A) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$ (B) $(0,\pi)-\frac{\pi}{2}$ (C) $[0,\pi]-\left\{\frac{\pi}{2}\right\}$ (D) $R-(-1,1)$

10. The principal value branch of $\sec^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)-\{0\}$ (B) $(0,\pi)-\left\{\frac{\pi}{2}\right\}$ (C) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$ (D) $[0,\pi]-\left\{\frac{\pi}{2}\right\}$.

11. The principal value branch of $\text{cosec}^{-1}x$. (Easy)
(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)-\{0\}$ (B) $(0,\pi)-\left\{\frac{\pi}{2}\right\}$ (C) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$ (D) $[0,\pi]-\left\{\frac{\pi}{2}\right\}$.

12. The domain of $\sec^{-1}x$ is (Easy)
(A) $(-1,1)$ (B) $R-(-1,1)$ (C) $R-[-1,1]$. (D) R.

13. Principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$ is (Easy)
(A) $-\frac{\pi}{6}$ (B) $\pi/3$ (C) $\pi/6$ (D) $-\pi/3$.

14. Principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$ is (Easy)
(A) $-\frac{\pi}{6}$ (B) $-\pi/3$ (C) $5\pi/6$ (D) $2\pi/3$.

15. Principal value of $\text{cosec}^{-1}(-\sqrt{2})$ is (Easy)
(A) $-\frac{\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{7\pi}{4}$

16. Principal value of $\tan^{-1}(-1)$ is (Easy)
(A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{5\pi}{4}$

17. The value of $\tan^{-1}(1)+\cos^{-1}\left(-\frac{1}{2}\right)+\sin^{-1}\left(-\frac{1}{2}\right)$ is equal to (Average)
(A) $\frac{3\pi}{2}$ (B) $\frac{3\pi}{4}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{3}$

18. The value of $\tan^{-1}(\sqrt{3})+\sec^{-1}(-2)$ is equal to (Average)
(A) π (B) $\frac{2\pi}{3}$ (C) $-\frac{\pi}{3}$ (D) $\frac{\pi}{3}$

19. The value of $\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$ is equal to (Average)

(A) $\frac{2\pi}{3}$ (B) $\frac{3\pi}{2}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{6}$

20. The value of $\tan^{-1}(\sqrt{3}) + \cot^{-1}(-\sqrt{3})$ is equal to (Average)

(A) π (B) $\frac{\pi}{6}$ (C) 0 (D) $\frac{7\pi}{6}$

21. $\sin\left(\frac{\pi}{3} - \sin\left(-\frac{1}{2}\right)\right)$ is equal to (Easy)

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 1

22. The principal value of $\cos^{-1}\left(\cos\left(\frac{7\pi}{6}\right)\right)$ is (Average)

(A) $\frac{7\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

23. The principal value of $\sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right)$ is (Easy)

(A) $\frac{2\pi}{3}$ (B) $-\frac{\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\sqrt{3}}{2}$.

24. The principal value of $\sin^{-1}\left(\sin\left(\frac{3\pi}{5}\right)\right)$ is (Average)

(A) $\frac{3\pi}{5}$ (B) $-\frac{\pi}{5}$ (C) $\frac{2\pi}{5}$ (D) $\frac{4\pi}{5}$.

25. $\sin(\tan^{-1}x)$, $|x| < 1$ is equal to (Average)

(A) $\frac{\sqrt{1-x^2}}{x}$ (B) $\frac{x}{\sqrt{1-x^2}}$ (C) $\frac{1}{1+x^2}$ (D) $\frac{x}{\sqrt{1+x^2}}$.

26. The value of x, if $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$ is (Average)

(A) $0, \frac{1}{2}$ (B) $1, \frac{1}{2}$ (C) 0 (D) $\frac{1}{2}$.

27. If $\sin^{-1}x = y$ then (Easy)

(A) $0 \le y \le \pi$ (B) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$ (C) $-1 \le y \le 1$ (D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

28. The value of $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right), |x| > 1$ (Average)

(A) $\cot^{-1}x$ (B) $\tan^{-1}x$ (C) $\sec^{-1}x$ (D) $\mathrm{cosec}^{-1}x$

29. $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)$ is equal to (Difficult)

(A) $\frac{\pi}{4} + \frac{x}{2}$ (B) $\frac{\pi}{4} - \frac{x}{2}$ (C) $\frac{\pi}{4} + \frac{x}{4}$ (D) $\frac{\pi}{4} - \frac{x}{4}$

30. The set of value of x, if $\sin^{-1}\left[2x\sqrt{1-x^2}\right] = 2\sin^{-1}x$, holds is (Average)

(A) $\frac{1}{\sqrt{2}} \le x \le 1$ (B) $-\frac{1}{\sqrt{2}} \le x \le \frac{1}{\sqrt{2}}$ (C) $-1 \le x \le 1$ (D) $-\frac{1}{2} \le x \le \frac{1}{2}$

31. The set of value of x, if $\sin^{-1}\left[2x\sqrt{1-x^2}\right] = 2\cos^{-1}x$, holds is (Average)

(A) $\frac{1}{\sqrt{2}} \le x \le 1$ (B) $-\frac{1}{\sqrt{2}} \le x \le \frac{1}{\sqrt{2}}$ (C) $-1 \le x \le 1$ (D) $-\frac{1}{2} \le x \le \frac{1}{2}$

32. The set of value of x, if $\sin^{-1}[3x - 4x^3] = 3\sin^{-1}x$, holds is (Average)

(A) $-\frac{1}{2} < x < \frac{1}{2}$ (B) $\frac{1}{2} \le x \le 1$ (C) $\frac{1}{2} < x < 1$ (D) $-\frac{1}{2} \le x \le \frac{1}{2}$

33. The set of value of x, if $\cos^{-1}[4x^3 - 3x] = 3\cos^{-1}x$, holds is (Average)

(A) $-\frac{1}{2} < x < \frac{1}{2}$ (B) $\frac{1}{2} \le x \le 1$ (C) $\frac{1}{2} < x < 1$ (D) $-\frac{1}{2} \le x \le \frac{1}{2}$

34. The set of value of x, if $\sin^{-1}[\sin x] = x$, holds is (Easy)

(A) $0 \le x \le 1$ (B) $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ (C) $-1 < x < 1$ (D) $-1 \le x \le 1$

35. Write the range of $\mathbf{f(x) = \sin^{-1}x}$ in $[\mathbf{0, 2\pi}]$ other than $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (Easy)

(A) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ (B) $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$ (C) $\left[-\frac{\pi}{2}, \frac{3\pi}{2}\right]$ (D) $\left(-\frac{\pi}{2}, -\frac{3\pi}{2}\right)$

36. What is the reflection of the graph of the function $\mathbf{y = sinx}$ along the line $\mathbf{y = x}$ (Easy)

(A) $\sin^{-1} x$ (B) $-\sin^{-1} x$ (C) $\cos^{-1} x$ (D) $-cos^{-1} x$

37. In which of the following the inverse of the function y=sinx does not exist. (Average)

(A)$[0,\pi]$ (B)$[-\frac{\pi}{2},\frac{\pi}{2}]$ (C)$\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$ (D)$\left[-\frac{3\pi}{2},-\frac{\pi}{2}\right]$

38. The graph of the function $y = \cos^{-1} x$ is the mirror image of the graph of the function y= cosx along the line (Easy)

(A)x=0 (B)y=x (C)y=1 (D)y=0

39. **Statement 1**: $sin^{-1}\left(sin\left(\frac{2\pi}{3}\right)\right)=\frac{2\pi}{3}$ (Easy)

Statement 2: $sin^{-1}\left(sin\left(\theta\right)\right)=\theta, if\ \theta\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

A) Statement 1 is true and Statement 2 is false
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is false and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

40. **Assertion (A):** Domain of f(x) = $sin^{-1} x + cos^{-1} x$ is [-1, 1] (Average)
Reason (R): Domain of a function is the set of all possible values for which function will be defined.

A) A is false and R is true
B) A is false and R is true
C) A is true and R is true
D) A is false and R is false.

41. **Assertion (A):** One branch of $sin^{-1}\left(x\right)$ other than the principal value branch is $\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$

Reason (R): sin(x) is invertible in the interval $\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$ (Easy)

A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true.

42. **Statement 1**: Principal value of $cos^{-1}\left(cos\left(\frac{7\pi}{6}\right)\right)$ is $\frac{5\pi}{6}$ (Average)

Statement 2: Principal value branch of $cos^{-1} x$ is $[0, \pi]$ and $cos^{-1}\left(cos\, x\right)=x$ if $x\in[0, \pi]$

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

43. **Statement 1**: If $\frac{1}{\sqrt{2}} \leq x \leq 1, then\ sin^{-1}\left[2x\sqrt{1-x^2}\right] = 2\,cos^{-1} x$ (Easy)

Statement 2: If $0 \leq x \leq \pi, then\ sin^{-1}(sin\, x) = x.$

A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

44. Match List I with List II (Average)

List I	List II
a) Domain of $sin^{-1} x$	i) $(-\infty, \infty)$
b) Domain of $tan^{-1} x$	ii) $[0, \pi]$
c) Range of $cos^{-1} x$	iii) [-1, 1]

Choose the correct answer from the options given below
A) a-i , b-ii, c-iii B) a-iii, b-ii, c-i C) a-ii, b-i, c-iii D) a-iii, b-i, c-ii

45. Match List I with List II (Average)

List I	List II
a) Range of $cot^{-1} x$	i) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
b) Range of $tan^{-1} x$	ii) $(0, \pi)$
c) Range of $sin^{-1} x$	iii) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Choose the correct answer from the options given below:
A) a-i , b-ii, c-iii B) a-iii, b-ii, c-i C) a-ii, b-i, c-iii D) a-iii, b-i, c-ii

46. Match Column I with Column II (Average)

Column I	Column II
a) Domain of $sec^{-1} x$	i) $R-(-1,1)$
b) Range of $cosec^{-1} x$	ii) $(0, \pi)$
c) Range of $cot^{-1} x$	iii) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

Choose the correct answer from the options given below:
A) a-i , b-ii, c-iii B) a-iii, b-ii, c-i C) a-i, b-iii, c-ii D) a-iii, b-i, c-ii

47. $cos\left(\frac{\pi}{3} - sin^{-1}(-\frac{1}{2})\right)$ *is equal to*_________ (Average)

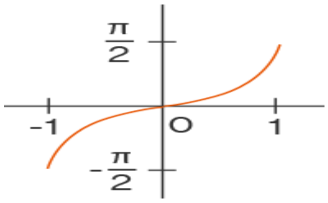
48. *Principal value of* $cos^{-1}\left(-\frac{1}{2}\right) = \frac{\pi}{k}$, *then the value of k is*_________ (Average)

49. *Principal value of* $cosec^{-1}(-2) = -\frac{\pi}{k}$, *then the value of k is*_________ (Average)

50. Principal value $\sin^{-1}(-1) = k\pi$, *then the value of k is*_________ (Average)

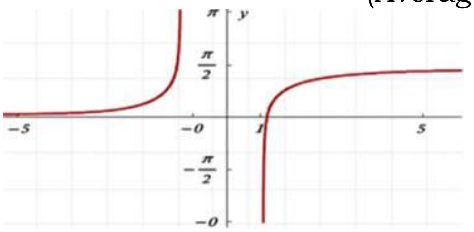
51. The values of $2\, cos\left(2\, sin^{-1}\left(\frac{1}{2}\right)\right)$ *is*_________ (Average)

52. The graph shown represents one of the inverse trigonometric functions. Identify the correct function from the following options:(Easy)



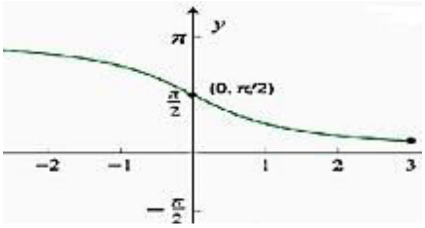
(A) $\sin^{-1} x$ (B) $cosec^{-1}$x (C) $\cos^{-1} x$ (D) sec^{-1}x

53. The graph shown below represents one of the inverse trigonometric functions.Identify the correct function from the following options: (Average)



(A) $\sin^{-1} x$ (B) $cosec^{-1}$x (C) $\cos^{-1} x$ (D) sec^{-1}x

54. The given graph is for which equation? (Average)



(A) $y = sec^{-1}$x (B)$y = \ cot^{-1}$x (C) y= $\cos^{-1} x$ (D) $y = tan^{-1}$x.

55. If $\sin^{-1}$ x – $\cos^{-1}$ x = $\frac{\pi}{6}$, then x =------ (Average)

56. The domain of the function defined by f(x) =$\sin^{-1}\sqrt{x-1}$ is (Difficult)

(A) [1, 2] (B) [-1, 1] (C) [0, 1] (D) [-1,0]

57. Which value is similar to $\sin^{-1}$sin(6 π/7)? (Average)

A) sin($\sin^{-1}$(π/7)) B) sin($\cos^{-1}$(π/7)) C) sin($\sin^{-1}$(2π/7)) D) sin($coses^{-1}$(π/7))

58. What is the value of $\cos^{-1}$(-x) for all x belongs to [-1, 1]? (Easy)

A) $\cos^{-1}$(-x) B) π – $\cos^{-1}$(x) C) π – $\cos^{-1}$(-x) D) π + $\cos^{-1}$(x).

59. The value of $\cos[tan^{-1}\frac{3}{4}]$ is ……. (Difficult)

60. $tan^{-1}\sqrt{3} + sec^{-1}2 - \cos^{-1}1 = \frac{\pi}{k}, then\ the\ value\ of\ k\ is$__________ (Difficult)

61. The domain of $\sin^{-1}$ (3x) is equal to (Average)

A) [-1, 1] B) [−1/3,1/3] C) [-3, 3] D) [-3π, 3π]

62. What is the value of $\cos^{-1}$(cos (2π/3)) + $\sin^{-1}$ (sin (π/3)) is ? (Average)

A) π B) π/2 C) 3π/4 D) 4π/3

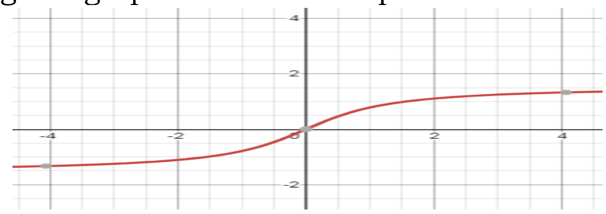
63. The value of tan^2($\sec^{-1}$ 2) + cot^2($cosec^{-1}$ 3) is (Average)

(A) 5 (B) 11 (C) 13 (D) 15.

64. The value of the expression sin [$\cot^{-1}$(cos ($\tan^{-1}$1))] is (Average)

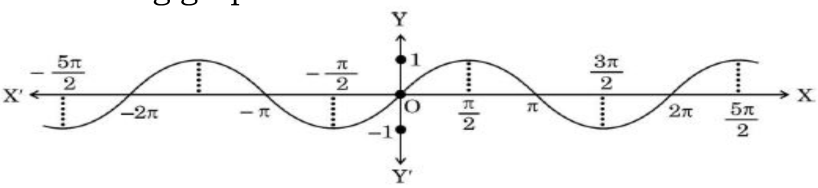
A) 0 B) 1 C) 1/√3 D) √(2/3).

65. The given graph is for which equation? (Easy)



A) y = $\cos^{-1}$x B) y = $\cot^{-1}$x C) y = $cosec^{-1}$x D) $y = \ tan^{-1}$x

66. The domain of sine function is R and function sine : $R \rightarrow R$ is neither one-one nor onto. The following graph shows the sine function. (Average)



y = sin x

Let sine function be defined from set A to [−1,1] such that inverse of sine function exists, i.e., $\sin^{-1}$ x is defined from [−1,1] to A. On the basis of the above information, The interval A other than principal value branch is

(A) $\left[-\frac{\pi}{2},\frac{3\pi}{2}\right]$ (B) $\left[-\frac{\pi}{2},\pi\right]$ (C) $\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$ (D) $\left[-\pi,0\right]$

Two Mark Questions

1. Find the value of $\tan^{-1}1+\cos^{-1}\left(\frac{-1}{2}\right)+\sin^{-1}\left(\frac{-1}{2}\right)$ (Average)
2. Find the value of $\cos^{-1}\frac{1}{2}+2\sin^{-1}\left(\frac{1}{2}\right)$ (Average)
3. Find the values of $\tan^{-1}\sqrt{3}-\sec^{-1}(-2)$ (Average)
4. Find the value of $\tan^{-1}\sqrt{3}-\cot^{-1}\left(-\sqrt{3}\right)$ (Average)
5. Find the value of $\sin\left[\frac{\pi}{3}-\sin^{-1}\left(-\frac{1}{2}\right)\right]$ (Average)
6. Find $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ (Easy)
7. If y = $cot^{-1}\left(\frac{-1}{\sqrt{3}}\right)$, then find value of y. (Easy)
8. Find the principal value $\sin^{-1}(-1)$. (Easy)
9. Find the principal value of $\tan^{-1}\left(-\sqrt{3}\right)$ (Easy)
10. Find the principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$ (Easy)
11. Find the principal value of $\operatorname{cosec}^{-1}\left(-\sqrt{2}\right)$ (Easy)
12. Find the principal value of $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ (Easy)
13. Find the principal value of $\cos^{-1}(-1)$ (Easy)
14. Find the principal value of $\sec^{-1}(-2)$ (Easy)
15. Find the value of $\sin\left[\frac{\pi}{2}-\sin^{1}\left(-\frac{\sqrt{3}}{2}\right)\right]$ (Average)
16. Evaluate $\sin^{-1}\left[\sin\frac{2\pi}{3}\right]$ (Average)
17. Evaluate $\cos^{-1}\left[\cos\frac{13\pi}{6}\right]$ (Average)
18. Evaluate $\tan^{-1}\left[\tan\frac{7\pi}{6}\right]$ (Average)
19. Evaluate $\sin^{-1}\left[\sin\frac{3\pi}{5}\right]$ (Average)
20. Evaluate $\tan^{-1}\left[\tan\frac{3\pi}{4}\right]$ (Average)
21. Evaluate $\cos^{-1}\left[\cos\frac{7\pi}{6}\right]$ (Average)
22. Express $\tan^{-1}\left[\frac{x}{\sqrt{a^2-x^2}}\right]$, $|x|<a$ in simplest form. (Average)

23. Prove that $tan^{-1}\sqrt{x}=\frac{1}{2}cos^{-1}\left(\frac{1-x}{1+x}\right),\ x\in[0,1]$ (Average)

24. Express $tan^{-1}\left[\frac{3a^2x-x^3}{a^3-3ax^2}\right], a>0, \frac{-a}{\sqrt{3}}<x<\frac{a}{\sqrt{3}}$ in simplest form (Average)

25. Write $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right)$, $0<x<\pi$ in simplest form (Average)

26. Express $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right)$, x>1 in the simplest form (Average)

27. Prove that $\sin^{-1}\left(2x\sqrt{1-x^2}\right)=2\sin^{-1}x,\quad \frac{-1}{\sqrt{2}}\le x\le\frac{1}{\sqrt{2}}$ (Average)

28. Prove that $\sin^{-1}\left(2x\sqrt{1-x^2}\right)=2\cos^{-1}x,\quad \frac{1}{\sqrt{2}}\le x\le 1$ (Average)

29. Prove that $3\sin^{-1}x=\sin^{-1}\left(3x-4x^3\right),\ x\in\left[\frac{-1}{2},\ \frac{1}{2}\right]$ (Average)

30. Prove that $3\cos^{-1}x=\cos^{-1}\left(4x^3-3x\right),\quad x\in\left[\frac{1}{2},\ 1\right]$ (Average)

31. Prove that $\sin\left(\tan^{-1}x\right)=\frac{x}{\sqrt{1+x^2}},\ |x|<1$ (Average)

32. Find the values of $tan^{-1}\left(2cos\ (2\,sin^{-1}\frac{1}{2})\right)$ (Average)

33. Prove that $2sin^{-1}\frac{3}{5}=tan^{-1}\frac{24}{7}$. (Average)

Additional Questions

34. Find $\sin\left[\frac{\pi}{2}-\sin^{-1}\left(\frac{-1}{2}\right)\right]$ (Average)

35. Find $\sin\left[\frac{\pi}{3}-\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right]$ (Average)

36. Find $\sin\left[\frac{1}{2}\sin^{-1}(-1)\right]$ (Average)

37. Express $\tan^{-1}\left[\frac{1}{\sqrt{x^2-1}}\right], |x|>1$, in the simplest form. (Average)

38. Write $\tan^{-1}\left(\sqrt{\frac{1+\cos x}{1-\cos x}}\right), x\ne 2n\pi$ in simplest form (Average)

39. Simplify $\tan^{-1}\left[\frac{3\cos x-4\sin x}{4\cos x+3\sin x}\right]$, if $\frac{3}{4}\tan x>-1$. (Average)

40. Simplify $\tan^{-1}\left[\frac{a\cos x-b\sin x}{b\cos x+a\sin x}\right]$, if $\frac{a}{b}\tan x>-1$. (Average)

41. Prove that $\frac{9\pi}{8}-\frac{9}{4}\sin^{-1}\frac{1}{3}=\frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$ (Average)

Three Mark Questions

1. Write $tan^{-1}\left(\frac{cos\,x - sin\,x}{cos\,x + sin\,x}\right), -\frac{\pi}{4} < x < \frac{3\pi}{4}$ in simplest form (Difficult)

2. Prove that $\tan^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right] = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}x,\ \frac{-1}{2} \le x \le 1$ (Difficult)

3. Prove that $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right) = \frac{x}{2},\ x \in \left(0\ \ \frac{\pi}{4}\right)$ (Difficult)

4. Express $tan^{-1}\left(\frac{cos\,x}{1 - sin\,x}\right), -\frac{3\pi}{2} < x < \frac{\pi}{2}$ in the simplest form (Difficult)

5. Prove that $\sin^{-1}\frac{8}{17} + \sin^{-1}\frac{3}{5} = \tan^{-1}\frac{77}{36}$ (Difficult)

6. Prove that $\tan^{-1}\frac{63}{16} = \sin^{-1}\frac{5}{13} + \cos^{-1}\frac{3}{5}$ (Difficult)

7. Prove that $\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$ (Difficult)

8. Prove that $\cos^{-1}\frac{12}{13} + \sin^{-1}\frac{3}{5} = \sin^{-1}\frac{56}{65}$ (Difficult)

9. Solve : $2\tan^{-1}(\cos x) = \tan^{-1}(2\ \text{cosec}\ x)$ (Difficult)

10. Solve : $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}x\quad (x>0)$ (Average)

11. Solve : $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$ (Average)

12. Write the function $tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right), x \neq 0$ in the simplest form (Difficult)

13. Find the values of $tan^{-1}\frac{1}{2}\left[sin^{-1}\frac{2x}{1+x^2} + cos^{-1}\frac{1-x^2}{1+x^2}\right], |x| < 1, y > 0\ and\ xy < 1$ (Difficult)

Additional Questions

14. Prove that $\sin^{-1}\frac{3}{5} - \sin^{-1}\frac{8}{17} = \cos^{-1}\frac{84}{85}$ (Difficult)

15. Prove that $\sin^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} + \tan^{-1}\frac{63}{16} = \pi$ (Difficult)

CHAPTER -03
MATRICES

MCQ /FB questions.

1. If A is a matrix of order 3 × 4, then each row of A has__ (Easy)
(A) 3 elements (B) 4 elements (C) 12 elements (D) 7 elements

2. If every row of a matrix A contains m elements and its column contains n elements, then the order of A is__ (Average)
(A) m × m (B) m × n (C) n × m (D) n × n

3. If the order of A is 4 × 3 and the order of B is 4 ×5, then the order of $(A^T B)^T$ is (Average)
(A) 3 × 5 (B) 3 × 4 (C) 4 × 3 (D) 5 ×3

4. If a matrix has 8 elements, then total number the possible different orders matrices (Easy)
(A) 8 (B) 6 (C) 4 (D) 2

5. If a matrix has 13 elements, then total number the possible different orders matrices (Easy)
(A) 1 (B) 2 (C) 3 (D) 4.

6. For any square matrix A = $[a_{ij}]$, $a_{ij} = 0$, when i ≠ j, then A is- (Easy)
(A) unit matrix (B) scalar matrix (C) diagonal matrix (D) row matrix

7. For 2 × 2 matrix, A = [aij], whose elements are given by $a_{ij} = \frac{(i+j)^2}{2}$ then A is equal to (Average)

(A) $\begin{bmatrix} 1 & \frac{9}{2} \\ \frac{9}{2} & 8 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & \frac{9}{2} \\ \frac{9}{2} & 4 \end{bmatrix}$ (C) $\begin{bmatrix} 2 & \frac{9}{2} \\ \frac{9}{2} & 8 \end{bmatrix}$ (D) $\begin{bmatrix} 2 & \frac{9}{2} \\ \frac{9}{2} & 2 \end{bmatrix}$

8. For 2x3 matrix $A = \left[a_{ij}\right]$ whose elements are given by $a_{ij} = \frac{(i+j)^2}{2}$ then A is equal to (Average)

(A) $\begin{bmatrix} 2 & 8 & \frac{9}{2} \\ 8 & \frac{9}{2} & \frac{25}{2} \end{bmatrix}$ (B) $\begin{bmatrix} 2 & \frac{9}{2} & 8 \\ \frac{9}{2} & 8 & \frac{25}{2} \end{bmatrix}$ (C) $\begin{bmatrix} 2 & \frac{9}{2} & 8 \\ 8 & \frac{9}{2} & \frac{25}{2} \end{bmatrix}$ (D) $\begin{bmatrix} 2 & \frac{25}{2} & 8 \\ \frac{9}{2} & \frac{9}{2} & 8 \end{bmatrix}$.

9. A row matrix has only- (Easy)
(A) one element (B) one row with one or more columns
(C) one column with one or more rows (D) one row and one column.

10. A matrix A = $(a_{ij})_{m \times n}$ is said to be a square matrix if- (Easy)
(A) m = n (B) m ≥n (C) m ≤ n (D) m < n.

11. If A and B are matrices of order m × n and n × n respectively, then which of the following are defined- (Easy)
(A) Both AB, BA (B) AB, A^2 (C) A^2, B^2 (D) AB, B^2

12. The number of all possible matrices of order 3 × 3 with each entry 0 or 1 is: (Average)
(A) 27 (B) 18 (C) 81 (D) 512.

13. The values of x and y make the following pair of matrices equal
$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 5 & y-2 \\ 8 & 4 \end{bmatrix}$ (Average)
(A) x =$-\frac{2}{3}, y = 7$ (B) x= $\frac{2}{3}, y = \frac{7}{3}$ (C) x=$\frac{-2}{3}, y = -7$ (D) x =$-\frac{1}{3}, y = 7$.

14. In the following, scalar matrix is- (Easy)

(A) $\begin{bmatrix} -1 & 3 \\ 2 & 4 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 3 \\ 2 & 0 \end{bmatrix}$ (C) $\begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$ (D) $\begin{bmatrix} 4 & 0 \\ 0 & 0 \end{bmatrix}$.

15. In the following, diagonal matrix is- (Easy)

(A) $\begin{bmatrix} 0 & 3 \\ 4 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 4 & 3 \\ 0 & 0 \end{bmatrix}$. (C) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$

16. If X+ Y = $\begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and X – Y = $\begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$ then the matrix X is- (Easy)

(A) $\begin{bmatrix} 8 & 8 \\ 0 & 8 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -4 \\ 0 & 10 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & -2 \\ 0 & 5 \end{bmatrix}$ (D) $\begin{bmatrix} 4 & 4 \\ 0 & 4 \end{bmatrix}$

17. If A, B are two matrices such that A + B = $\begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$, A – B = $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ then A equals- (Easy)

(A) $\begin{bmatrix} 4 & 0 \\ 2 & 8 \end{bmatrix}$ (B) $\begin{bmatrix} 10 & 0 \\ 2 & 8 \end{bmatrix}$ (C) $\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}$ (D) $\begin{bmatrix} 5 & 0 \\ 1 & 4 \end{bmatrix}$

18. If X is a matrix of order 2 × n and Z is a matrix of order 2 × p.
If n = p, then the order of the matrix 7X – 5Z is: (Easy)

(A) p× 2 (B) 2 × n (C) n × 3 (D) p × n

19. For matrices A and B, AB = 0, then- (Easy)

(A) A = 0 or B = 0 (B) It is not necessary that A = 0 or B = 0
(C) A = 0 and B = 0 (D) All above statements are wrong.

20. If A = $\begin{bmatrix} -1 & 0 & 2 \\ 3 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} -1 & 5 \\ 2 & 7 \\ 3 & 10 \end{bmatrix}$, then- (Easy)

(A) AB and BA both exist (B) AB exists but not BA
(C) BA exists but not AB (D) both AB and BA do not exist.

21. Which one of the following is not true (Easy)

(A) Matrix addition is commutative (B) Matrix addition is associative
(C) Matrix multiplication is commutative (D) Matrix multiplication is associative

22. If A and B are two matrices such that A+B and AB are both defined, then (Easy)

(A) A and B are two matrices not necessarily of same order
(B) A and B are square matrices of same order
(C) Number of columns of A= number of rows of B
(D) A and B are symmetric matrices

23. If $A(\alpha) = \begin{pmatrix} cos\alpha & sin\alpha \\ -sin\alpha & cos\alpha \end{pmatrix}$ then $A(\alpha) \cdot A(\beta)$ is equal to (Average)

(A) $A(\alpha) - A(\beta)$ (B) $A(\alpha) + A(\beta)$ (C) $A(\alpha - \beta)$ (D) $A(\alpha + \beta)$

24. For suitable matrices A, B; the false statement is- (Easy)

(A) $(BA)^T = A^T B^T$ (B) $(A^T)^T = A$ (C) $(A - B)^T = B^T - A^T$ (D) $(A + B)^T = A^T + B^T$

25. If A = $\begin{bmatrix} 3 & x \\ y & 0 \end{bmatrix}$ and A = A^T, then - (Easy)

(A) x = 0, y = 3 (B) x + y = 3 (C) x = y (D) x = – y

26. Which one of the following is not true (Easy)

(A)A is a symmetric matrix if $A^T = A$. (B)A is a skew symmetric matrix if $A^T = -A$.
(C)For any square matrix A with real number entries,
A + A′ is a skew symmetric matrix and A – A′ is a symmetric matrix.
(D)Every square matrix can be expressed as the sum of a symmetric and a skew symmetric matrix.

27. Matrix $\begin{bmatrix} 0 & 5 & -7 \\ -5 & 0 & 11 \\ 7 & -11 & 0 \end{bmatrix}$ is a- (Easy)

(A) diagonal matrix (B) scalar matrix (C) skew-symmetric matrix (D) symmetric matrix.

28. If A is symmetric as well as skew symmetric matrix, then - (Easy)

(A) A is a diagonal matrix (B) A is a null matrix

(C) A is a unit matrix (D) A is a triangular matrix

29. If A, B are symmetric matrices of the same order then (AB – BA) is : (Average)

(A) symmetric matrix (B) skew symmetric matrix (C) null matrix (D) unit matrix

30. If A= $\begin{bmatrix} 2 & x-3 & x-2 \\ 3 & -2 & -1 \\ 4 & -1 & -5 \end{bmatrix}$ is a symmetric matrix then $x=$ (Easy)

(A) 0 (B) 3 (C) 6 (D) 8

31. If A is a square matrix then $A - A^T$ is (Easy)

(A) Unit matrix (B) null matrix (C) skew-symmetric (D) Zero matrix

32. If A $=\begin{bmatrix} 1 & 2 \\ -4 & -1 \end{bmatrix}$, then $A^{-1}=$ (Average)

(A) $\frac{1}{7}\begin{bmatrix} 1 & 2 \\ -4 & -1 \end{bmatrix}$ (B) $\begin{bmatrix} -1 & -2 \\ 4 & 1 \end{bmatrix}$ (C) $\frac{1}{9}\begin{bmatrix} 1 & 2 \\ 4 & 1 \end{bmatrix}$ (D) $\frac{1}{7}\begin{bmatrix} -1 & -2 \\ 4 & 1 \end{bmatrix}$

33. Matrices A and B will be inverse of each other only if (Easy)

(A) AB = BA (B) AB = BA = 0 (C) AB = 0, BA = I (D) AB = BA = I

34. If $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is skew symmetric matrix then $a+b+c+d=$ (Average)

(A)-b (B)-c (C)0 (D)1

35. **Statement1:** If A is a symmetric as well as a skew symmetric matrix, then A is a null matrix

Statement 2: A is a symmetric matrix if A^T=A and A is a skew symmetric matrix if $A^T = -A$.

A) Statement 1 is true and Statement 2 is false. (Average)

B) Statement 1 is false and Statement 2 is false.

C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

D) Statement 1 is true and Statement 2 is true, Statement 2 is a correct explanation for Statement 1

36. **Statement 1**:$\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}=\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (Average)

Statement 2: For matrices A and B, AB = 0, then it is not necessary that A = 0 or B = 0

A) Statement 1 is true and Statement 2 is false.

B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1

C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

D) Statement 1 is false and Statement 2 is false.

37. **Assertion (A):** The matrix A = $\begin{bmatrix} 1 & 2 & 3 \\ -2 & 1 & 4 \\ -3 & -4 & 1 \end{bmatrix}$ is a skew symmetric matrix (Average)

Reason (R): If matrix A is a skew symmetric matrix , then $A^T = -A$.

A) A is false and R is true B) A is true and R is true

C)A is true and R is false D) A is false and R is false

38. **Statement 1 :** $A=\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is an identity matrix. (Average)

Statement 2 : A square matrix $A=\left[a_{ij}\right]$ is an identity matrix, if $a_{ij}=\begin{cases} 1 \text{ if } i=j \\ 0 \text{ if } i\neq j \end{cases}$

A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

39. **Statement1 :** Matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix (Average)

Statement 2 : Every scalar matrix is a diagonal matrix
A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

40. **Assertion (A):** The matrix A = $\begin{bmatrix} 0 & 2 & 3 \\ -2 & 0 & 4 \\ -3 & -4 & 1 \end{bmatrix}$ is a skew symmetric matrix (Average)

Reason (R): If matrix A is a symmetric matrix , then A^T = - A .

A) A is false and R is true B) A is true and R is true
C)A is true and R is false D) A is false and R is false

41. **Statement 1 :** Two matrices $A_{2\times3}$ and $B_{3\times2}$ can be multiplied and their product will be a matrix of order 2×2

Statement 2 : Two matrices can be multiplied if number of columns in the first matrix must be equal to the number of rows in the second matrix. (Easy)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

42. Total number of possible matrices of order 2 × 2 with each entry 1 or 0 is____ (Average)

43. A matrix $A=\left(a_{ij}\right)_{3\times n}$ is said to be a square matrix, then the value of n is _____ (Easy)

44. If A is a matrix of order 3 × 4, then each column of A has ______ elements. (Easy)

45. If A=$\begin{bmatrix} 2 & 0 \\ x-2 & 3 \end{bmatrix}$ is a symmetric matrix, then x = _____ (Easy)

46. If the order of matrix A is 5 × 3 and matrix B is 4 ×3 and order of $(AB^T)^T$ is 4 ×k , then k = _____ (Easy)

47. If a matrix A = $(a_{ij})_{m\times n}$, Match Column I with Column II (Average)

Column I	Column II
a) Square matrix	i) $m = 1$,
b) Column matrix	ii) $n = 1$
c) Row matrix	iii) $m = n$

Choose the correct answer from the options given below:

A) a-i , b-ii, c-iii B) a-iii, b-ii, c-i C) a-ii, b-iii, c-i D) a-iii, b-i, c-ii

48. If a matrix A = $(a_{ij})_{n \times n}$, Match List I with List II (Average)

List I	List II
a) Scalar matrix	i) $a_{ij} = 1, i = j and a_{ij} = 0, i \neq j$
b) Diagonal matrix	ii) $a_{ij} = k, i = j and a_{ij} = 0, i \neq j$
c) Identity matrix	iii) $a_{ij} = 0, i \neq j$

Choose the correct answer from the options given below:

A) a-i , b-ii, c-iii B) a-iii, b-ii, c-i

C) a-ii, b-iii, c-i D) a-iii, b-i, c-ii

49. If A is a matrix of order m × n and B is a matrix such that A B^T and B^T A are both defined, then the order of matrix B is (Difficult)

(A) m × m (B) n × n (C) n × m (D) m × n.

50. If A is a square matrix such that $A^2 = I$, then $(A - I)^3 + (A + I)^3 - 7A$ is equal to (Difficult)

(A) A (B) I – A (C) I + A (D) 3A

51. If A is an m × n matrix such that AB and BA are both defined, then B is a (Easy)

(A) m × n matrix (B) n × m matrix (C) n × n matrix (D) m × n matrix.

52. **Statement 1 :** Every identity matrix is a scalar matrix (Difficult)

Statement 2 : Every scalar matrix is a diagonal matrix

Statement 3 : Every identity matrix is a diagonal matrix

Choose the correct answer

(A) All 3 Statements are true (B) 1 and 2 Statements are true and 3 false

(C) 1 and 3 Statements are true and 2 false (D) 2 and 3 Statements are true and 1 false

53. If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to (Difficult)

(A) I (B) 0 (C) I – A (D) I + A

54. The matrix A = $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is (Easy)

(A) identity matrix (B) symmetric matrix

(C) skew symmetric matrix (D) scalar matrix

55. If A is a skew-symmetric matrix, then A^2 is a (Easy)

(A) Skew symmetric matrix (B) Symmetric matrix

(C) Null matrix (D) Cannot be determined

56. A square matrix in which all elements except at least one element in diagonal are zeros is said to be a (Easy)

(A) A is a diagonal matrix (B) A is a null matrix

(C) A is a unit matrix (D) A is a triangular matrix.

57. Which of the following is not a possible ordered pair for a matrix with 6 elements. (Easy)

A) (2,3) B) (3,2) C) (1,6) D) (3,1)

58. If A and B are symmetric matrices of the same order, then (Average)

Statement 1 : A + B is a symmetric matrix

Statement 2 : A – B is a symmetric matrix

Statement 3 : AB + BA is a symmetric matrix

Choose the correct answer

(A) All 3 Statements are true (B) 1 and 2 Statements are true and 3 false

(C) 1 and 3 Statements are true and 2 false (D) 2 and 3 Statements are true and 1 false

59. The matrix $A=\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$ is a (Easy)

(A) unit matrix (B) symmetric matrix (C) diagonal matrix (D) skew-symmetric matrix.

60. If A=$\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$ then $(A+I)^2 - 2A$ is equal to (Average)

(A) 2I (B) 3I (C) -2I (D) null matrix

Two marks questions:

1. Find x and y, if $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$ (Average)

2. If $x\begin{bmatrix}2\\ 3\end{bmatrix}+y\begin{bmatrix}-1\\ 1\end{bmatrix}=\begin{bmatrix}10\\ 5\end{bmatrix}$, find the values of x and y. (Average)

3. Find X, if $Y=\begin{bmatrix}3 & 2\\ 1 & 4\end{bmatrix}$ and $2X+Y=\begin{bmatrix}1 & 0\\ -3 & 2\end{bmatrix}$ (Average)

4. Find the values of x and y from the following equation (Average)

$2\begin{bmatrix}x & 5\\ 7 & y-3\end{bmatrix}+\begin{bmatrix}3 & -4\\ 1 & 2\end{bmatrix}=\begin{bmatrix}7 & 6\\ 15 & 16\end{bmatrix}$

5. Find the value of a, b, c and d from the equation: $\begin{bmatrix}a-b & 2a+c\\ 2a-b & 3c+d\end{bmatrix}=\begin{bmatrix}-1 & 5\\ 0 & 13\end{bmatrix}$ (Average)

6. Show that the matrix $A=\begin{bmatrix}1 & -1 & 5\\ -1 & 2 & 1\\ 5 & 1 & 3\end{bmatrix}$ is a symmetric matrix. (Easy)

7. Show that the matrix $A=\begin{bmatrix}0 & 1 & -1\\ -1 & 0 & 1\\ 1 & -1 & 0\end{bmatrix}$ is a skew symmetric matrix. (Easy)

8. Let A = $\begin{bmatrix}2 & 4\\ 3 & 2\end{bmatrix}$, B = $\begin{bmatrix}1 & 3\\ -2 & 5\end{bmatrix}$, C= $\begin{bmatrix}-2 & 5\\ 3 & 4\end{bmatrix}$. Find each of the following

(i) A + B (ii) A – B (iii) 3A – C (iv) AB (v) BA (Average)

9. Consider the following information regarding the number of men and women workers in three factories I, II and III (Difficult)

	Men Workers	Women workers
I	30	25
II	25	31
III	27	26

Represent the above information in the form of a 3 × 2 matrix. What does the entry in the third row and second column represent?

10. Given $A=\begin{bmatrix}\sqrt{3} & 1 & 1\\ 2 & 3 & 0\end{bmatrix}$ and $B=\begin{bmatrix}2 & \sqrt{5} & 1\\ -2 & 3 & \frac{1}{2}\end{bmatrix}$, find A + B (Easy)

11. If A = $\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\end{bmatrix}$ and B = $\begin{bmatrix}3 & -1 & 3\\ -1 & 0 & 2\end{bmatrix}$, then find 2A – B (Easy)

12. Find AB, if A = $\begin{bmatrix}6 & 9\\ 2 & 3\end{bmatrix}$ and B = $\begin{bmatrix}2 & 6 & 0\\ 7 & 9 & 8\end{bmatrix}$ (Average)

13. If A = $\begin{bmatrix}1 & 0\\0 & -1\end{bmatrix}$ and B = $\begin{bmatrix}0 & 1\\1 & 0\end{bmatrix}$, then prove that **i)** AB = $\begin{bmatrix}0 & 1\\-1 & 0\end{bmatrix}$ and **ii)** BA = $\begin{bmatrix}0 & -1\\1 & 0\end{bmatrix}$.(Average)

14. Find AB, if A = $\begin{bmatrix}0 & -1\\0 & 2\end{bmatrix}$ and B = $\begin{bmatrix}3 & 5\\0 & 0\end{bmatrix}$ (Average)

15. Simplify $\cos\theta\begin{bmatrix}\cos\theta & \sin\theta\\-\sin\theta & \cos\theta\end{bmatrix}+\sin\theta\begin{bmatrix}\sin\theta & -\cos\theta\\\cos\theta & \sin\theta\end{bmatrix}$ (Average)

16. Find the transpose of each of the following matrices: A = $\begin{bmatrix}3 & \sqrt{3} & 2\\4 & 2 & 0\end{bmatrix}$ and B = $\begin{bmatrix}2 & -1 & 2\\1 & 2 & 4\end{bmatrix}$.(Easy)

17. If A = $\begin{bmatrix}3 & \sqrt{3} & 2\\4 & 2 & 0\end{bmatrix}$ and B = $\begin{bmatrix}2 & -1 & 2\\1 & 2 & 4\end{bmatrix}$, verify that (Average)

(i) $(A')' = A$ **(ii)** $(A+B)' = A' + B'$

19. Compute the following (Average)

(i) $\begin{bmatrix}a & b\\-b & a\end{bmatrix}+\begin{bmatrix}a & b\\b & a\end{bmatrix}$ **(ii)** $\begin{bmatrix}a^2+b^2 & b^2+c^2\\a^2+c^2 & a^2+b^2\end{bmatrix}+\begin{bmatrix}2ab & 2bc\\-2ac & -2ab\end{bmatrix}$

(iii) $\begin{bmatrix}-1 & 4 & -6\\8 & 5 & 16\\2 & 8 & 5\end{bmatrix}+\begin{bmatrix}12 & 7 & 6\\8 & 0 & 5\\3 & 2 & 4\end{bmatrix}$ **(iv)** $\begin{bmatrix}\cos^2 x & \sin^2 x\\\sin^2 x & \cos^2 x\end{bmatrix}+\begin{bmatrix}\sin^2 x & \cos^2 x\\\cos^2 x & \sin^2 x\end{bmatrix}$

20. Compute the indicated products: (Average)

(i) $\begin{bmatrix}a & b\\-b & 1\end{bmatrix}\begin{bmatrix}a & -b\\b & a\end{bmatrix}$ **(ii)** $\begin{bmatrix}1\\2\\3\end{bmatrix}\begin{bmatrix}2 & 3 & 4\end{bmatrix}$ **(iii)** $\begin{bmatrix}1 & -2\\2 & 3\end{bmatrix}\begin{bmatrix}1 & 2 & 3\\2 & 3 & 1\end{bmatrix}$

(iv) $\begin{bmatrix}2 & 3 & 4\\3 & 4 & 5\\4 & 5 & 6\end{bmatrix}\begin{bmatrix}1 & -3 & 5\\0 & 2 & 4\\3 & 0 & 5\end{bmatrix}$ **(v)** $\begin{bmatrix}2 & 1\\3 & 2\\-1 & 1\end{bmatrix}\begin{bmatrix}1 & 0 & 1\\-1 & 2 & 1\end{bmatrix}$ **(vi)** $\begin{bmatrix}3 & -1 & 3\\-1 & 0 & 2\end{bmatrix}\begin{bmatrix}2 & -3\\1 & 0\\3 & 1\end{bmatrix}$

21. Find the values of x, y and z from the following equations: $\begin{bmatrix}x+y & 2\\5+z & xy\end{bmatrix}=\begin{bmatrix}6 & 2\\5 & 8\end{bmatrix}$. (Average)

22. Solve the equation for x, y, z and t, if $2\begin{bmatrix}x & z\\y & t\end{bmatrix}+3\begin{bmatrix}1 & -1\\0 & 2\end{bmatrix}=3\begin{bmatrix}3 & 5\\4 & 6\end{bmatrix}$ (Average)

23. Given $3\begin{bmatrix}x & y\\z & w\end{bmatrix}=\begin{bmatrix}x & 6\\-1 & 2w\end{bmatrix}+\begin{bmatrix}4 & x+y\\z+w & 3\end{bmatrix}$, find the values of x, y, z and w. (Average)

24. Find the values of a, b, c and d from the following equation

$\begin{bmatrix}2a+b & a-2b\\5c-d & 4c+3d\end{bmatrix}=\begin{bmatrix}4 & -3\\11 & 24\end{bmatrix}$ (Average)

25. If $\begin{bmatrix}x+3 & z+4 & 2y-7\\-6 & a-1 & 0\\b-3 & -21 & 0\end{bmatrix}=\begin{bmatrix}0 & 6 & 3y-2\\-6 & -3 & 2c+2\\2b+4 & -21 & 0\end{bmatrix}$, Find the values of a, b, c, x, y and z. (Average)

Three marks questions:

1. Find X and Y, if X + Y = $\begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and X – Y = $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ (Average)

2. Find X and Y, if 2X + 3Y = $\begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and 3X + 2Y = $\begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$ (Average)

3. If A = $\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}$, then find the matrix X, such that 2A + 3X = 5B. (Average)

4. Find X and Y, if X + Y = $\begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and X – Y = $\begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$ (Average)

5. If A = $\begin{bmatrix} \frac{2}{3} & 1 & \frac{5}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3} \\ \frac{7}{3} & 2 & \frac{2}{3} \end{bmatrix}$ and B = $\begin{bmatrix} \frac{2}{5} & \frac{3}{5} & 1 \\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5} \\ \frac{7}{5} & \frac{6}{5} & \frac{2}{5} \end{bmatrix}$, then compute 3A – 5B (Average)

6. If F(x) = $\begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$, show that $F(x)\cdot F(y) = F(x+y)$ (Difficult)

7. If (i) A = $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then verify that A′A = I (Difficult)

   (ii) If A = $\begin{bmatrix} \sin\alpha & \cos\alpha \\ -\cos\alpha & \sin\alpha \end{bmatrix}$, then verify that A′A = I

8. Show that $\begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \neq \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}$ (Average)

9. If A = $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and I = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find k so that $A^2 = kA - 2I$ (Difficult)

10. For the matrix A = $\begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, verify that (Average)

    (i) (A + A′) is a symmetric matrix **(ii)** (A - A′) is a skew symmetric matrix

11. Find $\frac{1}{2}(A+A')$ and $\frac{1}{2}(A-A')$, when A = $\begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$ (Average)

12. Express the following matrices as the sum of a symmetric and skew symmetric matrix: (Difficult)

    (i) $\begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix}$ (ii) $\begin{bmatrix} 1 & 5 \\ -1 & 2 \end{bmatrix}$ (iii) $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ (iv) $\begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ (v) $\begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$

13. If A and B are invertible matrices of the same order, then prove that $(AB)^{-1} = B^{-1}A^{-1}$ (Average)

14. Prove that for any square matrix A with real number entries, $A + A'$ is a symmetric matrix and $A - A'$ is a skew symmetric matrix. (Average)

15. Prove that any square matrix can be expressed as the sum of symmetric and skew symmetric matrix. (Difficult)

16. Prove that inverse of a square matrix, if it exist, is unique. (Average)

ADDITIONAL QUESTIONS:

17. Show that $\begin{bmatrix}1 & 2 & 3\\0 & 1 & 0\\1 & 1 & 0\end{bmatrix}\begin{bmatrix}-1 & 1 & 0\\0 & -1 & 1\\2 & 3 & 4\end{bmatrix} \neq \begin{bmatrix}-1 & 1 & 0\\0 & -1 & 1\\2 & 3 & 4\end{bmatrix}\begin{bmatrix}1 & 2 & 3\\0 & 1 & 0\\1 & 1 & 0\end{bmatrix}$ (Difficult)

18. If A = $\begin{bmatrix}-1 & 2 & 3\\5 & 7 & 9\\-2 & 1 & 1\end{bmatrix}$ and B = $\begin{bmatrix}-4 & 1 & -5\\1 & 2 & 0\\1 & 3 & 1\end{bmatrix}$, then verify that

(i) $(A + B)' = A' + B'$ (ii) $(A - B)' = A' - B'$ (Average)

19. If A′ = $\begin{bmatrix}3 & 4\\-1 & 2\\0 & 1\end{bmatrix}$ and B = $\begin{bmatrix}-1 & 2 & 1\\1 & 2 & 3\end{bmatrix}$, then verify that (Average)

(i) $(A + B)' = A' + B'$ (ii) $(A - B)' = A' - B'$

20. If A′ = $\begin{bmatrix}-2 & 3\\1 & 2\end{bmatrix}$ and B = $\begin{bmatrix}-1 & 0\\1 & 2\end{bmatrix}$, then find $(A + 2B)'$ (Average)

21. If A = $\begin{bmatrix}1 & -2 & 3\\-4 & 2 & 5\end{bmatrix}$ and B = $\begin{bmatrix}2 & 3\\4 & 5\\2 & 1\end{bmatrix}$ then find AB, BA. Show that AB ≠ BA. (Difficult)

22. In a legislative assembly election, a political group hired a public relations firm to promote its candidate in three ways: telephone, house calls, and letters. The cost per contact (in paise) is given in matrix A as Cost per contact (Difficult)

$$A = \begin{array}{c} \\ \begin{bmatrix}40\\100\\50\end{bmatrix}\end{array}\begin{array}{l} \\ \textit{Telephone}\\ \textit{Hou sec all}\\ \textit{Letter}\end{array}$$

The number of contacts of each type made in two cities X and Y is given by

$$\begin{array}{cc} & \begin{array}{ccc}\textit{Telephone} & \textit{Hous sec all} & \textit{Letter}\end{array}\\ B = & \begin{bmatrix}1000 & 500 & 5000\\3000 & 1000 & 10000\end{bmatrix}\begin{array}{l}\to X\\ \to Y\end{array}\end{array}.$$

Find the total amount spent by the group in the two cities X and Y.

23. A trust fund has RS. 30,000 that must be invested in two different types of bonds. The first bond pays5 % interest per year, and the second bond pays 7 % interest per year. Using matrix multiplication, determine how to divide Rs. 30,000 among the two types of bonds. If the trust fund must obtain an annual total interest of : (a) Rs. 1800 (b) Rs. 2000 (Difficult)

24. A book shop of a particular school has 10 dozen chemistry books, 8 dozen physics books, 10 dozen economics books. Their selling prices are Rs. 80, Rs. 60 and Rs. 40 each respectively. Find the total amount the bookshop will receive from selling all the books using matrix algebra. (Difficult)

25. If A and B are symmetric matrices of the same order, then show that AB is symmetric if and only if A and B commute, that is AB = BA. (Average)

Five marks questions:

1. For the matrices A and B , verify that $(AB)' = B'A'$, where

(i) $A=\begin{bmatrix}-2\\4\\5\end{bmatrix}, B=\begin{bmatrix}1 & 3 & -6\end{bmatrix}$ **(ii)** $A=\begin{bmatrix}0\\1\\2\end{bmatrix}, B=\begin{bmatrix}1 & 5 & 7\end{bmatrix}$ **(iii)** $A=\begin{bmatrix}1\\-4\\3\end{bmatrix}, B=\begin{bmatrix}-1 & 2 & 1\end{bmatrix}$ (Difficult)

2. If A = $\begin{bmatrix}1 & 2 & -3\\5 & 0 & 2\\1 & -1 & 1\end{bmatrix}$, B = $\begin{bmatrix}3 & -1 & 2\\4 & 2 & 5\\2 & 0 & 3\end{bmatrix}$ and C = $\begin{bmatrix}4 & 1 & 2\\0 & 3 & 2\\1 & -2 & 3\end{bmatrix}$ (Difficult)

Then compute (A + B) and (B – C). Also, verify that A + (B – C) = (A + B) – C

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

find A(BC), (AB)C and show that (AB)C = A(BC). (Difficult)

4. Find $A^2-5A+6I$, if $A=\begin{bmatrix}2 & 0 & 1\\2 & 1 & 3\\1 & -1 & 0\end{bmatrix}$ (Difficult)

5. If $A=\begin{bmatrix}0 & 6 & 7\\-6 & 0 & 8\\7 & -8 & 0\end{bmatrix}, B=\begin{bmatrix}0 & 1 & 1\\1 & 0 & 2\\1 & 2 & 0\end{bmatrix}, C=\begin{bmatrix}2\\-2\\3\end{bmatrix}$

Calculate AC, BC and (A + B) C. Also, verify that (A + B)C = AC + BC. (Difficult)

6. If $A=\begin{bmatrix}1 & 1 & 1\\1 & 2 & -3\\2 & -1 & 3\end{bmatrix}$, verify that $A^3-6A^2+5A+11I=O$,

where O is zero matrix of order 3 x 3. (Difficult)

7. If A = $A=\begin{bmatrix}1 & 2 & 3\\3 & -2 & 1\\4 & 2 & 1\end{bmatrix}$, then show that $A^3-23A-40I=O$. (Difficult)

ADDITIONAL QUESTIONS:

8. If $A=\begin{bmatrix}1 & 0 & 2\\0 & 2 & 1\\2 & 0 & 3\end{bmatrix}$, prove that $A^3-6A^2+7A+2I=0$. (Difficult)

9. Let A = $A=\begin{bmatrix}2 & -1\\3 & 4\end{bmatrix}, B=\begin{bmatrix}5 & 2\\7 & 4\end{bmatrix}, C=\begin{bmatrix}2 & 5\\3 & 8\end{bmatrix}$. Find a matrix D such that $CD-AB=O$ (Average)

10. If $A=\begin{bmatrix}0 & -\tan\frac{\alpha}{2}\\ \tan\frac{\alpha}{2} & 0\end{bmatrix}$ and I is the identity matrix of order 2, show that

$I+A=(I-A)\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$. (Difficult)

11. If $A=\begin{bmatrix}3 & \sqrt{3} & 2\\4 & 2 & 0\end{bmatrix}; B=\begin{bmatrix}2 & -1 & 2\\1 & 2 & 4\end{bmatrix}$ then verify $(A+B)^1 = A^1+B^1$ (Difficult)

12. If $A=\begin{bmatrix}1 & 2\\2 & 1\end{bmatrix}, B=\begin{bmatrix}2 & 0\\1 & 3\end{bmatrix}$ & $C=\begin{bmatrix}1 & 1\\2 & 3\end{bmatrix}$ calculate AC, BC and $(A+B)C$. Also verify that $(A+B)C=AC+BC$ (Difficult)

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CHAPTER -4
DETERMINANTS

MCQ /FB questions:

1. If A = kB, where A and B are square matrices of order n, then | A| = (Easy)
(A) $k|B|$ (B) $k^n|B|$ (C) $k^{n+1}|B|$ (D) $nk|B|$.

2. The value of determinant $\begin{vmatrix} 0 & \sin\alpha & -\cos\alpha \\ -\sin\alpha & 0 & \sin\beta \\ \cos\alpha & -\sin\beta & 0 \end{vmatrix}$= (Easy)
(A) 0 (B) 1 (C) $\sin\alpha$ (D) $\cos\alpha$.

3. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ then x is equal to (Average)
(A) 2 (B) 4 (C) 8 (D) $\pm 2\sqrt{2}$.

4. If $\begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix} = \begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix}$, then value of x is (Average)
(A) $\sqrt{3}$ (B) $\pm\sqrt{3}$ (C) $\pm\sqrt{6}$ (D) $\sqrt{6}$.

5. If A is square matrix of order 3×3, then $|kA|$is equal to (Easy)
(A) $k|A|$ (B) $k^2|A|$ (C) $k^3|A|$ (D) $3k|A|$

6. If A= $\begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$, then $|2A|$is equal to (Easy)
(A) $2|A|$ (B) $3|A|$ (C) $4|A|$ (D) $|A|$.

7. If A=$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$, then $|3A|$is equal to (Average)
(A) 27 (B) 4 (C) 54 (D) 108.

8. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$, then value of x is (Average)
(A) 3 (B) ± 3 (C) ± 6 (D) 6.

9. If $\begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix} = \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$, then value of x is (Easy)
(A) 2 (B) ± 2 (C) -2 (D) 3.

10. Which of the following is correct (Easy)
(A) Determinant is a square matrix
(B) Determinant is a number associated to a matrix.
(C) Determinant is a number associated to a square matrix.
(D) Determinant is just an arrangement of numbers

11. Adjoint of a matrix A =$\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$ (Easy)
(A) $\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$ (B)$\begin{bmatrix} 2 & -3 \\ -1 & 4 \end{bmatrix}$ (C) $\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$ (D) $\begin{bmatrix} 4 & -3 \\ -1 & 2 \end{bmatrix}$.

12. If A be a non singular matrix of order 3, then |adj A| is equal to (Easy)
(A) $|A|$ (B)$|A|^2$ (C)$|A|^3$ (D)$3|A|$.

13. If A is an invertible matrix of order 2, then det (A^{-1}) is equal to (Easy)
(A) det (A) (B) $\frac{1}{\det(A)}$ (C) 0 (D) 1.

14. If A is a square matrix of order 2 and |A| = 3, then | A^{-1}| = (Easy)
(A) 3 (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) 12.

15. If A is *a* square matrix of order *n*, then | *adj*(A) | = (Easy)
(A) $|A|$ (B)$|A|^n$ (C)$|A|^{n-1}$ (D) $n|A|$.

16. If A and B are invertible matrices, then which of the following is not correct? (Easy)
(A) A (*adj* A) = (*adj* A) A = A I (B) A (*adj* A) = (*adj* A) A = $|A|$I
(C) $(AB)^{-1}=B^{-1}A^{-1}$ (D) $|A| \neq 0$ and $|B| \neq 0$.

17. For a square matrix A in matrix equation AX = B, Which of the following is not correct (Easy)
    (A) $|A| \neq 0$, there exists unique solution
    (B) $|A| = 0$ and $(adj\,A)\,B \neq 0$, then there exists no solution
    (C) $|A| = 0$ and $(adj\,A)\,B = 0$, then system may or may not be consistent
    (D) $|A| \neq 0$, then system is *inconsistent.*

18. If A = $\begin{bmatrix} 1 & 2 & -1 \\ 1 & x-2 & 1 \\ x & 1 & 1 \end{bmatrix}$ *is singular then the value of x is* (Average)
    (A) 2 (B) 3 (C) 1 (D) 0.

19. If A is a square matrix of order 3 and $|adjA| = 25$, then $|A|$ is (Average)
    (A) $\frac{1}{25}$ (B) 25 (C) 5 (D) $\frac{1}{5}$.

20. If A = $\begin{bmatrix} 2 & \lambda & -4 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A^{-1} exists if (Average)
    (A) $\lambda = -2$ (B) $\lambda \neq 2$ (C) $\lambda \neq -2$ (D) $\lambda \neq 2$ and $\lambda \neq -2$.

21. The inverse of the matrix $\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$ is (Easy)
    (A) $\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -3 \\ -4 & 6 \end{bmatrix}$ (C) $\begin{bmatrix} 6 & -3 \\ -4 & 2 \end{bmatrix}$ (D) Does not exists.

22. The inverse of the matrix $\begin{bmatrix} 2 & 2 \\ 4 & 3 \end{bmatrix}$ is (Easy)
    (A) $\frac{1}{2}\begin{bmatrix} 3 & -2 \\ -4 & 2 \end{bmatrix}$ (B) $\frac{1}{2}\begin{bmatrix} -3 & 2 \\ 4 & -2 \end{bmatrix}$ (C) $\frac{1}{2}\begin{bmatrix} 3 & 2 \\ 4 & 2 \end{bmatrix}$ (D) $-\frac{1}{2}\begin{bmatrix} 3 & 2 \\ 4 & 2 \end{bmatrix}$.

23. Consider the system of linear equations: (Average)
    $3x - 2y + 3z=8$, $2x + y - z=1$ and $4x - 3y + 2z=4$.The system has
    (A) exactly 3 solutions (B) a unique solution
    (C) no solution (D) infinite number of solutions.

24. If $A^2 - 4A + I = O$, then the inverse of A is (Average)
    (A) A + I (B) A- 4I (C) A – I (D) 4I – A.

25. If area of triangle is 35 sq units with vertices (2, – 6), (5, 4) and (k, 4) then k is (Average)
    (A) 12 (B) –2 (C) –12, –2 (D) 12, –2

26. If area of triangle is 4 sq units with vertices (k, 0), (4, 0) and (0, 2) then k is (Average)
    (A) 2,6 (B) –2,6 (C) 0, 8 (D) 0, 4

27. In matrix equation AX = B, $|A|=0$ and $(adjA)B=0$, then system of equations has (Easy)
    A) unique solution B) finite solution
    C) either infinity many solutions or no solution D) infinitely many solution

28.If $A$and $B$are square matrix of order 3 and $|A|=5$, $|B|=3$ then $|3AB|=$ (Average)
    A) 405 B) 45 C) 135 D) 675

29.If $A$is a matrix of order 3, such that $A(adjA)=10I$then $|adjA|=$ (Average)
    A) 10 B) 30 C) 1 D) 100

30. Which of the following is not correct? (Easy)
    (A) A square matrix A is said to be singular if $|A| = 0$
    (B) If elements of a row (or column) are multiplied with cofactors of any other row (or column), then their sum is zero.
    (C) A square matrix A is invertible if and only if A is singular matrix
    (D) A square matrix A is said to be non-singular if $|A| \neq 0$

31. **Statement 1:** Matrix A $= \begin{bmatrix} 1 & 2 & 1 \\ 1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ *is* a *singular* matrix. (Easy)

Statement 2: A square matrix A is said to be singular if $|A| = 0$.

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

32.**Assertion (A):** If A is a square matrix of order 2 and $|A| = 3$, then $|adj(A)| = 9$ (Average)

Reason (R): If A is *a* square matrix of order *n*, then $|adj(A)| = |A|^{n-1}$

A) A is false and R is true
B) A is true and R is false
C) A is true and R is true
D) A is false and R is false.

33.**Assertion (A):** The matrix A = $\begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & 4 \\ -2 & -4 & 0 \end{bmatrix}$,then $|A| = 0$. (Average)

Reason (R): If Determinant of a skew-symmetric matrix of odd order is zero

A) A is true and R is true
B) A is false and R is true
C) A is true and R is false
D) A is false and R is false.

34.**Statement 1**: If A is a square matrix of order 2 and $|\boldsymbol{A}| = 7$, then $|\boldsymbol{4A}| = 112$ (Average)

Statement 2: $|\boldsymbol{\lambda A}| = \lambda^n\ |\boldsymbol{A}|$, where n is order of square matrix

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true.
C) Statement 1 is true and Statement 2 is true.
D) Statement 1 is false and Statement 2 is false.

35.**Statement I** : The inverse of the matrix A=$\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$does not exist (Average)

Statement II : The inverse of singular matrix does not exist

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

36. If A is matrix of order 3×3, then number of minors in determinant of A is ___ (Easy)
37. If $A=[aij]$ is a square matrix of order 3, $|A| = 3$ and A_{ij} is cofactor of a_{ij} then $a_{11}A_{21}+a_{12}A_{22}+a_{13}A_{23}$ is equal to _____ (Easy)
38. If $A$is an invertible matrix of order 2 then $|AA^{-1}|$=______ (Easy)
39. If $A$and $B$are square matrices of same order and $|AB|$=16, $|A|$=8 then $|B|$=______ (Easy)
40. A is a square matrix of order 2 and $|adjA|$=9, then $|A|$ =______ (Easy)
41. If A= $\begin{bmatrix} 1 & 1 \\ 3 & 2 \end{bmatrix}$, then $\left|2A^T\right|$=______ (Average)
42. If A is a square matrix of order 3 with $|A| = 3$, find the values of $\left|AA^T\right|$= ------------- (Easy)
43. If A is a square matrix such that $A^2 = I \text{ and } |A| \neq 0$, then A^{-1} is equal to (Easy)

(A) 2A (B) O (C) A (D) A^2

44. The value of $\begin{vmatrix} \cos 15^\circ & \sin 15^\circ \\ \sin 15^\circ & \cos 15^\circ \end{vmatrix}$ is (Average)

(A) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1}{2}$ (D) $\frac{\sqrt{3}+1}{2\sqrt{2}}$.

45. If A is a square matrix of order 3 and |A| = 5, then the value of |2A′| is (Average)
(A) -10 (B) 10 (C) -40 (D) 40.

46. Given that A = [a_{ij}] is a square matrix of order 3×3 and |A| = -7, then the value of $\sum_{i=1}^{3} a_{i2}A_{i2}$,
where A_{ij} denotes the cofactor of element a_{ij} is (Average)
(A) 7 (B) -7 (C) 0 (D) 49.

47. If A and B are square matrices of order 3 such that $|A| = -1, |B| = 3$, then $|3AB^{-1}| =$ (Average)
A)-9 B)-81 C)-27 D)81.

48. If A and B are invertible square matrices of order n, then which of the following is not true? (Average)
(A) det (AB) = det(A)det(B) (B) det (kA) = k^n det(A)
(C) det (A+B) = det(A) + det(B) (D) det (A^T) = 1/ det(A^{-1})

49. For a non singular matrix A, |A| is (Easy)
A) $|A| \geq 0$ B) $|A| \leq 0$ C) |A| = 0 D) $|A| \neq 0$

50. For any singular matrix A, A^{-1} = (Easy)
A) $\frac{AdjA}{|A|}$ B) $\frac{1}{|A|AdjA}$ C) |A| adj A D) does not exist.

51. If A and B are square matrices of same order n × n and |A| = 3, |B| = 2. (Average)
i) det (AB) = 6 ii) det ($A^T B^T$) = 1/6 iii) det (kAB) = $k^n 6$.
A) only i) is true B) only i) and ii) statements are true.
C) only i) and iii) statements are true. D) all i), ii) and iii) statements are true.

52. The system of equations 4x + 6y = 5, 8x + 12y = 10 has (Easy)
A) No solution. B) Infinitely many solutions.
C) A unique solution. D) trivial solution.

53. A and B are invertible matrices of the same order such that $\left|(AB)^{-1}\right| = 8$. If $|A| = 2$, then |B| is equal to (Average)
A)16 B) 4 C)6 D) 1/ 16.

54. For any 2×2 matrix, if A(adjA) = $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to (Easy)
A) 20 B) 100 C)10 D) 0

55. The Values of k for which the matrix $\begin{bmatrix} k & -2 \\ 3 & k-5 \end{bmatrix}$ has no inverse is (Average)
A) k = 3, 2 B) k = -2, 3 C) $k \neq 3$,2 D) $k \neq 2$, -3

56. If the value of a third- order determinant is 6, then the value of the determinant formed by replacing each of its elements by its cofactor (Average)
(A) 12 (B)36 (C) 216 (D) 18

57. If A is square matrix of order 3 and |A|=4, then |A adjA| is (Average)
(A) 64 (B)16 (C) 4 (D) 12.

58. If A =$\begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$, B=$\begin{bmatrix} 2 & -1 \\ 1 & 2 \end{bmatrix}$ then |ABB′| = (Average)
(A) 50 (B) -250 (C) 100 (D) 250.

59. If A =$\begin{bmatrix} 2 & \lambda & 3 \\ 2 & 0 & 5 \\ 0 & 3 & 3 \end{bmatrix}$ is non singular matrix if (Average)
(A) λ = 3 (B)$\lambda \neq -3$ (C)$\lambda \neq$ - 2 (D) $\lambda \neq -2$

60. For a square matrix A in matrix equation AX = B (Average)
i) |A| ≠ 0, system of equations is consistent
ii) |A| = 0 and (*adj* A) B ≠ 0, then system of equations is inconsistent.
iii) |A| = 0 and (adj A) B = 0, then system may or be either consistent or inconsistent
A) only i) is true B) i) and ii) statements are true.
C) i) and iii) statements are true. D) all i), ii) and iii) statements are true.

Two/Three marks questions:

1. Find the equation of the line joining the points $(3, 1)$ and $(9, 3)$ using determinants. (Average)
2. Find the equation of the line joining the points $(1, 2)$ and $(3, 6)$ using determinants. (Average)
3. Find the area of the triangle whose vertices are $(3, 8), (-4, 2)$and $(5, 1)$ using determinants. (Average)
4. Find the area of the triangle whose vertices are $(2, 7), (1, 1)$ and $(10, 8)$ using determinants. (Average)
5. If the area of the triangle with vertices $(-2, 0), (0, 4)$ and $(0, k)$ is 4 square units. Find the values of k using determinants. (Average)
6. If the area of the triangle with vertices (2, – 6), (5, 4) and (k, 4) is 35 square units. Find the values of k using determinants. (Average)
7. If the area of the triangle with vertices (k, 0), (4, 0) and (0, 2) is 4 square units. Find the values of k using determinants. (Average)
8. Find the area of the triangle whose vertices are $(1, 0)(6, 0)$and $(4, 3)$ using determinants. (Average)
9. Find$k$, if the area of the triangle is 3 square units and whose vertices are $(k, 0)(1, 3)$ and $(0, 0)$ using determinants. (Average)
10. Prove that $|adjA| = |A|^2$, where A is the matrix of order 3×3. (Average)
11. Solve the system of linear equations using matrix method: (Average)
    (i) $2x + 5y = 1,\ 3x + 2y = 7$ (ii) $5x + 2y = 4,\ 7x + 3y = 5$
    (iii) $5x + 2y = 3,\ 3x + 2y = 5$ (iv) $4x - 3y = 3,\ 3x - 5y = 7$
12. Find adjA for A $=\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$. (Average)
13. Find the inverse of the matrices $\begin{bmatrix} 2 & -2 \\ 4 & 3 \end{bmatrix}$. (Average)
14. Find the inverse of the matrices $\begin{bmatrix} -1 & 5 \\ -3 & 2 \end{bmatrix}$. (Average)
15. Examine the consistency of the system of equations $x + 2y = 2$, $2x + 3y = 3$. (Average)
16. Examine the consistency of the system of equations $x + 3y = 5$, $2x + 6y = 8$. (Average)
17. Examine the consistency of the system of equations $3x – y – 2z = 2$, $2y – z = –1$ and $3x – 5y = 3$. (Average)
18. Examine the consistency of the system of equations $5x – y + 4z = 5$, $2x + 3y + 5z = 2$ and $5x – 2y + 6z = –1$. (Average)
19. If A be any given square matrix of order n, then prove that A(adj A) = (adj A) A = |A| I , where I is the identity matrix of order n (Difficult)
20. If A is a square matrix of order 3, then prove that | adj(A) | = $|A|^2$. (Average)
21. Find P^{-1}, if it exits, given $P = \begin{bmatrix} 10 & -2 \\ -5 & 1 \end{bmatrix}$ (Average)

Four marks questions:

1. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 5A + 7I = 0$ and hence find A^{-1}. (Difficult)
2. Show that the matrix A = $\begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ satisfies the equation A^2-4A+I =O, where I is 2 x 2 identity matrix and 2 x 2 zero matrix. Using this equation, find A^{-1}. (Difficult)
3. If $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ then verify that A adj A = |A| I. Also find A^{-1}. (Difficult)
4. If A $=\begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and B $=\begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$then verify that $(AB)^{-1} = B^{-1}A^{-1}$ (Difficult)
5. If A $=\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ Verify A (adj A) = (adj A) A = |A| I . (Difficult)
6. If A $=\begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ and B $=\begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$then verify that $(AB)^{-1} = B^{-1}A^{-1}$ (Difficult)
7. If $A^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$,find $(AB)^{-1}$. (Difficult)

Five marks questions:

1. Solve the system of equations $x + y + z = 6,\ y + 3z = 11$ and $x - 2y + z = 0$ by matrix method. (Difficult)
2. Solve the system of equations $3x - 2y + 3z = 8,\ 2x + y - z = 1$ and $4x - 3y + 2z = 4$ by matrix method. (Difficult)
3. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1}. Using A^{-1}, solve the system of equations (Difficult) $2x - 3y + 5z = 11, 3x + 2y - 4z = -5$and $x + y - 2z = -3$.
4. Solve the system of equations $4x+3y+2z=60,\ 2x+4y+6z=90,\ 6x+2y+3z=70$ by matrix method. (Difficult)
5. Solve the equations $2x + y + z = 1, x - 2y - z = \frac{3}{2}$ and $3y - 5z = 9$ by matrix method. (Difficult)
6. Use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equations $x - y + 2z = 1,\ 2y - 3z = 1, 3x - 2y + 4z = 2$. (Difficult)
7. Solve the system of equations $x - y + 2z = 7, 3x + 4y - 5z = -5$ and $2x - y + 3z = 12$ by matrix method. (Difficult)
8. Solve the system of equations $x - y + z = 4,\ 2x + y - 3z = 0$ and $x + y + z = 2$ by matrix method. (Difficult)
9. Solve the system of equations $2x + 2y + 3z = 4,\ x - 2y + z = -3$ and $3x - 4y - 2z = 5$ by matrix method. (Difficult)
10. Solve the system of equations $2x + 3y + 3z = 5,\ x - 2y + z = -4$ and $3x - y - 2z = 3$ by matrix method. (Difficult)

ADDITIONAL QUESTIONS :

11. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is Rs 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90. The cost of 6 kg onion, 2 kg wheat and 3 kg rice is Rs 70. Find the cost of each item per kg by matrix method. (Difficult)
12. The sum of three numbers is 6. If we multiply the third number by 3 and add the second number to it we get 11. By adding the first and third numbers, we get double the second number. Represent it algebraically and find the numbers using matrix method. (Difficult)
13. Solve the system of equations $\frac{2}{z}+\frac{3}{y}+\frac{10}{z}=4, \frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1, \& \frac{6}{x}+\frac{9}{y}-\frac{20}{z}=2$ by matrix method (Difficult)

CHAPTER-5
CONTINUITY AND DIFFERENTIABILITY

MCQ /FB questions:

1. Which of the following is true for the function f given by $f(x) = |x - 1|$ (Easy)
A) Discontinuous and differentiable at $x = 1$
B) Continuous but not differentiable at $x = 1$
C) Continuous and differentiable at $x = 1$
D) Discontinuous and not differentiable at $x = 1$

2. The left hand derivative of $f(x)=|x|$ at x = 0 is (Easy)
A) 1 B) -1 C) 0 D) does not exist.

3. The right hand derivative of $f(x)=|x-2|$ at x = 2 is (Average)
A) 1 B) -1 C) 0 D) does not exist.

4. The greatest integer function defined by $f(x) = [x]$ is (Average)
A) Continuous but not differentiable at $x = 1$ B) Continuous and differentiable at $x = 1$
C) Discontinuous but differentiable at $x = 1$ D) Discontinuous and not differentiable at $x = 1$

5. Number of points in the interval (-3, 3) in which f(x) = [x], where [ ] denotes the greatest integer function, is not differentiable is (Average)
A) 0 B) 3 C) 5 D) 7

6. The greatest integer function f(x) = [x] is (Easy)
A) continuous at x = 0 B) differentiable at x = 0
C) both continuous and differentiable at x = 0 D) discontinuous at x = 0

7. The derivative of $f(x)=|x-3|$ at x = 3 is (Average)
A) 0 B) 1 C) -1 D) does not exist.

8. The statement which is not true in the options given below is (Average)
A) Every polynomial function is continuous.
B) Every rational function is continuous.
C) Every differentiable function is continuous.
D) Every continuous function is differentiable.

9. The function $f(x) = |x - a|$ is (Average)
A) continuous and differentiable at $x = a$
B) continuous but not differentiable at $x = a$
C) not continuous but differentiable at $x = a$
D) not continuous and not differentiable at $x = a$

10. The function $f(x)=|x+1|+|x-1|$ is (Difficult)
A) continuous at $x=-1$ as well as $x=1$ B) continuous at $x=1$ but not $x=-1$
C) continuous at $x=-1$ but not $x=1$ D) discontinuous at $x = -1$ as well as $x = 1$

11. If $y = \tan(2x + 3)$, then $\frac{dy}{dx} =$ (Easy)
A) $2sec(2x + 3)$ B) $2sec^2(2x + 3)$ C) $sec^2(2x + 3)$ D) $sec(2x + 3)$.

12. If $y = \sin(cos\, x^2)$, then $\frac{dy}{dx} =$ (Average)
A) $\cos(cos\, x^2)$ B) $\cos(cos\, x^2) \sin x^2$ C) $2x \cos(cos\, x^2) \sin x^2$ D) $-2x \cos(cos\, x^2) \sin x^2$.

13. If $\boldsymbol{x - y = \pi}$, then $\boldsymbol{\frac{dy}{dx}} =$ (Easy)
A) π B) 1 C) $1 + \pi$ D) -1.

14. If $y = \sin^{-1} x + \sin^{-1} \sqrt{1 - x^2}, 0 < x < 1$ then $\frac{dy}{dx} =$ (Difficult)
A) $\frac{1}{\sqrt{1-x^2}}$ B) -1 C) 0 D) $\frac{2}{\sqrt{1-x^2}}$.

15. If $y = \cos^{-1}(\sin x)$ where $x \in \left(0, \frac{\pi}{2}\right)$, then $\frac{dy}{dx} =$ (Average)

A) $\frac{1}{\sqrt{1-x^2}}$ B) $\frac{-1}{\sqrt{1-x^2}}$ C) 1 D) −1.

16. If $y = a^x + x^a + a^a$, then $\frac{dy}{dx} =$ (Average)

A) $a^x \log_e a + ax^{a-1} + aa^{a-1}$ B) $a^x \log_e a + x^{a-1}$

C) $a^x \log_e a + ax^{a-1}$ D) $a^x \log_e a + x^a logx + a^a loga$.

17. If $y = sec(tan\sqrt{x})$, then $\frac{dy}{dx} =$ (Average)

A) $sec(tan\sqrt{x})tan(tan\sqrt{x})sec^2(\sqrt{x})$ B) $\frac{sec(tan\sqrt{x})tan(tan\sqrt{x})}{2\sqrt{x}}$

C) $\frac{sec(tan\sqrt{x})tan(tan\sqrt{x})sec^2(\sqrt{x})}{2\sqrt{x}}$ D) $\frac{sec(tan\sqrt{x})tan(tan\sqrt{x})sec^2(\sqrt{x})}{\sqrt{x}}$.

18. If $y = \cos(\sqrt{x})$, then $\frac{dy}{dx} =$ (Easy)

A) $sin(\sqrt{x})$ B) $-sin(\sqrt{x})$ C) $\frac{sin(\sqrt{x})}{2\sqrt{x}}$ D) $\frac{-sin(\sqrt{x})}{2\sqrt{x}}$.

19. The derivative of $e^{2\log_e x}$ with respect to x is (Average)

A) $e^{2\log_e x}$ B) $\frac{2}{x}$ C) $2x$ D) $\frac{e^{\log_e x^2}}{x}$.

20. The derivative of e^{-x} with respect to x is (Easy)

A) $-e^{-x}$ B) e^x C) $-e^x$ D) e^{-x} .

21. If $y = \cos^{-1}(e^x)$, then $\frac{dy}{dx} =$ (Average)

A) $\frac{e^x}{\sqrt{1-e^{2x}}}$ B) $-\frac{e^x}{\sqrt{1-e^{2x}}}$ C) $\frac{1}{\sqrt{1-e^{2x}}}$ D) $-\frac{1}{\sqrt{1-e^{2x}}}$.

22. If $y = \sin^{-1}(x\sqrt{x})$, then $\frac{dy}{dx} =$ (Difficult)

A) $\frac{1}{\sqrt{1-x^3}}$ B) $\frac{2\sqrt{x}}{3\sqrt{1-x^3}}$ C) $\frac{3\sqrt{x}}{2\sqrt{1-x^3}}$ D) $\frac{-3\sqrt{x}}{2\sqrt{1-x^3}}$.

23. If $y = \sqrt{e^{\sqrt{x}}}$, then $\frac{dy}{dx} =$ (Average)

A) $\frac{1}{2\sqrt{e^{\sqrt{x}}}}$ B) $\frac{e^{\sqrt{x}}}{2\sqrt{e^{\sqrt{x}}}}$ C) $\frac{e^{\sqrt{x}}}{2\sqrt{x}\sqrt{e^{\sqrt{x}}}}$ D) $\frac{e^{\sqrt{x}}}{4\sqrt{x}\sqrt{e^{\sqrt{x}}}}$.

24. The derivative of $e^{\sin^{-1}x}$ with respect to x is (Easy)

A) $\frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}}$ B) $\frac{e^{\sin^{-1}x}}{\sin^{-1}x}$ C) $-\frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}}$ D) $e^{\sin^{-1}x}$.

25. If $y = sin\ (log\ x)$, then $\frac{dy}{dx} =$ (Average)

A) $\frac{\sin(\log x)}{x}$ B) $\frac{\sqrt{1-y^2}}{y}$ C) $\frac{\sqrt{1-y^2}}{x}$ D) $\frac{\sqrt{1-x^2}}{x}$.

26. If $y = \log(\log x)$, then $\frac{dy}{dx} =$ (Average)

A) $\frac{1}{x}$ B) $\frac{1}{x\log x}$ C) $\frac{1}{\log x}$ D) $\frac{\log x}{x}$.

27. If $y = \log_7(logx)$, then $\frac{dy}{dx} =$ (Difficult)

A) $\frac{1}{xlog7logx}$ B) $\frac{1}{x\log x}$ C) $\frac{log7}{x\log x}$ D) $\frac{\log 7}{x}$.

28. If $y = logx$, then $\frac{d^2y}{dx^2} =$ (Average)

A) $\frac{1}{x}$ B) $\frac{1}{x\log x}$ C) $\frac{1}{x^2}$ D) $-\frac{1}{x^2}$.

29. If $y = x^{20}$, then $\frac{d^2y}{dx^2} =$ (Average)

A) $20x^{19}$ B) $20x^{18}$ C) $380\ x^{18}$ D) $360x^{18}$.

30. If $y = sin\ x^2$, then $\frac{dy}{dx} =$ (Easy)

A) 2sin2x B) 2sinxcosx C) $2\cos x^2$ D) $2x\cos x^2$

31. The derivative of f given by $f(x) = \sin^{-1}x$ exists, if x ∈ (Difficult)

A) $(-1, 1)$ B) $[-1, 1]$ C) $(-\infty, \infty)$ D) $R - (-1, 1)$

32. The derivative of f given by $f(x) = \tan^{-1}x$ exists, if x ∈ (Average)

A) $(-1,1)$ B) $[-1,1]$ C) $(-\infty, \infty)$ D) $R - (-1,1)$

33. Suppose f and g be two real functions continuous at $x = c$,then (Easy)

A) $f + g$ is discontinuous at $x = c$. B) $f - g$ is discontinuous at $x = c$.

C) $f \cdot g$ is discontinuous at $x = c$. D) f/g is continuous at $x = c$, (provided $g(c) \neq 0$).

34. Derivative of $sin(ax + b)$ with respect to x is (Easy)

A) $\frac{1}{a}cos(ax + b)$ B) $a\,cos(ax + b)$ C) $-\frac{1}{a}cos(ax + b)$ D) $-\mathrm{a}\cos(\mathrm{ax} + \mathrm{b})$

35. If $y = \sin(cosx)$, then $\frac{dy}{dx} =$ (Easy)

A) $\cos(cosx)$ B) $\cos(cosx)\sin x$ C) $-\cos(cosx)\sin x$ D) $-\cos(cosx)\,cosx$.

36. Derivative of sin $(x^2 + 5)$ with respect to x is (Easy)

A) $\cos(x^2 + 5)$ B) $-\cos(x^2 + 5)$ C) $-2x\cos(x^2 + 5)$ D) $2x\cos(x^2 + 5)$.

37. Derivative of $2\sqrt{\cot x^2}$ with respect to x is (Average)

A) $\frac{-cosecx^2}{\sqrt{\cot x^2}}$ B) $\frac{2xcosecx^2}{\sqrt{\cot x^2}}$ C) $-\frac{2xcosec^2x^2}{\sqrt{\cot x^2}}$ D) $-\frac{2xcosecx}{\sqrt{\cot x^2}}$.

38. If $y = \cos(logx + e^x)$,then$\frac{dy}{dx} =$ (Difficult)

A) $\sin(logx + e^x)\frac{1}{x+e^x}$ B) $\frac{\sin(logx+e^x)}{x+e^x}$ C) $\frac{-\sin(logx+e^x)}{x+e^x}$ D)$-\sin(logx + e^x)\left(\frac{1}{x} + e^x\right)$.

39. If $y = \log(\cos e^x)$, then $\frac{dy}{dx} =$ (Average)

A) $-e^x tane^x$ B) $e^x tane^x$ C)$-e^x cote^x$ D)$-tane^x$.

40. If $y = e^x + e^{x^2} + e^{x^3} + e^{x^4} + e^{x^5}$,then $\frac{dy}{dx}$ at x =1 is (Average)

A) $5e$ B) 15e C) 15 D)5.

41. If $x = at^2$ and $y = 2at$, then $\frac{dy}{dx} =$ (Average)

A) $2at$ B) $\frac{1}{2at}$ C) $\frac{1}{t}$ D) t

42. The greatest integer function defined by $f(x) = [x]$, $0 < x < 3$ is not differentiable at (Average)

A) all non itegral points B) $x = 0, 1, 2, 3$ C) $x = 1, 2$ D) $x = 1, 2, 3$

43. The number of points in the set of real number R in which the function f (x)= |x|+ |x + 1| is not differentiable, is (Average)

A) 0 B) 1 C) 2 D) $infinite$.

44. If $y = A\sin x + B\cos x$, $then$ $\frac{d^2y}{dx^2} =$ (Easy)

A) y B) $-$y C)x D)y^2.

45. If $y = 5\cos x - 3\sin x$, $then$ $\frac{d^2y}{dx^2} + y =$ (Average)

A) 0 B) 1 C)$\frac{\mathrm{dy}}{\mathrm{dx}}$ D)2y.

46. **Statement 1:** The function f(x) = $|\boldsymbol{x}|$ is discontinuous at x =0 (Difficult)

Statement 2: The function f(x) = $|\boldsymbol{x}|$ is not differentiable at x =0

A) Statement 1 is true and Statement 2 is false

B) Statement 1 is false and Statement 2 is true

C) Both Statement 1and 2 are true

D) Both Statement 1 and 2 are false

47. **Assertion (A) :** The function f (x) = [x], where [x] denotes the greatest integer less than or equal to x , is discontinuous at x = 1.

Reason (R) : The greatest integer function is discontinuous at all integral points (Difficult)

A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true.

48. **Assertion (A) :** The function f (x) = $|x-1|$ is continuous and differentiable at x = 0.
Reason (R): Every differentiable function is continuous. (Difficult)
A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true

49. **Assertion (A):** f(x)=$|x-3|$ is continuous at x = 3.
Reason (R): f(x) =$|x-3|$ is differentiable at x = 3. (Average)
A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true

50. **Statement I:** If $f(x)$ is continuous at $x = a$, then $\lim_{x\to a} f(x) = f(a)$

Statement II: Every differentiable function is continuous. (Average)
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

51. **Statement 1:** Left hand derivative of $f(x) = |x|$ at x = 0 is -1.
Statement 2: Left hand derivative of f(x) at x = a is $\lim_{h\to 0} f(a-h)$ (Average)
A) Statement 1 is true, and Statement 2 is false.
B) Statement 1 is true, and Statement 2 is true, Statement 2 is correct Explanation for Statement 1
C) Statement 1 is true, and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false, and Statement 2 is false.

52. Right hand derivative of f(x) = $|x|$ at x = 1 is _______ (Average)

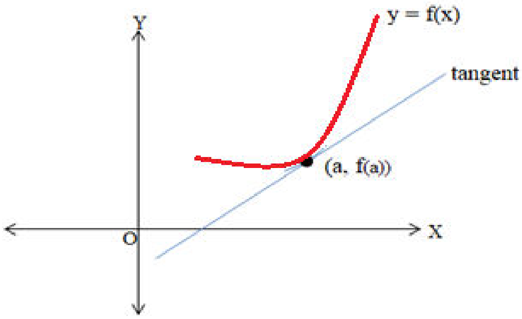
53. If y =2cosx +3 sinx , then $\frac{d^2y}{dx^2}$ + y = __________ (Average)

54. Left hand derivative of f(x) = $|x-7|$ at x = 7 is _________ (Average)

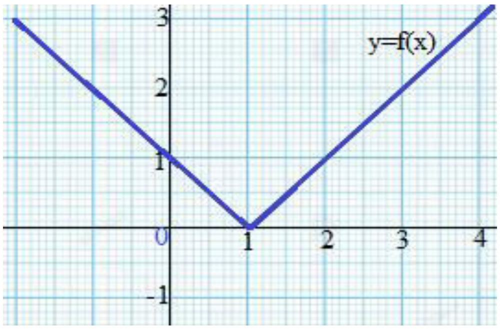
55. The number of points in R at which the function f(x) =$|x|+|x+1|$is not differentiable, is-... (Average)

56. For the figure given below the slope of tangent to the curve at x = a is (Average)

A) $f(a) - a$
B) $\lim_{x\to a}(f(x))$
C) $\lim_{x\to a}\left(f(x) - f(a)\right)$
D) $f^{/}(a)$.



57. For the figure given below, consider the following statements 1 and 2 (Difficult)



Statement 1: The given function is differentiable at x=0

Statement 2: The given function is continuous at x=1

A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Both Statement 1and 2 are true
D) Both Statement 1 and 2 are false

58. Consider the following statements about the function where f(x) = | x - 2|

1. f(x) is not continuous at x = 2 2. f(x) is differentiable at x = 0 (Average)

Choose the correct statement?
A) Statement 2 is correct
B) Both statement 1 and statement 2 are correct
C) Both statements 1 and statement 2 are wrong D) Statement 1 is correct

59. The derivative of $2x + 3y = sinx$ is (Average)

A) $\frac{\cos x+2}{3}$ B) $\frac{\cos x-2}{3}$ C) $\frac{\sin x-2}{3}$ D) $\frac{\sin x+2}{3}$.

60. If the function f(x) = a^x (Difficult)

1. Its domain is (∞, ∞) 2. It is a continuous function 3. It is differentiable at x = 0

Which of the above statements are correct?
A) 1 and 2 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3.

61. The conditions for a function to be continuous on (a, b)? (Difficult)

1) The function is continuous at each point of (a, b).
2) The function is right continuous at each point of (a, b).
3) The function is left continuous at each point of (a, b).

Which of the above statements are correct?
A) 1 and 2 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3.

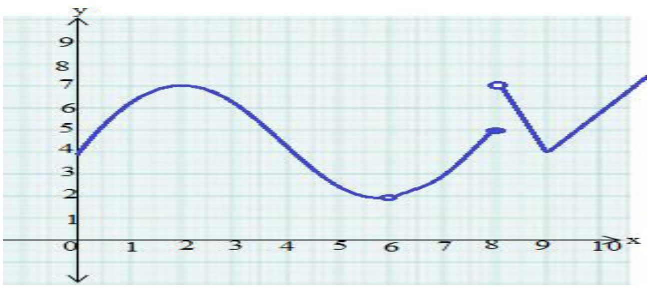
62. The value of f(x),if the function f(x)=$\frac{x^2-2x}{x-2}$ is continuous at the point x = 6 is (Average)

A) 12 B) 36 C) 6 D) 0

63. Consider the function f:$\mathcal{R} - \{2\} \to \mathcal{R}$ defined by f(x)=$\frac{x^2-2x}{x-2}$. What should be the value of f(2) if f(x) is a continuous function from $\mathcal{R}$ to $\mathcal{R}$? Where $\mathcal{R}$ is the set of all real numbers. (Average)

A) 2 B) -2 C) 0 D) 1

64. For the figure given below, consider the following statements 1,2 and 3 (Difficult)



Statement 1: The given function is continuous and differentiable at x=2

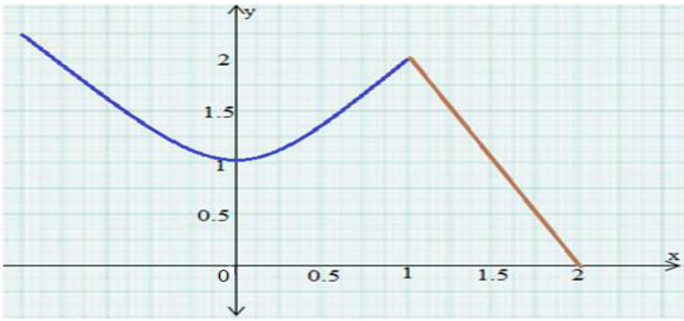
Statement 2: The given function is not continuous but differentiable at x=6 and x=8

Statement 3: The given function is continuous but not differentiable at x=9

Then which of the following is true

A) Statement 1 is true and Statements 2 and 3 are false
B) Statements 1 and 3 are true but Statement 2 is false
C) Statements 2 and 3 are true but Statement 1 is false
D) All the Statements 1 ,2 and 3 are true.

65. For the figure given below, consider the following statements 1 and 2 (Difficult)



Statement 1: The given function is continuous and differentiable at x=0

Statement 2: The given function is not continuous and not differentiable at x=1

A) Statement 1 is true and Statement 2 is false

B) Statement 1 is false and Statement 2 is true

C) Both Statement 1and 2 are true

D) Both Statement 1 and 2 are false

66. If $f(x)=\begin{cases} x\sin\frac{1}{x}, & x\neq 0 \\ k, & x=0 \end{cases}$ is continuous at $x=0$, then the value of k is = ________ (Difficult)

67. If $f(x)=|x-3|$, then f is continuous but not differentiable at x=___ (Easy)

68. $\frac{d}{dx}(3x^x)$ at x =1 is= ____________ (Average)

69. The value of $\frac{d}{dx}(|x|-|x-2|)$at x = 1is __________ (Difficult)

70. If x = acos²θ , y = asin²θ , then $\frac{dy}{dx}$= ___________ (Difficult)

TWO MARK QUESTIONS

1. Check the continuity of the function f given by $f(x)=2x+3$ *at* $x=1$. (Easy)

2. Examine whether the function f given by $f(x)=x^2$ is continuous at $x=0$. (Average)

3. Discuss the continuity of the function f given by $f(x)=|x|$ at $x=0$. (Average)

4. Show that the function f given by $f(x)=\begin{cases} x^3+3, & \text{for } x\neq 0 \\ 1, & \text{for } x=0 \end{cases}$ is not continuous at $x=0$.(Average)

5. Check the points where the constant function $f(x)=\text{k}$ is continuous. (Easy)

6. Prove that the identity function on real numbers given by $f(x)=x$ is continuous at every real number. (Easy)

7. Is the function defined by $f(x)=|x|$, a continuous function? Justify your answer. (Average)

8. Discuss the continuity of the function f given by $f(x)=x^3+x^2-1$. (Average)

9. Discuss the continuity of the function f defined by $f(x)=\frac{1}{x}$, $x\neq 0$. (Average)

10. Prove that the function $f(x)=5x-3$ is, continuous at (i) $x=0$ (ii) $x=-3$ (iii) $x=5$ (Easy)

11. Examine the continuity of the function $f(x)=2x^2-1$ at $x=3$. (Average)

12. Examine the following functions for continuity: (Each question of 2 Marks)

a) $f(x)=x-5$ **b)** $f(x)=|x-5|$

c) $f(x)=\frac{x^2-25}{x+5}$, $x\neq -5$ **d)** $f(x)=\frac{1}{x-5}$, $x\neq 5$. (Average)

13. Prove that the function $f(x)=x^n$ is continuous at $x=n$, where n is a positive integer. (Average)

14. Discuss the continuity of the following functions: (Each question is of 2 Marks)

a) $f(x)=\sin x+\cos x$ **b)** $f(x)=\sin x-\cos x$ **c)** $f(x)=\sin x\cdot\cos x$. (Average)

15. If $y=(2x+1)^3$, find $\frac{dy}{dx}$. (Easy)

16. Find the derivative of the function given by $f(x)=\sin(x^2)$. (Easy)

17. Find $\frac{dy}{dx}$, *if* $y+\sin y=\cos x$. (Average)

18. Find $\frac{dy}{dx}$, if $2x+3y=\sin x$. (Easy)

19. Find $\frac{dy}{dx}$, if $2x+3y=\sin y$. (Average)

20. Find $\frac{dy}{dx}$, if $ax+by^2=\cos y$. (Average)

21. Find $\frac{dy}{dx}$, if $x^2+xy+y^2=100$. (Average)

22. Find $\frac{dy}{dx}$, if $\sin^2 x+\cos^2 y=1$. (Average)

23. If $\sqrt{x}+\sqrt{y}=10$, show that $\frac{dy}{dx}+\sqrt{\frac{y}{x}}=0.$ (Easy)

24. Find $\frac{dy}{dx}$, if $y=\sin^{-1}\left(\frac{2x}{1+x^2}\right)$, $-1 < x < 1$. (Average)

25. Find $\frac{dy}{dx}$, if $y=\tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right), -\frac{1}{\sqrt{3}}<x<\frac{1}{\sqrt{3}}$. (Average)

26. If $y=\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, $0<x<1$, find $\frac{dy}{dx}$. (Average)

27. Find $\frac{dy}{dx}$, if $y=\sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, $0<x<1$. (Average)

28. Find $\frac{dy}{dx}$, if $y=\cos^{-1}\left(\frac{2x}{1+x^2}\right)$, $-1<x<1$. (Average)

29. Find $\frac{dy}{dx}$, if $y=\sin^{-1}\left(2x\sqrt{1-x^2}\right)$, $\frac{-1}{\sqrt{2}}<x<\frac{1}{\sqrt{2}}$. (Average)

30. Find $\frac{dy}{dx}$, if $y=\sec^{-1}\left(\frac{1}{2x^2-1}\right)$, $0<x<\frac{1}{\sqrt{2}}$. (Average)

31. Find $\frac{dy}{dx}$, if $y=\log_a x$. (Difficult)

32. Find $\frac{dy}{dx}$, if $y=\frac{e^x}{\sin x}$. (Easy)

33. Find $\frac{dy}{dx}$, if $y=\sin\left(\tan^{-1}e^{-x}\right)$. (Difficult)

34. Find $\frac{dy}{dx}$, if $y=\log\left(\cos e^{x}\right)$. (Difficult)

35. Find $\frac{dy}{dx}$, if $y=e^{x}+e^{x^2}+e^{x^3}.....+e^{x^5}$. (Average)

36. Find $\frac{dy}{dx}$, if $y=\sqrt{e^{\sqrt{x}}}$, $x>0$. (Average)

37. Find $\frac{dy}{dx}$, if $y=\frac{\cos x}{\log x}$, $x>0$. (Easy)

38. Find $\frac{dy}{dx}$, if $y=\cos(\log x+e^{x})$, $x>0$. (Average)

39. Differentiate $\left(\log x\right)^{\cos x}$ with respect to x. (Average)

40. If $y=x^{x}$, find $\frac{dy}{dx}$. (Easy)

41. Differentiate $\left(x+\frac{1}{x}\right)^{x}$ w. r. to x. (Average)

42. Find $\frac{dy}{dx}$, if $y=x^{\left(x+\frac{1}{x}\right)}$. (Average)

43. Find $\frac{dy}{dx}$, if (i) $y=\left(\log x\right)^{x}$ (ii) $y=x^{(\log x)}$. (Average)

44. Find $\frac{dy}{dx}$, if (i) $y=\left(\sin x\right)^{x}$ (ii) $y=\sin^{-1}\sqrt{x}$. (Average)

45. Find $\frac{dy}{dx}$, if (i) $y=x^{\sin x}, x>0$ (ii) $y=\left(\sin x\right)^{(\cos x)}$ (Average)

46. Find $\frac{dy}{dx}$, if $y=log_7(log\, x)$. (Average)

47. Find $\frac{dy}{dx}$, if $y=\cos^{-1}\left(\sin x\right)$. (Average)

48. Find $\frac{dy}{dx}$, if $y=(3x^2-9x+5)^9$. (Easy)

49. Find $\frac{dy}{dx}$, if $y=\left(5x\right)^{3\cos 2x}$. (Average)

50. Find $\frac{dy}{dx}$, if $y=\frac{\cos^{-1}\frac{x}{2}}{\sqrt{2x+7}}$, $-2<x<2$. (Average)

51. Find $\frac{dy}{dx}$, if $y=\left(\log x\right)^{\log x}$, $x>1$. (Average)

52. Find $\frac{dy}{dx}$, if $y=\cos(a\cos x+b\sin x)$, for some constant ‘a’ and ‘b’ (Average)

53. Find $\frac{dy}{dx}$, if $y = x^3 \log x$. (Easy)

54. Find $\frac{dy}{dx}$, if $y = e^x \sin 3x$. (Easy)

55. Find $\frac{dy}{dx}$, if $y = e^{6x} \cos 3x$. (Average)

56. Find $\frac{dy}{dx}$, if y = $\sin(\cos(x^2))$ (Average)

57. Find $\frac{dy}{dx}$, if $y = \sin^3 x + \cos^6 x$. (Average)

58. If (i) $y = \sec\left(\tan(\sqrt{x})\right)$ (ii) $y = \cos x^3 \cdot \sin^2(x^5)$ find $\frac{dy}{dx}$. (Average)

THREE MARK QUESTIONS

1. Discuss the continuity of the function f defined by $f(x) = \begin{cases} x+2, & if\ x \le 1 \\ x-2, & if\ x > 1 \end{cases}$. (Easy)

2. Find all the points of discontinuity of the function f defined by $f(x) = \begin{cases} x+2, & if\ x < 1 \\ 0, & if\ x = 1 \\ x-2, & if\ x > 1 \end{cases}$. (Average)

3. Discuss the continuity of the function f defined by $f(x) = \begin{cases} x+2, & if\ x \le 0 \\ -x+2, & if\ x > 0 \end{cases}$ (Easy)

4. Discuss the continuity of the function f defined by $f(x) = \begin{cases} x, & if\ x \ge 0 \\ x^2, & if\ x < 0 \end{cases}$. (Average)

5. Is the function f defined by $f(x) = \begin{cases} x, & if\ x \le 1 \\ 5, & if\ x > 1 \end{cases}$ continuous at $x = 0$? At $x = 1$? At $x = 2$ (Average)

6. Prove that the function f given by $f(x) = |x-1|, x \in R$ is not differentiable at $x = 1$. (Easy)

7. If $y = 2\sqrt{\cot(x^2)}$, find $\frac{dy}{dx}$. (Average)

8. Find $\frac{dy}{dx}$, *if* $x + sin\, xy - y = 0$. (Easy)

9. Find $\frac{dy}{dx}$, if $xy + y^2 = \tan x + y$. (Easy)

10. Find $\frac{dy}{dx}$, if $x^3 + x^2 y + xy^2 + y^3 = 81$. (Easy)

11. Find $\frac{dy}{dx}$, if $\sin^2 x + \cos xy = k$. (Easy)

12. Differentiate $\sqrt{\frac{(x-3)(x^2+4)}{3x^2+4x+5}}$ with respect to x. (Easy)

13. Find $\frac{dy}{dx}$, *if* $y^x + x^y + x^x = a^b$. (Easy)

14. Find $\frac{dy}{dx}$, if $y = \cos x \cdot \cos 2x \cdot \cos 3x$. (Easy)

15. Differentiate $\sqrt{\dfrac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$ with respect to x. (Average)

16. Find $\dfrac{dy}{dx}$, if $y = x^x - 2^{\sin x}$. (Difficult)

17. Find $\dfrac{dy}{dx}$, if $y = (x+3)^2 \cdot (x+4)^3 \cdot (x+5)^4$. (Easy)

18. Find $\dfrac{dy}{dx}$, if $x^y = y^x$. (Average)

19. Find $\dfrac{dy}{dx}$, if $xy = e^{x-y}$. (Average)

20. Find the derivative of the function given by $f(x) = (1+x)(1+x^2)(1+x^4)(1+x^8)$ and hence find $f'(1)$. (Easy)

21. Differentiate $(x^2 - 5x + 8)(x^3 + 7x + 9)$ with respect to *x*, by using product rule. (Easy)

22. Find $\dfrac{dy}{dx}$, if $(i)\ y = x^{x\cos x}$ $(ii)\ y = \dfrac{x^2+1}{x^2-1}$. (Any One) (Average)

23. Find $\dfrac{dy}{dx}$, if $(i)\ y = (x\cos x)^x$ $(ii)\ y = (x\sin x)^{\frac{1}{x}}$ (Any One) (Average)

24. Find $\dfrac{dy}{dx}$, if $x = a\cos\theta,\ y = a\sin\theta$. (Easy)

25. Find $\dfrac{dy}{dx}$, if $x = at^2,\ y = 2at$. (Easy)

26. Find $\dfrac{dy}{dx}$, if $x = a(\theta + \sin\theta),\ y = a(1 - \cos\theta)$. (Easy)

27. Find $\dfrac{dy}{dx}$, if $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. (Average)

28. Find $\dfrac{dy}{dx}$, if $x = 2at^2,\ y = at^4$. (Average)

29. Find $\dfrac{dy}{dx}$, if $x = a\cos\theta,\ y = b\cos\theta$. (Easy)

30. Find $\dfrac{dy}{dx}$, if $x = \sin t,\ y = \cos 2t$. (Average)

31. Find $\dfrac{dy}{dx}$, if $x = 4t,\ y = \dfrac{4}{t}$. (Average)

32. Find $\dfrac{dy}{dx}$, if $x = \cos\theta - \cos 2\theta,\ y = \sin\theta - \sin 2\theta$. (Average)

33. If $x = a(\theta - \sin\theta)$ and $y = a(1 + \cos\theta)$ then prove that $\dfrac{dy}{dx} = -\cot\left(\dfrac{\theta}{2}\right)$. (Average)

34. Find $\dfrac{dy}{dx}$, if $x = \dfrac{\sin^3 t}{\sqrt{\cos 2t}},\ y = \dfrac{\cos^3 t}{\sqrt{\cos 2t}}$. (Difficult)

35. Find $\dfrac{dy}{dx}$, if $x = a\sec\theta,\ y = b\tan\theta$. (Easy)

36. Find $\frac{dy}{dx}$, if $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$. (Average)

37. If $x = \sqrt{a^{\sin^{-1}t}}$ *and* $y = \sqrt{a^{\cos^{-1}t}}$, then prove that $\frac{dy}{dx} = -\frac{y}{x}$. (Average)

38. If $x = a(\theta + \sin\theta)$ *and* $y = a(1 - \cos\theta)$. Prove that $\frac{dy}{dx} = \tan\left(\frac{\theta}{2}\right)$. (Average)

39. Find $\frac{dy}{dx}$, if $y = \sqrt{3x+2} + \frac{1}{\sqrt{2x^2+4}}$. (Difficult)

40. Find $\frac{dy}{dx}$, if $y = e^{\sec^2 x} + 3\cos^{-1}x$. (Average)

41. Find $f'(x)$, if $f(x) = \sin^{-1}\left(\frac{2^{x+1}}{1+4^x}\right)$. (Difficult)

42. Find $f'(x)$, if $f(x) = \tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$. (Difficult)

43. Find $f'(x)$ if $f(x) = (\sin x)^{\sin x}$ for all $0 < x < \pi$. (Average)

44. For a positive constant 'a' find $\frac{dy}{dx}$, where $y = a^{t+\frac{1}{t}}$ and $y = \left(t + \frac{1}{t}\right)^a$. (Difficult)

45. Differentiate $\sin^2 x$ with respect to $e^{\cos x}$. (Average)

46. Find $\frac{dy}{dx}$, if $y = \cot^{-1}\left[\frac{\sqrt{1+\sin x} + \sqrt{1-\sin x}}{\sqrt{1+\sin x} - \sqrt{1-\sin x}}\right], 0 < x < \frac{\pi}{2}$.
(Difficult)

47. Find $\frac{dy}{dx}$, if $y = (\sin x - \cos x)^{(\sin x - \cos x)}$, $\frac{\pi}{4} < x < \frac{3\pi}{4}$. (Average)

48. Find $\frac{dy}{dx}$, if $x^x + x^a + a^x + a^a$, for some fixed $a > 0$ *and* $x > 0$. (Easy)

49. Find $\frac{dy}{dx}$, if $y = 12(1-\cos t)$, $x = 10(t - \sin t)$, $-\frac{\pi}{2} < t < \frac{\pi}{2}$. (Average)

50. Find $\frac{dy}{dx}$, if $y = \sin^{-1}x + \sin^{-1}\sqrt{1-x^2}$, $0 < x < 1$. (Easy)

51. If $f(x) = |x|^3$, show that $f''(x)$ exists for all real x and find it. (Average)

52. If $y = \cos x^3 \cdot \sin^2(x^5)$, find $\frac{dy}{dx}$. (Average)

53. Prove that the greatest integer function defined by $f(x) = [x],\ 0 < x < 3$ is not differentiable at $x = 1$ *and* $x = 2$. (Average)

FOUR MARK QUESTIONS

1. Find the relationship between 'a' and 'b' so that the function 'f' defined by $f(x)=\begin{cases} ax+1, & if \ x \le 3 \\ bx+3, & if \ x>3 \end{cases}$ is continuous at $x=3$. (Easy)

2. For what value of λ is the function defined by $f(x)=\begin{cases} \lambda(x^2-2x), & \text{if } x \le 0 \\ 4x+1, & if \ x>0 \end{cases}$ is continuous at $x=0$? What about continuity at $x=1$? (Average)

3. Find all the points of discontinuity of f, where $f(x)=\begin{cases} \dfrac{\sin x}{x}, & if \ x<0 \\ x+1, & if \ x \ge 0 \end{cases}$. (Average)

4. Determine if f defined by $f(x)=\begin{cases} x^2 \sin\dfrac{1}{x}, & if \ x \ne 0 \\ 0, & if \ x=0 \end{cases}$ is continuous a function? (Average)

5. Examine the continuity of f, where f is defined by $f(x)=\begin{cases} \sin x-\cos x, & if \ x \ne 0 \\ -1, & if \ x=0 \end{cases}$. (Easy)

6. Determine the value of k, if $f(x)=\begin{cases} \dfrac{k\cos x}{\pi-2x}, & if \ x \ne \dfrac{\pi}{2} \\ 3, & if \ x=\dfrac{\pi}{2} \end{cases}$ is continuous at $x=\dfrac{\pi}{2}$. (Easy)

7. Find the value of k if $f(x)=\begin{cases} kx^2, & if \ x \le 2 \\ 3, & if \ x>2 \end{cases}$ is continuous at $x=2$. (Easy)

8. Find the value of k so that the function $f(x)=\begin{cases} kx+1, & if \ x \le \pi \\ \cos x, & if \ x>\pi \end{cases}$, is continuous at $x=\pi$. (Easy)

9. Find the value of k so that the function $f(x)=\begin{cases} kx+1, & if \ x \le 5 \\ 3x-5, & if \ x>5 \end{cases}$, is a continuous at $x=5$. (Easy)

10. Find the values of $a \, and \, b$ such that $f(x)=\begin{cases} 5, & if \ x \le 2 \\ ax+b, & if \ 2<x<10 \\ 21, & if \ x \ge 10 \end{cases}$ is a continuous function.(Average)

ADDITIONAL QUESTIONS:

11. Find all points of discontinuity of f, where f is defined by: $f(x)=\begin{cases} 2x+3, & if \ x \le 2 \\ 2x-3, & if \ x>2 \end{cases}$ (Easy)

12. Find all points of discontinuity of f, where f is defined by: $f(x)=\begin{cases} |x|+3, & if \ x \le -3 \\ -2x, & if \ -3<x<3 \\ 6x+2, & if \ x \ge 3 \end{cases}$ (Average)

13. Find all points of discontinuity of f, where f is defined by: $f(x)=\begin{cases} x+1, & if \ x \ge 1 \\ x^2+1, & if \ x<1 \end{cases}$ (Easy)

14. Find all points of discontinuity of f, where f is defined by: $f(x)=\begin{cases} \dfrac{x}{|x|}, & if \ x<0 \\ -1, & if \ x \ge 0 \end{cases}$ (Average)

15. Find all points of discontinuity of f , where f is defined by: $f(x)=\begin{cases} \frac{|x|}{x}, & if \quad x\neq 0 \\ 0, & if \quad x=0 \end{cases}$ (Average)

16. Find all points of discontinuity of f , where f is defined by: $f(x)=\begin{cases} x^3-3, & if \quad x\leq 2 \\ x^2+1, & if \quad x>2 \end{cases}$ (Easy)

17. Find all points of discontinuity of f , where f is defined by: $f(x)=\begin{cases} x^{10}-1, & if \quad x\leq 1 \\ x^2, & if \quad x>1 \end{cases}$. (Easy)

18. Is the function defined by $f(x)=\begin{cases} x+5, & if \quad x\leq 1 \\ x-5, & if \quad x>1 \end{cases}$ a continuous function? (Easy)

19. Discuss the continuity of the function f , where f is defined by: $f(x)=\begin{cases} 3, & if \ 0\leq x\leq 1 \\ 4, & if \ 1<x<3 \\ 5, & if \ 3\leq x\leq 10 \end{cases}$

(Average)

20. Discuss the continuity of the function f ,where f is defined by: $f(x)=\begin{cases} 2x, & if \ x<0 \\ 0, & if \ 0\leq x\leq 1 \\ 4x, & if \ x>1 \end{cases}$

(Average)

21. Discuss the continuity of the function f ,where f is defined by: $f(x)=\begin{cases} -2, & if \ x\leq -1 \\ 2x, & if \ -1<x\leq 1 \\ 2, & if \ x>1 \end{cases}$

(Average)

22. If $x\sqrt{1+y}+y\sqrt{1+x}=0,\ for\ -1<x<1$ and $x\neq y$. Prove that $\frac{dy}{dx}=-\frac{1}{(1+x)^2}$. (Average)

23. Find $\frac{dy}{dx}$, if $y=(x)^{x^2-3}+(x-3)^{x^2}$, $for\, x>3$. (Average)

24. Find $\frac{dy}{dx}$, if $x^y+y^x=1$. (Average)

25. If $cos\, y=x\, cos(a+y)$ with $cos\, a\neq\pm 1$ prove that $\frac{dy}{dx}=\frac{cos^2(a+y)}{sin\, a}$ (Easy)

26. If $x=a\, cos^3\theta\ and\ y=a\, sin^3\theta,$ prove that $\frac{dy}{dx}=-\sqrt[3]{\frac{y}{x}}$. (Average)

27. Find $\frac{dy}{dx}$, if $x=a\left(\cos t+\log\tan\frac{t}{2}\right), y=a\sin t$. (Average)

FIVE MARKS QUESTIONS

1. If $y=3e^{2x}+2e^{3x}$, then prove that $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0.$ (Easy)

2. If $y=\sin^{-1}x$, then prove that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}=0.$ (Easy)

3. If $y=5\cos x-3\sin x$, then prove that $\frac{d^2y}{dx^2}+y=0.$ (Easy)

4. If $y=\cos^{-1}x$, *find* $\frac{d^2y}{dx^2}$ in terms if y alone (Average)

5. If $y=3\cos(\log x)+4\sin(\log x)$, show that $x^2 y_2+xy_1+y=0.$ (Easy)

6. If $y=Ae^{mx}+Be^{nx}$, prove that $\frac{d^2y}{dx^2}-(m+n)\frac{dy}{dx}+(mn)y=0.$ (Easy)

7. If $y=500e^{7x}+600e^{-7x}$, show that $y_2=49y.$ (Easy)

8. If $e^y(x+1)=1$, Prove that $\frac{dy}{dx}=-e^y$ hence prove that $\frac{d^2y}{dx^2}=\left(\frac{dy}{dx}\right)^2.$ (Average)

9. If $y=\left(\tan^{-1}x\right)^2$, show that $(1+x^2)^2y_2+2x(1+x^2)y_1=2.$ (Easy)

ADDITIONAL QUESTIONS:

10. If $y=e^{a\cos^{-1}x}$, $-1\le x\le 1$, show that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}-a^2y=0.$ (Difficult)

12. If $x=a(\cos t+t\sin t)$ and $y=a(\sin t-t\cos t)$, find $\frac{d^2y}{dx^2}$. (Difficult)

13. If $(x-a)^2+(y-b)^2=c^2$, *for some* $c>0$, prove that $\frac{\left(1+y_1^{\,2}\right)^{\frac{3}{2}}}{y_2}$ is a constant independent of a and b. (Difficult)

CHAPTER -06
APPLICATION OF DERIVATIVES

MCQ /FB questions:

1. The rate of change of the area of a circle with respect to its radius r when r = 5cm is.... cm^2/cm. (Average)

A) 10π B) 12π C) 8π D) 11π

2. The rate of change of the area of a circle with respect to its radius r when r = 4 cm is.... ....πcm^2/cm. (Average)

A) 10 B) 12 C) 8 D) 11

3. The total revenue in Rupees received from the sale of x units of a product is given by R (x)=$13x^2+26x-15$, then the marginal revenue when $x = 1$ is .... Rupees (Difficult)

A) 26 B) 13 C) 52 D) 104

4. The total revenue in rupees received from the sale of x units of a product is R (x) = $3x^2+36x+5$, then the marginal revenue when $x = 15$ is .... Rupees (Difficult)

A) 116 B) 96 C) 90 D) 126

5. The radius of circle is increasing at the rate of 0.7 cm/sec, then the rate of increase of its circumference is _____ π cm/sec (Easy)

A) 2 B) 1.4 C) 0.7 D) 4.9

6. The radius of an air bubble is increasing at the rate of $\frac{1}{2}$cm/s, then the volume of the bubble increasing when the radius is 1 cm is ____cc/sec (Average)

A) 2π B) 2 C) 2π D) 8π

7. The function $f(x)=\cos x$ is increasing in the interval...... (Average)

A) $\left(0,\frac{\pi}{2}\right)$ B) $(0,\pi)$ C) $\left(\frac{\pi}{2},\pi\right)$ D) $(\pi,2\pi)$

8. The function $f(x)=3x+17$ is strictly increasing on .... (Average)

A) $(-\infty,\infty)$ B) $(0,\infty)$ C) $(-\infty,0)$ D) $(0,3)$.

9. The interval in which $y=x^2e^{-x}$ is increasing is........ (Difficult)

A) $(-\infty,0)$ B) $(-\infty,0)\cup(2,\infty)$ C) $(2,\infty)$ D) $(0,2)$

10. The interval in which $y=x^2e^{-x}$ is decreasing is........ (Difficult)

a) $(-\infty,0)$ B) $(-\infty,0)\cup(2,\infty)$ C) $(2,\infty)$ D) $(0,2)$

11. The minimum value of $|x|$ in R is...... (Easy)

A) 0 B) 1 C) 2 D) does not exist.

12. The maximum value of the function $f(x)$ = $|x|$ *is.... in R.* (Average)

A) 0 B) 1 C) 2 D) does not exist.

13. The maximum values of the function given by $f(x) = x$, $x \in [0, 1]$ is ...... (Easy)

A) 0 B) 1 C) 2 D) does not exist.

14. The minimum values of the function given by $f(x) = x$, $x \in [0, 1]$ is ...... (Easy)

A) 0 B) 1 C) 2 D) does not exist.

15. For a function ' f ' defined on an interval I if $f'(c)=0$ *and* $f''(c)>0$ for some $c\in I$ then at 'c' the function f attains ___ (Average)

A) the absolute maximum value B) the absolute minimum value

C) a local maximum value. D) a local minimum value.

16. A stone is dropped into a quiet lake and waves move in circles at a speed of 4cm per second. At the instant, when the radius of the circular wave is 10 cm, the enclosed area is increasing at the rate of _____ cm^2/sec (Average)

A) 20π B) 40π C) 80π D) 60π

17. Point of minimum value of the function given by $f(x) = |x|$ *is* x = _____ (Average)

A) 1 B) 2 C) 0 D) does not exist

18. The number of points of local maxima and local minima of the function f given by $f(x) = x^3 - 3x + 3$ *is* ______ (Average)

A) 0 B) 1 C) 2 D) 3.

19. The absolute maximum value of the function f given by $f(x) = x^3$, $x \in [-2, 2]$ *is* = ___ (Average)

A) -2 B) 2 C) 0 D) 8.

20. The function f given by $f(x) = x^2 - x + 1$ is. (Average)

A) neither strictly increasing nor decreasing on $(-1, 1)$ B) decreasing on $\left(\frac{1}{2}, \infty\right)$

C) increasing on $(-\infty, \infty)$ D) increasing on $\left(-\infty, \frac{1}{2}\right)$

21. Which of the following functions is decreasing on $\left(0, \frac{\pi}{2}\right)$ (Average)

A) $\cos x$ B) $\sin x$ C) $\cos 3x$ D) $\tan x$

22. The function f given by $f(x) = x^2 + ax + 1$ is increasing on [1, 2], then (Difficult)

A) $a < -2$ B) $a < 2$ C) $a > -2$ D) $a < 0$

23. The function f given by $f(x) = log|sinx|$ is increasing on (Difficult)

A) $\left(0, \frac{\pi}{2}\right)$ B) $(0, \pi)$ C) $\left(\frac{\pi}{2}, \pi\right)$ D) $\left(\frac{3\pi}{2}, 2\pi\right)$

24. A cylindrical tank of radius 10 m is being filled with wheat at the rate of 314cubic meter per hour. Then the depth of the wheat is increasing at the rate of (Average)

A) 1 m/h B) 0.1 m/h C) 1.1 m/h D) 0.5 m/h

25. The maximum and minimum values of the function $|sin4x + 3|$ are respectively (Difficult)

A) 1,2 B) 4,2 C) 2,4 D) -1,1

26. On which of the following intervals is the function f given by $f(x) = x^{100} + \sin x - 1$ decreasing? (Difficult)

A) $\left(0, \frac{\pi}{2}\right)$ B) (0,1) C) $\left(\frac{\pi}{2}, \pi\right)$ D) $(0, \pi)$

27. If a function f is such that $f^{/}$ (c) = 0 and $f^{//}$(c) < 0 for some 'c' on an interval 'I', then at c the function f attains (Easy)

A) the absolute maximum value B) the absolute minimum value

C) a local maximum value D) a local minimum value

28. The edge of a cube is increasing at the rate of $5cm/\text{sec}$. How fast is the volume of the cube increasing when the edge is $12cm$ long (Average)

A) $432cm^3/\text{sec}$ B) $2160cm^3/\text{sec}$ C) $180cm^3/\text{sec}$ D) $5^3 \times 12cm^3/\text{sec}$

29. The radius of an air bubble is increasing at the rate of 1cm/s, then the volume of the bubble increasing when the radius is 1cm is _______ πcc/sec (Average)

30. Minimum value of f(x) = $|x + 2| - 1$ is ________ (Average)

31. Local maxima of f(x) = $\sin x + \cos x$, $0 < x < \pi$ is ________ (Average)

32. If x is a real, the minimum value of $x^2 - 8x + 17$ is _______ (Difficult)

33. The maximum value of $sinx.cosx$ is _________ (Average)

34. If $x + y = 10$, then the maximum value of xy ________ (Average)

35. **Assertion (A) :** The function $f(x) = x^2$ is decreasing in the interval $(0, \infty)$
Reason (R) : Any function $y = f(x)$ is decreasing, if $\frac{dy}{dx} < 0$ (Difficult)
A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true.

36. **Statement-1 :** Intervals in which the function $f(x) = x^2 - 4x + 6$ is increasing is $(2, \infty)$.
Statement-2: Let f be continuous on [a, b] and differentiable on the open interval (a, b). Then f is an increasing function in [a, b] if $f'(x) > 0$ for each $x \in (a, b)$. (Difficult)
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

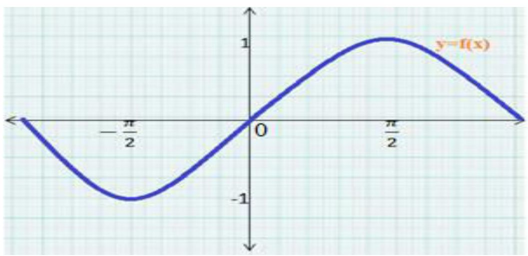
37. **Assertion (A):** A particle moving in a straight line covers a distance of x cm in t seconds, where $x = t^3 + 3t^2 - 6t + 18$. The velocity of particle at the end of 3 seconds is 9cm/s
Reason (R): Velocity of the particle at the end of 3 seconds is $\frac{dx}{dt}$ $at\ t = 3$ (Difficult)
A) A is false and R is true
B) A is true and R is false
C) A is true and R is true
D) A is false and R is false

38. **Statement-1:** The function $f(x) = x^3 - 12x$ is increasing in $(-\infty, -2) \cup (2, \infty)$.
Statement-2: For increasing function f in an open interval I , $f'(x) > 0$ for all $x \in I$. (Difficult)
A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

39. **Assertion (A):** The maximum value of the function $f(x) = x^5$, $x \in [-1, 1]$, is attained at its critical point, $x = 0$.
Reason (R): The local maximum or local minimum values of a function can only occur at turning points. (Difficult)
A) A is false and R is true
B) A is false and R is false
C) A is true and R is false
D) A is true and R is true.

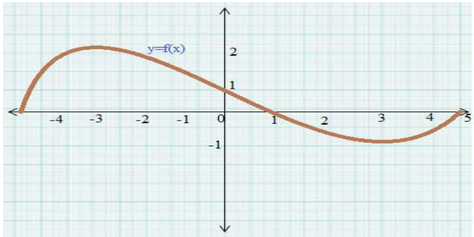
40. **Statement-1:** The rate of change of area of a circle with respect to its radius r when $r = 6$ cm is 12π cm^2 /cm.
Statement-2 : Rate of change of area of a circle with respect to its radius r is $\frac{dA}{dr}$, where A is the area of the circle. (Difficult)
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

41. The point of inflection for the following graph is (Difficult)



(A) $-\frac{\pi}{2}$ B) $\frac{\pi}{2}$
C) 0 D) point of inflection does not exist

42. The value of x for local maxima, local minima and inflection for the following graph of y = f(x) respectively are (Difficult)



A) −3, 3, 1
B) −3, 3, 0
C) -1, 0, 1
D) -3, 1, 3

43. ***Assertion (A)***: The maximum value of the function $f(x) = x^3$, $x \in [-1, 1]$, is attained at its end point, $x = 1$.
Reason (R): The function $f(x) = x^3$ is an increasing function in [-1, 1]. (Difficult)
A) Both A and R are true and R is the correct explanation for A
B) Both A and R are true but R is not the correct explanation for A.
C) A is false and R is true. D) Both A and R are false.

44. The absolute maximum value of $y = x^3 - 3x + 2$ in $0 \le x \le 2$ is (Average)
A) 0 B) 2 C) 4 D) 6

45. The function f(x) = x + cos x (for $x \neq n\pi$) is (Difficult)
A) Always increasing B) Always decreasing
C) Increasing for a certain range of x D) Decreasing for a certain range of x

46. Let the f: R → R be defined by f(x) = 2x + cos x , (for $x \neq n\pi$) then (Difficult)
1. f has a maximum value at x = 0 **2.** f is an increasing function **3.** f is a decreasing function
Which of the above statements are correct?
A) 1 only B) 2 only C) 3 only D) All 1, 2 and 3.

47. Consider the function
1.f(x) $= e^{-x}$ 2. f(x) $= x^2 - sinx$ 3.f(x) $= \sqrt{x^3+1}$
Which of the above functions is/ are increasing in [0,1] (Difficult)
A) 2 only B) 2 and 3 only C) 3 only D) 1 and 3 only.

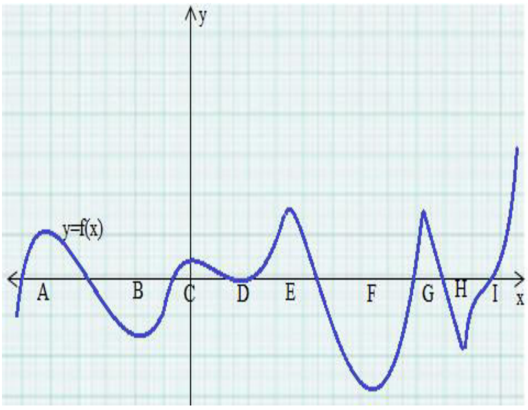
48. The point(s) on the curve $y = x^2$, at which y-coordinate is changing four times as fast as x- coordinate is/are (Average)
A) (4, 16) B) (2, 4) C) (-2, 4) D) (2, 4), (-2, 4).

49.The function $f(x) = x^5 - 5x^4 + 5x^3 - 1$ has (Average)
A) 1 critical point B) 2 critical points C) 3 critical points D) 4 critical points

50. The volume of a sphere is increasing at the rate of $\pi\ cm^3/sec$. The rate at which the radius is increasing is_____, when the radius is 3cm. (Average)
A) $\frac{1}{36}cm/sec$ B) $36cm/sec$ C) $9\ cm/sec$ D) $27cm/sec$

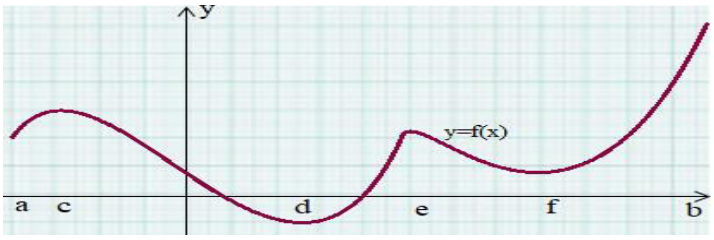
51. The function f(x) = x^x decreasing in (Average)
A) (0, e) B) (0, ∞) C) $(0, \frac{1}{e})$ D) (0, 1).

52. For the figure given below, consider the following statements 1,2 and 3 (Difficult)



Statement 1: f has local maximum values at x = C, E, G
Statement 2: f has local minimum values at x = D, F, H
Statement 3: f has neither local maximum nor local minimum value at x = D, I.
A) Statement 1 is true and Statement 2 and 3 are false.
B) Statement 1 and 2 are true but Statement 3 is false.
C) Statement 1and 3 are true but Statement 2 is false.
D) Statement 2 and 3 are true but Statement 1 is false.

53. For the figure given below, consider the following statements 1 and 2 (Difficult)



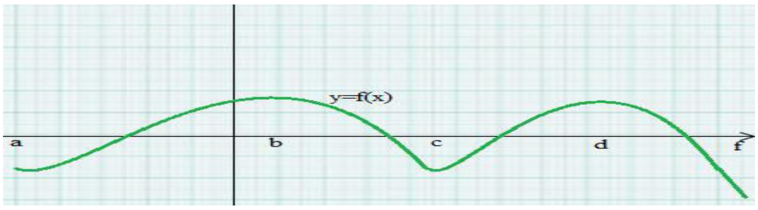
Statement 1: The absolute maximum value of the function $y= f(x)$, $x \in$ [a, b], is f(e)

Statement 2: The absolute minimum value of the function $y= f(x)$, $x \in$ [a, b], is f(d)

A) Statement 1 is true and 2 is false. B) Statement 1 is true and 2 is true

C) Statement 1 and 2 are false. D) Statement 1 is false and 2 is true.

54. For the figure given below, consider the following statements 1 and 2 (Difficult)



Statement 1: The function $y = f(x)$ is decreasing in the interval(b, c).

Statement 2: The absolute minimum value of the function $y = f(x)$, $x \in$ [a, f], is f(a).

A) Statement 1 is true and 2 is false B) Statement 1 and 2 are true

C) Statement 1 and 2 are false D) Statement 1 is false and 2 is true

55. The function $f(x) = tanx - x$ (Average)

A) always increases B) always decreases

C) never increases D) sometimes increases and sometimes decreases.

56. The maximum value of $3sinx + 4\,cosx$ is (Average)

A) 25 B) 5 C)$\sqrt{5}$ D) $\sqrt{7}$.

57. **Statement 1 :** The function $y = e^{-x}$ is ever increasing in the set of real numbers R.

Statement 2 : The function $y = log_e x$ is ever decreasing in $(0, \infty)$. (Difficult)

A) Statement 1 is false and Statement 2 is true

B) Statement 1 is true and Statement 2 is false

C) Both Statements 1 and 2 are true D) Both Statements 1 and 2 are false.

58. Consider the function f given by $f(x) = -x^2$

Statement 1: The function f is strictly increasing in $(-\infty, 0)$.

Statement 2: The function f is neither increasing nor decreasing in $(-\infty, \infty)$. (Difficult)

A) Statement 1 is false and Statement 2 is true

B) Statement 1 is true and Statement 2 is false

C) Both Statements 1 and 2 are true D) Both Statements 1 and 2 are false.

59. Consider the function f given by $f(x) = (x - 1)^3$

Statement 1:$x = 1$ is a point of inflection of f.

Statement 2: An interior critical point which is neither a point of local maxima nor a point of local minima is a point of inflection. (Difficult)

A) Statement 1 is false and Statement 2 is true

B) Statement 1 is true and Statement 2 is false

C) Statement 1 is true, statement 2 is true and statement 2 is a correct explanation for statement 1

D) Statement 1 is true, statement 2 is true and statement 2 is not a correct explanation for statement 1.

60. Consider the function f given by $f(x) = |x| + 3$

Statement 1: The critical point of f is 0.

Statement 2: Local minimum value of f at $x = 0$ is 3. (Difficult)

A) Statement 1 is false and Statement 2 is true

B) Statement 1 is true and Statement 2 is false

C) Both Statements 1 and 2 are true

D) Both Statements 1 and 2 are false

TWO MARK QUESTIONS

1. The radius of a circle is increasing at the rate of 0.7 cm/s. What is the rate of increase of its circumference? (Average)

2. The total cost $C(x)$ in Rupees, associated with the production of x units of an item is given by $C(x) = 0.005x^3 - 0.02x^2 + 30x + 5000$. Find the marginal cost when 3 units are produced, where by marginal cost we mean the instantaneous rate of change of total cost at any level of output. (Average)

3. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. Find the marginal revenue, when $x = 5$, where by marginal revenue we mean the rate of change of total revenue with respect to the number of items sold at an instant. (Average)

4. The total cost $C(x)$ in Rupees associated with the production of x units of an item is given by $C(x) = 0.007x^3 - 0.003x^2 + 15x + 4000$. Find the marginal cost when 17 units are produced. (Average)

5. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 13x^2 + 26x + 15$. Find the marginal revenue when $x = 7$. (Average)

6. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. Find the marginal revenue, when $x = 15$. (Average)

7. The total cost C(x) in Rupees, associated with the production of x units of an item is given by C(x) = 0.005 x^3 – 0.02 x^2+ 30x + 5000. Then the marginal cost when 3 units are produced, where by marginal cost we mean the instantaneous rate of change of total cost at any level of output, is _____ (Difficult)

8. The radius of a circle is increasing uniformly at the rate of $3\ cm/s$. Find the rate at which the area of the circle is increasing when the radius is $10\ cm$. (Easy)

9. Find the rate of change of the area of a circle with respect to its radius r when $r = 6\ cm$. (Easy)

10. A stone is dropped into a quiet lake and waves move in circles at a speed of 4cm per second. At the instant, when the radius of the circular wave is $10\ cm$, how fast is the enclosed area increasing? (Average)

11. Show that the function given by $f(x) = 7x - 3$ is increasing on R. (Easy)

12. Show that the function f given by $f(x) = x^3 - 3x^2 + 4x, x \in R$ is increasing on R. (Average)

13. Find the interval in which the function f given by $f(x) = 2x^2 - 3x$ is increasing. (Easy)

14. Show that the function given by $f(x) = \cos x$ is

(i) decreasing in $(0, \pi)$ **(ii)** increasing in $(\pi,\ 2\pi)$

(iii) neither increasing nor decreasing in $(0, 2\pi)$ (Each sub question carries 2 marks) (Easy)

15. Show that the function given by $f(x)=3x+17$ is increasing on R. (Easy)

16. Show that the function given by $f(x)=e^{2x}$ is increasing on R. (Average)

17. Show that the function given by $f(x)=\sin x$ is

(i) increasing in $\left(0,\frac{\pi}{2}\right)$ **(ii)** decreasing in $\left(\frac{\pi}{2},\pi\right)$

(iii) neither increasing nor decreasing in $(0,\pi)$ (Each sub question carries 2 marks) (Easy)

18. Find the intervals in which the function f given by $f(x)=2x^2-3x$ is

(i) strictly increasing. **(ii)** strictly decreasing (Each sub question carries 2 marks) (Average)

19. Prove that the logarithmic function is increasing on $(0,\infty)$. (Easy)

20. Show that the function given by $f(x)=\cos 2x$ is decreasing in $\left(0,\frac{\pi}{2}\right)$. (Easy)

21. Show that the function given by $f(x)=\cos 3x$ is decreasing in $\left(0,\frac{\pi}{3}\right)$. (Easy)

22. Show that the function given by $f(x)=\tan x$ is increasing in $\left(0,\frac{\pi}{2}\right)$. (Easy)

23. Prove that the function f given by $f(x)=x^3-3x^2+3x-100$ is increasing in R. (Average)

24. Prove that the function f given by $f(x)=x^2e^{-x}$ is increasing in $(0,2)$. (Average)

25. Find the maximum and the minimum values of the following functions f given by

(i) $f(x)=x^2,\ x\in R$. **(ii)** $f(x)=|x|,\ x\in R$ **(iii)** $f(x)=x,\ x\in(0,1)$ (Average)

(Each sub question carries 2 marks)

26. Prove that the following functions do not have maxima or minima.

(i) $g(x)=\log x$ **(ii)** $f(x)=e^x$ **(iii)** $h(x)=x^3+x^2+x+1$ (Average)

(Each sub question carries 2 marks)

27. It is given that at $x=1$, the function $f(x)=x^4-62x^2+ax+9$ attains its maximum value, on the interval $[0,2]$. Find the value of 'a'. (Difficult)

28. Find all points of local maxima and local minima of the following functions f given by

(i) $f(x)=x^3-3x+3$. **(ii)** $f(x)=2x^3-6x^2+6x+5$

(Each sub question carries 2 marks) (Average)

29. Find local minimum value of the function f given by $f(x)=3+|x|,\ x\in R$. (Easy)

30. Show that the function given by $f(x)=\dfrac{\log x}{x}$ has maximum at $x=e$. (Average)

31. At what points in the interval $[0,2\pi]$, does the function $\sin 2x$ attain its maximum value? (Average)

THREE MARK QUESTIONS

1. A balloon, which always remains spherical on inflation, is being inflated by pumping in 900 cubic centimeters of gas per second. Find the rate at which the radius of the balloon increases when the radius is 15 cm. (Average)

2. The radius of an air bubble is increasing at the rate of $\frac{1}{2}cm/s$. At what rate is the volume of the bubble increasing when the radius is $1\,cm$? (Average)

3. A balloon, which always remains spherical, has a variable diameter $\frac{3}{2}(2x+1)$. Find the rate of change of its volume with respect to x. (Average)

4. The length x of a rectangle is decreasing at the rate of $3\ cm/minute$ and the width y is increasing at the rate of $2\ cm/minute$. When $x = 10\ cm\ and\ y = 6\ cm$, find the rate of change of the perimeter. (Average)

5. The length x of a rectangle is decreasing at the rate of $3\ cm/minute$ and the width y is increasing at the rate of $2\ cm/minute$. When $x = 10\ cm\ and\ y = 6\ cm$, find the rate of change of the area of the rectangle. (Average)

6. The length x of a rectangle is decreasing at the rate of $5\ cm/minute$ and the width y is increasing at the rate of $4\ cm/minute$. When $x = 8\ cm$ and $y = 6\ cm$, find the rates of change of the area of the rectangle. (Average)

7. The length x of a rectangle is decreasing at the rate of $5\ cm/minute$ and the width y is increasing at the rate of $4\ cm/minute$. When $x = 8\ cm$ and $y = 6\ cm$, find the rates of change of the perimeter. (Average)

8. The volume of a cube is increasing at the rate of $8\ cm^3/s$. How fast is the surface area increasing when the length of an edge is $12\ cm$? (Difficult)

9. The volume of a cube is increasing at a rate of 9 cubic centimeters per second. How fast is the surface area increasing when the length of an edge is 10 centimeter? Average)

10. An edge of a variable cube is increasing at the rate of $3\ cm/s$. How fast is the volume of the cube increasing when the edge is $10\ cm$ long? (Average)

11. A car starts from a point P at time $t = 0$ seconds and stops at point Q. The distance x, in meters, covered by it, in t seconds is given by $x = t^2\left(2 - \frac{t}{3}\right)$.

Find the time taken by it to reach Q (Difficult)

12. Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is
(i) strictly increasing **(ii)** strictly decreasing (Easy)

13. Find the intervals in which the function f given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is
(i) strictly increasing **(ii)** strictly decreasing (Average)

14. Find intervals in which the function given by $f(x) = \sin 3x,\ x \in \left[0, \frac{\pi}{2}\right]$ is

(i) increasing **(ii)** decreasing (Easy)

15. Find the intervals in which the function f given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ is decreasing. (Average)

16. Find the intervals in which the function f given by $10 - 6x - 2x^2$ is
(i) increasing **(ii)** decreasing (Average)

17. Find the intervals in which the function f given by $6 - 9x - x^2$ is increasing. (Average)

18. Prove that the function f given by $f(x) = x^2 - x + 1$ is neither increasing nor decreasing on $(-1, 1)$. (Average)

19. Show that the function given by $f(x) = x^{100} + \sin x - 1$ is

(i) increasing in $(0,1)$ **(ii)** increasing in $\left(\frac{\pi}{2}, \pi\right)$ **(iii)** increasing in $\left(0, \frac{\pi}{2}\right)$ (Average)

20. Find the least value of 'a'such that the function f given by $f(x) = x^2 + ax + 1$ is increasing on $(1, 2)$. (Average)

21. Prove that the function f given by $f(x)=\log(\sin x)$ is increasing on $\left(0,\frac{\pi}{2}\right)$ and decreasing on $\left(\frac{\pi}{2},\pi\right)$. (Average)

22. Prove that the function f given by $f(x)=\log(\cos x)$ is decreasing on $\left(0,\frac{\pi}{2}\right)$ and increasing on $\left(\frac{\pi}{2},\pi\right)$. (Average)

23. Find the intervals in which the function f given by $f(x)=\sin x+\cos x$, $0\le x\le 2\pi$ is increasing or decreasing. (Average)

24. Find the intervals in which the following functions are increasing or decreasing:
(i) $-2x^3-9x^2-12x+1$ **(ii)** $(x+1)^3(x-3)^3$. (Difficult)

25. Show that $y=\log(1+x)-\frac{2x}{2+x}$, $x>-1$, is an increasing function of x throughout its domain. (Difficult)

26. Find the values of x for which $y=\left[x(x-2)\right]^2$ is an increasing function. (Average)

27. Prove that $y=\frac{4\sin\theta}{(2+\cos\theta)}-\theta$ is an increasing function of θ in $\left[0,\frac{\pi}{2}\right]$. (Difficult)

28. Find intervals in which the function given by $f(x)=\frac{3}{10}x^4-\frac{4}{5}x^3-3x^2+\frac{36}{5}x+11$ is (Difficult)
(a) increasing **(b)** decreasing.

29. Show that the function f given by $f(x)=\tan^{-1}(\sin x+\cos x)$, $x>0$ is always an increasing function in $\left(0,\frac{\pi}{4}\right)$. (Difficult)

30. Find the intervals in which the function f given by $f(x)=\frac{4\sin x-2x-x\cos x}{2+\cos x}$ is
(i) increasing **(ii)** decreasing. (Difficult)

31. Find the intervals in which the function f given by $f(x)=x^3+\frac{1}{x^3}$, $x\neq 0$ is
(i) increasing **(ii)** decreasing. (Average)

32. Find local maximum and local minimum values of the function f given by $f(x)=3x^4+4x^3-12x^2+12$. (Average)

33. Find the maximum and minimum values, if any, of the function given by (Easy)

(i) $f(x)=(2x-1)^2+3$ **(ii)** $f(x)=9x^2+12x+2$ **(iii)** $f(x)=-(x-1)^2+10$

(iv) $g(x)=x^3+1$ **(v)** $f(x)=|x+2|-1$ **(vi)** $g(x)=-|x+1|+3$

(vii) $h(x)=\sin(2x)+5$ **(viii)** $h(x)=|\sin 4x+3|+5$ **(ix)** $h(x)=x+1,\ x\in(-1,1)$

(Each sub question carries 3 marks)

34. Find both the maximum value and the minimum value of $3x^4-8x^3+12x^2-48x+25$ on the interval $[0,3]$. (Difficult)

35. Find two positive numbers whose sum is 15 and the sum of whose squares is minimum. (Average)

36. Find two numbers whose sum is 24 and whose product is as large as possible. (Average)

37. Find two positive numbers x *and* y such that $x+y=60$ and xy^3 is maximum. (Difficult)

38. Find two positive numbers x *and* y such that their sum is 35 and the product x^2y^5 is a maximum. (Difficult)

39. Find two positive numbers whose sum is 16 and the sum of whose cubes is minimum (Difficult)

40. Find the local maxima and local minima of the function $g(x) = x^3 - 3x$. Also find the local maximum and the local minimum values. (Average)

41. Find the local maxima and local minima of the function $f(x) = x^2$. Also find the local maximum and the local minimum values. (Average)

42. Find the local maxima and local minima of the function $g(x) = \frac{x}{2} + \frac{2}{x},\ x > 0$.
Also find the local maximum and the local minimum values. (Average)

43. Find the local maxima and local minima of the function $f(x) = \sin x - \cos x,\ 0 < x < 2\pi$.
Also find the local maximum and the local minimum values. (Average)

44. Find the local maxima and local minima of the function $f(x) = x\sqrt{1-x},\ 0 < x < 1$.
Also find the local maximum and the local minimum values. (Difficult)

45. Find the local maxima and local minima of the function $g(x) = \frac{1}{x^2+2}$.
Also find the local maximum and the local minimum values. (Average)

46. Find the absolute maximum value and the absolute minimum value of the function
$f(x) = (x-1)^2 + 3,\ x \in [-3, 1]$. (Average)

47. Find the absolute maximum value and the absolute minimum value of the function
$f(x) = x^3,\ x \in [-2, 2]$. (Average)

48. Find the absolute maximum and minimum values of a function $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval $[1, 5]$. (Average)

49. Find the absolute maximum value and the absolute minimum value of the function
$f(x) = \sin x + \cos x,\ x \in [0, \pi]$. (Average)

50. Find the absolute maximum and the absolute minimum values of the function f given by
$f(x) = \cos^2 x + \sin x,\ x \in [0, \pi]$. (Difficult)

51. Find the maximum profit that a company can make, if the profit function is given by
$p(x) = 41 - 72x - 18x^2$. (Average)

52. Find the maximum value of $2x^3 - 24x + 107$ in the interval $[1, 3]$. (Average)

53. Find the maximum and minimum values of $x + \sin 2x$ on $[0, 2\pi]$. (Average)

54. For all real values of x, find the minimum value of $\frac{1-x+x^2}{1+x+x^2}$. (Difficult)

ADDITIONAL QUESTIONS

1. A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi-vertical angle is $\tan^{-1}(0.5)$. Water is poured into it at a constant rate of 5 cubic meter per hour. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 4m. (Difficult)
2. A sand is pouring from a pipe at the rate of $12cm^3/s$. The falling sand form a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is $4cm$? (Difficult)
3. A ladder $5m$ long is leaning against a wall. The bottom of the ladder is Pulled along the ground, Away from the wall at the rate of $2m/sec$.How fast is its height on the wall decreasing when the foot of the ladder is $4m$ away from the wall? (Difficult)
4. A ladder 24 feet long leans against a vertical wall. The lower end is moving away at the rate of 3feet/sec. find the rate at which the top of the ladder is moving downwards, if its foot is 8feet from the wall. (Difficult)
5. A man of height 2 meters walks at a uniform speed of 5 km/hour, away from a lamp post which is 6 meters high. Find the rate at which the length of the his shadow increases. (Difficult)
6. A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the $y-$coordinate is changing 8 times as fast as the $x-$coordinate. (Average)
7. If length of three sides of a trapezium other than base are equal to 10cm, then find the area of the trapezium when it is maximum. (Difficult)
8. Prove that the radius of the right circular cylinder of greatest curved surface area which can be inscribed in a given cone is half of that of the cone. (Difficult)
9. An Apache helicopter of enemy is flying along the curve given by $y = x^2 + 7$. A soldier, placed at $(3,7)$, wants to shoot down the helicopter when it is nearest to him. Find the nearest distance. (Difficult)
10. A square piece of tin of side 18 cm is to be made into a box without top, by cutting a square from each corner and folding up the flaps to form the box. What should be the side of the square to be cut off so that the volume of the box is the maximum possible. (Difficult)
11. A rectangular sheet of tin $45\ cm$ by $24\ cm$ is to be made into a box without top, by cutting off square from each corner and folding up the flaps. What should be the side of the square to be cut off so that the volume of the box is maximum ? (Difficult)
12. Show that of all the rectangles inscribed in a given fixed circle, the square has the maximum area. (Difficult)
13. Show that the right circular cylinder of given surface and maximum volume is such that its height is equal to the diameter of the base. (Difficult)
14. A wire of length $28\ m$ is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined area of the square and the circle is minimum? (Difficult)
15. Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere. (Difficult)
16. Show that the right circular cone of least curved surface area and given volume has an altitude equal to $\sqrt{2}$ time the radius of the base. (Difficult)

17. Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$. (Difficult)

18. An open topped box is to be constructed by removing equal squares from each corner of a 3 meter by 8 meter rectangular sheet of aluminum and folding up the sides. Find the volume of the largest such box. (Difficult)

19. Find the maximum area of an isosceles triangle inscribed in the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with its vertex at one end of the major axis. (Difficult)

20. The sum of the perimeter of a circle and square is k, where k is some constant. Prove that the sum of their areas is least when the side of square is double the radius of the circle. (Difficult)

21. A window is in the form of a rectangle surmounted by a semicircular opening. The total perimeter of the window is $10\ m$. Find the dimensions of the window to admit maximum light through the whole opening. (Difficult)

22. Show that the altitude of the right circular cone of maximum volume that can be inscribed in a sphere of radius r is $\frac{4r}{3}$. (Difficult)

23. Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume. (Difficult)

24. Find the point on the curve $x^2 = 2y$ which is nearest to the point $(0,5)$. (Average)

CHAPTER -7
INTEGRALS

MCQ /FB questions:

1. If $\int f(x)\ dx = F(x)$+C, then (Easy)

A) $f(x)$ is called primitive or anti derivative
B) $\frac{d}{dx}(F(x)) = f(x)$
C) F(x) is called Integrand
D) C is any integer.

2. The anti-derivative of $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)$ is equal to (Easy)

A) $\frac{1}{3}x^{\frac{1}{3}} + 2x^{\frac{1}{2}} + c$
B) $\frac{2}{3}x^{\frac{2}{3}} + \frac{1}{2}x^2 + c$
C) $\frac{2}{3}x^{\frac{3}{2}} + 2x^{\frac{1}{2}} + c$
D) $\frac{3}{2}x^{\frac{3}{2}} - \frac{1}{2}x^{\frac{1}{2}} + c$

3. $\int x^2 e^{x^3} dx =$ (Average)

A) $\frac{1}{3}e^{x^3} + c$ B) $\frac{1}{3}e^{x^2} + c$ C) $\frac{1}{2}e^{x^3} + c$ D) $\frac{1}{2}e^{x^2} + c$

4. $\int \left(x^{3/2} + 2e^x - \frac{1}{x}\right)\ dx$= (Average)

A) $\frac{2x^{5/2}}{5} + 2e^x - \log|x| + C$
B) $\frac{2x^{5/2}}{5} + 2e^x + \log|x| + C$
C) $\frac{5x^{5/2}}{2} + 2e^x - \log|x| + C$
D) $\frac{5x^{5/2}}{2} + 2e^x + \log|x| + C$.

5. $\int \left(x^{2/3} + 5\right)\ dx$= (Easy)

A) $\frac{3x^{5/3}}{5} + C$ B) $\frac{3x^{5/3}}{5} + 5x + C$ C) $\frac{5x^{5/2}}{3} + 5x + C$ D) $\frac{5x^{5/2}}{3} + C$.

6. $\int (4e^x + 1)\ dx$ (Easy)

A) $4e^x + 1 + C$ B) $4e^x + C$ C) $4e^x + x + C$ D) $\frac{e^x}{4} + x + C$

7. $\int (\cos x - \sin x)dx =$ (Easy)

A) $\sin x - \cos x + C$ B) $\sin x + \cos x + C$ C) $-\sin x - \cos x + C$ D) $-\sin x + \cos x + C$

8. $\int (2x - 3\cos x + e^x)dx$ is (Average)

A) $x^2 + 3sinx + e^x + C$
B) $x^2 - 3sinx + e^x + C$
C) $x^2 + sinx + e^x + C$
D) $2x^2 - 3sinx + e^x + C$

9. $\int (ax^2 + bx + c)dx$ is (Average)

(A) $\frac{ax^3}{3} + \frac{bx^2}{2} + c + C$ (B) $\frac{ax^3}{3} + \frac{bx^2}{2} + C$ (C) $\frac{ax^3}{3} + \frac{bx^2}{2} + cx + C$ (D) $\frac{ax^3}{3} + \frac{bx^2}{2} + cx$

10. $\int (1-x)\sqrt{x}dx$ (Average)

A) $\frac{3x^{\frac{3}{2}}}{2} - \frac{2x^{\frac{5}{2}}}{5} + C$ B) $\frac{2x^{\frac{3}{2}}}{3} - \frac{2x^{\frac{5}{2}}}{5} + C$ C) $\frac{2x^{\frac{3}{2}}}{3} - \frac{5x^{\frac{5}{2}}}{2} + C$ D) $\frac{3x^{\frac{3}{2}}}{2} - \frac{5x^{\frac{5}{2}}}{2} + C$

11. The anti-derivative of $\frac{1}{\sqrt{x^2-a^2}}$w .r .t x is equal to (Average)

A) $\frac{1}{2a}log\left|\frac{a+x}{a-x}\right| + C$ B) $\frac{1}{2}log\left|\frac{x-a}{x+a}\right| + C$ C) $log\left|x + \sqrt{x^2 - a^2}\right| + C$ D) $\sin^{-1}\frac{x}{a} + C$

12. The anti-derivative of $\frac{1}{\sqrt{a^2-x^2}}$ (Easy)

A) $\sin^{-1}\frac{x}{a} + C$ B) $\cos^{-1}\frac{x}{a} + C$ C) $\frac{1}{a}\sin^{-1}\frac{x}{a} + C + C$ D) $cosec^{-1}\frac{x}{a} + C$

13. The anti-derivative of $\frac{1}{x\sqrt{x^2-1}}, x>1$ with respect to x (Easy)

A) $\sin^{-1} x + C$ B) $\cos^{-1} x + C$ C) $\mathrm{cosec}^{-1} x + C$ D) $sec^{-1}x + C$

14. $\int\left(x^2\left(1-\frac{1}{x^2}\right)\right)dx =$ (Average)

A) $\frac{x^3}{3} - 1 + C$ B) $\frac{x^3}{3} + x + C$ C) $\frac{x^2}{2} + x + C$ D) $\frac{x^3}{3} - x + C$

15. $\int \frac{dx}{x^2+2x+2} =$ (Difficult)

A) $x\tan^{-1}(x+1) + c$ B) $\tan^{-1}(x+1) + c$

C) $(x+1)\tan^{-1}(x+1) + c$ D) $\tan^{-1}(x) + c$

16. The anti-derivative of sin2x with respect to x (Easy)

A) $cos\, 2x + C$ B) $\frac{1}{2}cos2x + C$ C) $-cos\, 2x + C$ D) $-\frac{1}{2}cos2x + C$

17. $\int \mathrm{cosec}\, x\,(\mathrm{cosec}\, x + \cot x)\; dx =$ (Average)

A) $-\cot x - \mathrm{cosec}\, x + \mathrm{C}$ B) $\cot x - \mathrm{cosec}\, x + \mathrm{C}$

C) $-\cot x + \mathrm{cosec}\, x + \mathrm{C}$ D) $\cot x + \mathrm{cosec}\, x + \mathrm{C}$

18. $\int \tan^2 2x$ dx is (Average)

A) sec2x - x +C B) $\frac{sec2x}{2}$ + x+C C) $\frac{tan2x}{2}$ – x +C D) $\frac{tan(2x)}{2}$ + x + C

19. $\int \frac{1-x}{\sqrt{x}}dx$ is (Average)

A) $2\sqrt{x} + \frac{3x^{\frac{3}{2}}}{2} + \mathrm{C}$ B) $2\sqrt{x} - \frac{2x^{\frac{3}{2}}}{3} + \mathrm{C}$ C) $2\sqrt{x} + \frac{3x^{\frac{3}{2}}}{2} + \mathrm{C}$ D) $2\sqrt{x} - \frac{3x^{\frac{3}{2}}}{2} + \mathrm{C}$

20. The anti derivative of $x^2\left(3+\frac{2}{x}\right)$ with respect to x. (Average)

A) $x^3 + x^2 + C$ B) $\frac{x^3}{3} + x + C$ C) $3\,x^3 + 2x^2 + C$ D) $\frac{3x^3}{3} + \frac{2x^2}{2} + x + C$

21. $\int \frac{x^3+5x^2-4}{x^2}dx =$ (Average)

A) $\frac{x^2}{2} + 5x - 4\log|x^2| + \mathrm{C}$ B) $\frac{x^2}{2} + 5x - \frac{4}{x} + \mathrm{C}$ C) $\frac{x^2}{2} + 5x + \frac{4}{x} + \mathrm{C}$ D) $\frac{x^2}{2} + 5x - \frac{8}{x^3} + \mathrm{C}$.

22. $\int \frac{x^3-x^2+x-1}{x-1}dx$ is (Difficult)

A) $x^2 + x + C$ B) $\frac{x^3}{3} + x + C$ C) $\frac{x^3}{3} - x + C$ D) $\frac{x^3}{3} + \frac{x^2}{2} + x + C$

23. $\int \sqrt{x}(3x^2+2x+3)dx$ = (Average)

A) $\frac{6x^{5/2}}{5} + \frac{4x^{3/2}}{3} + \frac{6x^{1/2}}{1} + \mathrm{C}$ B) $\frac{6x^{7/2}}{7} + \frac{4x^{5/2}}{5} + \frac{6x^{3/2}}{3} + \mathrm{C}$

C) $\frac{6x^{7/2}}{2} + \frac{4x^{5/2}}{2} + \frac{6x^{3/2}}{2} + \mathrm{C}$ D) $\frac{21x^{7/2}}{2} + \frac{10x^{5/2}}{2} + \frac{9x^{3/2}}{2} + \mathrm{C}$

24. $\int (2x^2 - 3\sin x + 5\sqrt{x})dx =$ (Average)

A) $\frac{2x^3}{3} - 3\cos x + \frac{10x^{3/2}}{3} + \mathrm{C}$ B) $\frac{2x^3}{3} + 3\cos x + \frac{10x^{3/2}}{3} + \mathrm{C}$

C) $\frac{2x^3}{3} - 3\cos x + \frac{5x^{3/2}}{3} + \mathrm{C}$ D) $\frac{2x^3}{3} + 3\cos x + 10\sqrt{x} + \mathrm{C}$

25. $\int \frac{(1-\sin x)dx}{\cos^2 x} =$ (Average)

A) $secx - tanx + C$ B) $secx + tanx + C$ C) $tanx - secx + C$ D) $-(secx + tanx) + C$

26. $\int \frac{sin^2x-cos^2x}{sin^2x\, cos^2x}dx$ is equal to (Average)

A) tanx + cotx + c
B) tanx + cosecx + c
C) - tanx + cotx + c
D) tanx + secx + c

27. $\int(\frac{x^3-1}{x^2})dx$ equals (Average)

A) $\frac{x^2}{2}-\frac{1}{x}+C$ B) $\frac{x^2}{2}+\frac{1}{x}+C$ C) $\frac{x^2}{2}+\frac{2}{x}+C$ D) $\frac{x^2}{2}-\frac{2}{x}+C$

28. $\int \sec x(\sec x+\tan x)dx=$ (Average)

A) $secx - tanx + C$ B) $tanx + secx + C$ C) $tanx - secx + C$ D) $-(secx + tanx) + C$

29. The anti-derivative of sin $2x$ – 4 e^{3x} w .r. t x (Average)

A) $\frac{-cos2x}{2}$ - 4$\frac{e^{3x}}{3}$ +C B) $\frac{cos2x}{2}$ - 4$\frac{e^{3x}}{3}$ +C C) $2cos2x-12e^{3x}$ +C D) $\frac{sin(2x)}{2}$ - 4$\frac{e^{3x}}{3}$ + C

30. $\int \sqrt{1+\sin 2x}dx$ = (Average)

A) $cos\, x - sinx + C$ B) $sinx - cosx + C$ C) $sinx + cosx + C$ D) $-(sinx + cosx) + C$

31. $\int \frac{\sec^2 x}{\cos ec^2 x}dx=$ (Difficult)

A) secx − x + C B) tanx + x + C C) secx + x + C D) tanx − x + C

32. $\int \frac{e^x(1+x)}{sin^2(xe^x)}dx=$ (Difficult)

A) $cot(xe^x)+C$ B) $-cosec(xe^x)+C$ C) $-tan(xe^x)+C$ D) $-cot(xe^x)+C$

33. $\int \frac{dx}{x^2+x-2}=$ (Difficult)

A) $\frac{1}{3}log\left|\frac{x+2}{x-1}\right|+C$ B) $\frac{1}{3}log\left|\frac{x-1}{x+2}\right|+C$ C) $\frac{1}{3}log\left|\frac{x-2}{x+1}\right|+C$ D) $\frac{1}{3}log\left|\frac{x+1}{x-2}\right|+C.$

34. $\int \frac{\sin^2 x}{1+\cos x}dx=$ (Average)

A) $x-sinx+C$ B) $x+sinx+C$ C) $x+cosx+C$ D) $x-cosx+C$

35. $\int \frac{cos^2x}{1+sinx}dx$ = (Average)

A) $x-sinx+C$ B) $x+sinx+C$ C) $x+cosx+C$ D) $x-cosx+C$

36. $\int \frac{1}{\sin^2 x\cos^2 x}dx=$ (Average)

A) $tanx - cotx + C$ B) $tanx + cotx + C$ C) $secx - cosecx + C$ D) $-cotx - tanx + C$

37. $\int \frac{2sinx-3cosx}{2cosx+3sinx}dx=$ (Difficult)

A) log(2cosx+3sinx)+C
B) log(2cosx-3sinx)+C
C) -log(2cosx+3sinx)+C
D) - log(2sinx -3cosx)+C

38. $\int \frac{dx}{x^2-16}=$ (Easy)

A) $\tan^{-1}(\frac{x}{4})$ +C B) $\frac{1}{8}\log\left|\frac{x-4}{x+4}\right|$ +C C) $\frac{1}{4}\log\left|\frac{x-4}{x+4}\right|$ +C D) $\frac{1}{8}\log\left|\frac{4+x}{4-x}\right|$ +C

39. $\int \sqrt{ax+b}dx$ = (Average)

A) $2\sqrt{ax+b}+C$ B) $\frac{1}{2\sqrt{ax+b}}+C$ C) $\frac{(ax+b)^{\frac{3}{2}}}{a}+C$ D) $\frac{2(ax+b)^{\frac{3}{2}}}{3a}+C.$

40. $\int \frac{\sin(\tan^{-1} x)}{1+x^2} dx =$ (Average)

A) $-\cos(x^2+1)+C$ B) $\cos(x^2+1)+C$ C) $-cos(\tan^{-1} x)+C$ D) $cos(\tan^{-1} x)+C$

41. $\int \frac{10x^9+10^x \log_e 10}{x^{10}+10^x} dx =$ (Average)

A) $10\, log|x^{10}+10^x|+C$ B) $\frac{1}{10} log|x^{10}+10^x|+C$ C) $log|x^9+10^x|+C$ D) $\log|x^{10}+10^x| + C$

42. $\int \frac{2-3\sin x}{\cos^2 x} dx =$ (Average)

A) 2tanx - 3 secx +C B) 2tanx+3secx + C C) 2tanx - 2secx+C D) 2secx -3tanx+C

43. $\int \left(\sqrt{x}-\frac{1}{\sqrt{x}}\right)^2 dx =$ (Difficult)

A) $\frac{x^2}{2}+\log|x|+2x+C$ B) $\frac{x^2}{2}+\log|x|-2x+C$

C) $\frac{x^2}{2}-\log|x|+2x+C$ D) $\frac{x^2}{2}-\log|x|-2x+C$

44. $\int \sqrt{1+x^2}\, dx =$ (Average)

A) $\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\log\left|x+\sqrt{1+x^2}\right|+C$ B) $\frac{x}{2}\sqrt{1+x^2}-\frac{1}{2}\log\left|x+\sqrt{1+x^2}\right|+C$

$C)$ $\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\log\left|x-\sqrt{1+x^2}\right|+C$ D) $\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\sin^{-1} x+C$

45. $\int \frac{dx}{x^2-6x+13} =$ (Difficult)

A) $\tan^{-1}(\frac{x-3}{2})$ +C B) $\frac{1}{4}\log\left|\frac{x-3}{x+3}\right|$ +C C) $\frac{1}{2}\tan^{-1}(\frac{x-3}{2})$ +C D) $\frac{1}{4}\log\left|\frac{3+x}{3-x}\right|$ +C

46. $\int \frac{2x}{1+x^2} dx =$ (Average)

A) $2\tan^{-1}x$ +C B) $\log|1+x^2|$ +C C) $\tan^{-1}(x)$ +C D) $2\log|1+x^2|$ +C

47. $\int \frac{(\log x)^2}{x} dx =$ (Average)

A) $\frac{(logx)^3}{3}$ + C B) $\frac{(logx)^2}{3x}$ +logx + C C) $\frac{(logx)^2}{2}$ +C D) $2(logx)^3+\frac{1}{x}$ +C

48. $\int \frac{e^{\tan^{-1} x}}{1+x^2} dx =$ (Average)

A) $\frac{e^{tan^{-1}x}}{1+x^2}$ + C B) $\frac{1}{2}\left(e^{tan^{-1}x}\right)^2$ + C C) $e^{tan^{-1}x}$ + C D) $\frac{1}{1+x^2}$ +C

49. $\int \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx =$ (Average)

A) $\frac{1}{\sqrt{1-x^2}}$ + C B) $\frac{1}{2}(sin^{-1}x)$ + C C) $\frac{sin^{-1}x}{\sqrt{1-x^2}}$ + C D) $\frac{(sin^{-1}x)^2}{2}+C.$

50. $\int sec^2(7-4x)dx=$ (Average)

A) $\tan(7-4x)$+C B) $-\frac{1}{4}\tan(7-4x)$+C C) $\frac{1}{4}\tan(7-4x)$ +C D) $-\frac{1}{4}\sec(7-4x)\tan(7-4x)$ +C

51. $\int \frac{cosx}{\sqrt{1+sinx}} dx=$ (Average)

A) $\frac{\cos^2 x}{2}$+C B) $2\sqrt{1+\sin x}$+C C) $\frac{1}{2}\sqrt{1+\sin x}$ +C D $\sqrt{1+\sin x}$ +C

52. $\int \frac{1}{1-\cos x} dx =$ (Difficult)

A) $-\cot x-\operatorname{cosec} x$ + C B) $\cot x - \operatorname{cosec} x$ + C C) $-\cot x + \operatorname{cosec} x$ + C D) $\cot x + \operatorname{cosec} x$ + C

53. $\int \sin 2x \cos 3x dx$ = (Difficult)

A) $\frac{sin5x}{5} + sinx$ + C B) $\frac{1}{2}\left(-\frac{\cos 5x}{5} + \cos x\right)$ + C

C) $\frac{\cos 5x}{5} + \cos x$ + C D) $\frac{1}{2}[-\frac{\cos 5x}{5} - \cos x] + C$.

54. $\int \frac{x-1}{\sqrt{x^2-1}} dx$ = (Difficult)

A) $\sqrt{x^2-1}$ + $\log|x + \sqrt{x^2-1}| + C$ B) $\sqrt{x^2-1} - \log|x + \sqrt{x^2-1}| + C$

C) $\frac{2}{3}(x^2-1)^{\frac{3}{2}}$ +$\log|x + \sqrt{x^2-1}| + C$ D) $2\sqrt{x^2-1} - \log|x + \sqrt{x^2-1}| + C$

55. $\int x \sin x dx$ = (Average)

A) –x cos x – sin x + C B) xcos x − sin x + C C) −xcos x + sin x + C D) xcos x + sin$x$ + C

56. $\int e^x(x^5 + 5x^4 + 1)\,dx$ (Average)

A) $e^{x+1}.x^5 + C$ B) $5x^4e^x$+C C) $e^x x^5 + C$ D) $e^x(\boldsymbol{x^5} + 1) + C$.

57. $\int xe^x dx$ is (Average)

A) $xe^x + e^x + C$ B) $xe^x - e^x + C$ C) $x+e^x + C$ D) $x^2+e^x + C$

58. $\int x \cos x \, dx$ = (Average)

A) –x sin$x$ + cos x + C B) xcos x − sin x + C C) xsin x − cos x + C D) xsin x + cos x + C

59. $\int \frac{3\cos x + 4}{\sin^2 x} dx$ = (Average)

A) -3cosecx – 4cotx +C B) 4cotx+3cosecx + C

C) -3cosecx + 4cotx +C D) 3cosecx – 4cotx +C

60. $\int \frac{x^3 + 3x + 4}{\sqrt{x}} dx$ is (Average)

A) $\frac{3x^{\frac{3}{2}}}{2} + \frac{6x^{\frac{5}{2}}}{5} + 4\sqrt{x} + C$ B) $\frac{2x^{7/2}}{7} + \frac{6x^{3/2}}{3} + 8\sqrt{x} + C$

C) $\frac{7x^{7/2}}{2} + \frac{9x^{3/2}}{2} + \frac{2}{\sqrt{x}} + C$ D) $\frac{2x^{\frac{5}{2}}}{5} + \frac{3x^{3/2}}{2} + 8\sqrt{x} + C$

61. $\int \log x \, dx$ = (Average)

A) xlogx + x + C B) logx + x + C C) xlogx − x + C D) xlogx $-\frac{x^2}{2}$ + C

62. $\int e^x \sec x(1+\tan x) dx$ = (Average)

A) $e^x secx + C$ B) $e^x sec^2 x + C$ C) $e^x tanx + C$ D) $e^x(\mathbf{1} + tanx) + C$.

63. $\int e^x(sinx + cosx)dx$= (Easy)

A) $e^x cosx + C$ B) $e^x sinx + C$ C) $e^x tanx + C$ D) $e^x(sinx + cosx) + C$.

64. $\int e^x\left(\frac{1}{x} - \frac{1}{x^2}\right) dx$ (Easy)

A) $\frac{e^x}{x^2} + C$ B) $xe^x + C$ C) $\frac{e^x}{x} + C$ D) $x^2e^x + C$.

65. $\int x^2 e^{x^3} dx =$ (Average)

A) $\frac{1}{3}e^{x^2} + C$ B) $\frac{1}{3}e^{x^3} + C$ C) $\frac{1}{2}e^{x^2} + C$ D) $\frac{1}{2}e^{x^3} + C$

66. $\int e^x\left(\tan^{-1}x+\frac{1}{1+x^2}\right)dx=$ (Easy)

A) $\tan^{-1}x+c$
B) $e^x\tan^{-1}x+c$
C) $\frac{e^x}{1+x^2}+c$
D) $\frac{1}{1+x^2}$

67. $\int e^x(sinx-cosx)dx=$ (Easy)

A) $e^x sinx+c$
B) $e^x cosx+c$
C) $-e^x sinx+c$
D) $-e^x cosx+c$

68. $\int\frac{e^{2x}-1}{e^{2x}+1}dx=$ (Difficult)

A) $\log(e^{2x}+1)+C$ B) $\log(e^{2x}-1)+C$ C) $\log(e^x-e^{-x})+C$ D) $\log(e^x+e^{-x})+C$

69. $\int\frac{\mathbf{1}}{\boldsymbol{x}-\sqrt{\boldsymbol{x}}}\boldsymbol{dx}=$ (Difficult)

A) $2\log(\sqrt{x}-1)+C$ B) $\frac{1}{2}\log(\sqrt{x}+1)+C$ C) $2\log(\sqrt{x}+1)+C$ D) $2\log(1-\sqrt{x})+C$.

70. $\int\frac{1}{x+xlogx}dx=$ (Average)

A) $2\log(1+x)+C$ B) $\log(x+logx)+C$ C) $\log(1+logx)+C$ D) $2\log(1+logx)+C$.

71. $\int\frac{\sin x}{(1+\cos x)^2}dx=$ (Average)

A) $-\log(1+cosx)+C$ B) $\frac{-3}{(1+cosx)^3}+C$ C) $\frac{1}{1+cosx}+C$ D) $\frac{-1}{1+cosx}+C$.

72. If $f(x)=\int_0^x t\sin t\,dt$ then $f^/(x)$ is (Difficult)

$(A) cosx+\ x\sin x$ $(B) x\ sinx$ $(C) x\ cosx$ $(D)\ sinx+\ x\ cosx$.

73. $\int_0^4\frac{dx}{16+x^2}=$ (Easy)

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{8}$ (D) $\frac{\pi}{16}$

74. $\int_1^{\sqrt{3}}\left(\frac{1}{1+x^2}\right)dx=$ (Average)

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{12}$

75. $\int_0^{\frac{2}{3}}\left(\frac{1}{4+9x^2}\right)dx=$ (Difficult)

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{24}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{12}$

76. $\int_2^3\frac{xdx}{x^2+1}=$ (Average)

A) $2log2$ B) $\frac{1}{2}\log 2$ C) $\frac{1}{2}\log\frac{4}{3}$ D) $\frac{1}{2}\log 50$.

77. $\int_0^1 xe^x\,dx=$ (Average)

(A) $e-1$ (B) 1 (C) -1 (D) $2e-1$

78. $\int_0^{\pi}(\sin^2\frac{x}{2}-\cos^2\frac{x}{2})dx=$ (Average)

A) 0 B) 1 C) -1 D) -2.

79. $\int_{-1}^1 x^{17}cos^4x\,dx=$ (Easy)

(A) 1 (B) -1 (C) 0 (D) 17

80. $\int_{-1}^1(x^3+xcosx+tan^5x)dx=$ (Average)

(A) 1 (B) -1 (C) 0 (D) 8

81. $\int_{-1}^{1} 1\, dx =$ (Average)

(A) 1 (B) -1 (C) 0 (D) 2

82. $\int_{-1}^{1} sin^5 x cos^4 x\, dx =$ (Average)

(A) 1 (B) -1 (C) 0 (D) 2

83. $\int_{-\pi/2}^{\pi/2} \sin^7 x dx =$ (Easy)

(A) 1 (B) -1 (C) 0 (D) 7

84. $The\ integral\ of\ 2xsin(x^2+1)\ with\ respect\ to\ x\ is$ (Average)

$(A) 2cos(x^2+1)+C$ $(B)\ cos(x^2+1)\ +C$ $(C) -cos(x^2+1)+C$ $(D)\ 2cos(x^2+1)+x^2+C$

85. The integral of $\sin^{-1}(\cos x)$ is (Average)

A)$\frac{1}{sinx}+C$ B)$\cos^{-1}(\cos x)+C$ C)$\frac{\pi}{2}x-\frac{x^2}{2}+C$ D) $\frac{\pi}{2}-\frac{x^2}{2}+C$

86. $\int x\sqrt{1+2x^2}dx =$ (Average)

A) $\frac{x^{\frac{3}{2}}}{2}-\frac{2(1+2x^2)^{\frac{3}{2}}}{3}+C$ B)$\frac{1}{4}(1+2x^2)^{\frac{3}{2}}+C$ C)$\frac{1}{6}(1+2x^2)^{\frac{3}{2}}+C$ D)$\frac{8}{3}(1+2x^2)^{\frac{3}{2}}+C$

87. $\int(4x+2)\sqrt{x^2+x+1}dx =$ (Average)

A) $\frac{4}{3}(x^2+x+1)^{\frac{3}{2}}+C$ B)$\frac{2}{3}(x^2+x+1)^{\frac{3}{2}}+C$ C) $4\sqrt{x^2+x+1}\ +C$ D)$\frac{1}{\sqrt{x^2+x+1}}+C$

88. $\int\frac{x}{9-4x^2}dx =$ (Average)

A) $\frac{1}{6}\log\left|\frac{3+2x}{3-2x}\right|+C$ B) $\frac{1}{6}\log\left|\frac{3-2x}{3+2x}\right|+C$ C)$-8\log|9-4x^2|+C$ D)$-\frac{1}{8}\log|9-4x^2|+C$

89. **Assertion(A):** $\int_{-1}^{1}(x^3+sin^5x)dx = 0$ (Average)

Reason(R): $f(x) = x^3 + sin^5x$ is an odd function.

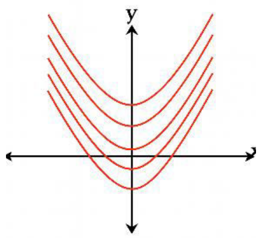
A) A is false and R is true B) A is true and R is false

C) A is true and R is true D)A is false and R is false.

90. The equation of the family of curves in the given figure is (Difficult)

A) $y=\int dx$ B) $y=\int 2dx$

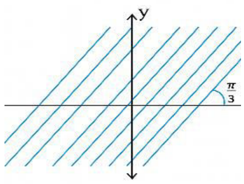
$C) y=\int x^2dx$ D) $y=\int xdx$



91. The equation of the family of curves in the given figure is (Difficult)

A) $y=\int dx$ B) $y=\int\sqrt{3}dx$

$C) y=\int\sqrt{3}xdx$ D) $y=\int\frac{1}{\sqrt{3}}dx$



92. **Statement 1 :** $\int e^x(cos\,x+sin\,x)dx = e^x\,cos\,x + c$

Statement 2 : $\int e^x\left(f(x)+f^1(x)\right)dx = e^x f(x)+c$ (Difficult)

A) Statement 1 is true and Statement 2 is false.

B) Statement 1 is true and Statement 2 is true

C) Statement 1 is false and Statement 2 is true

D) Statement 1 is false and Statement 2 is false.

93. **Statement 1:** $\int \frac{2x}{1+x^2}dx = log\left|x^2+1\right| + C,$ **Statement 2:** $\int \frac{f^1(x)}{f(x)}dx = log\left|f(x)\right| + C$ (Difficult)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

94. **Assertion(A):** $\int_{-1}^{1} (2)dx = 4$

Reason(R): $\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx,\ if$ f(x) is an even function (Difficult)

A) A is false and R is true
B) A is true and R is false
C) A is true and R is true
D) A is false and R is false.

95. **Statement 1:** The anti-derivative of $secx$ w. r. t x is $log|secx + tanx|$.

Statement 2: The derivative of $log|cosecx - cotx|$ w. r. t is cosecx (Difficult)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

96. $\int_{-3}^{3} 1\, dx =$______________ (Average)

97. $\int_{0}^{2} [x]\, dx =$____________________ (Average)

98. $\int e^x(x^3 + kx^2 + 10)\,dx = e^x(x^3 + 10) + c$, then k = _________ (Average)

99. Match Column I with Column II (Difficult)

Column I	Column II
a) $\int e^{-x}dx$	i) $\frac{-e^{-2x}}{2} + C$
b) $\int e^{-2x}dx$	ii) $e^{x^2} + C$
c) $\int 2xe^{x^2}dx$	iii) $-e^{-x} + C$

Choose the correct answer from the options given below:
(A) a-i , b-ii, c-iii (B) a-iii, b-ii, c-i (C) a-ii, b-iii, c-i (D) a-iii, b-i, c-ii.

100. **Statement 1:** The anti-derivative of $(\sqrt{1+x^2})$ with respect to x is
$\frac{x}{2}\sqrt{1+x^2} + \frac{1}{2}\log\left|x + \sqrt{1+x^2}\right| + C.$

Statement 2: The derivative of $\frac{x}{2}\sqrt{1+x^2} + \frac{1}{2}\log\left|x + \sqrt{1+x^2}\right| + C$ with respect to x is $\sqrt{1+x^2}$ (Difficult)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false

101. **Statement 1 :** $\int e^x(1 - cotx + cot^2x)\,dx = -e^x cotx + c$ (Difficult)

Statement 2 : $\int e^x\left(f(x) + f^1(x)\right)dx = e^x f(x) + c$

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true.
C) Statement 1 is false and Statement 2 is true.
D) Statement 1 is false and Statement 2 is false.

102. **Statement 1 :** $\int_{-1}^{1} x\,dx = 0.$

Statement 2 : $\int_{-a}^{a} f(x)dx = 0,\ if$ f(x) is an odd function

Statement 3: $\int e^x\,dx = e^x \because \frac{de^x}{dx} = e^x$ (Difficult)

Which of the above statements are correct?

(A) 1and 3 only (B) 2 and 3 only (C) 3 only (D) All 1, 2 and 3.

103. $\int_{-1}^{1}\{x-[x]\}\,dx =$........ (Average)

104. $If\ \int_0^{\frac{\pi}{2}} sin^2x\,dx = \frac{\pi}{4}$ and $\int_0^{\frac{\pi}{2}} cos^2x\,dx = \frac{\pi}{k}$, then k =...... (Average)

105. **Statement 1:**$\int \frac{1}{x\sqrt{x^2-a^2}}dx = \frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right) + C.$

Statement 2: The derivative of $\sec^{-1}\left(\frac{x}{a}\right)$ with respect to x is $\frac{a}{x\sqrt{x^2-a^2}}$ (Difficult)

A) Statement 1 is true and Statement 2 is false.

B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1

C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

D) Statement 1 is false and Statement 2 is false

106. **Statement 1 :** The process of differentiation and integration are inverses of each other

Statement 2 : Two indefinite integrals with the same derivative lead to the same family of Curves. (Difficult)

A) Statement 1 is true and Statement 2 is false

B) Statement 1 is false and Statement 2 is true

C) Statement 1 is true and Statement 2 is true

D) Statement 1 is false and Statement 2 is false

TWO MARKS QUESTIONS

1. Integrate with respect to x : $\tan^2(2x-3)$. (Average)

2. Find $\int \frac{\sin^2 x}{1+\cos x}dx$ (Difficult)

3. Find: $\int \frac{dx}{x^2-16}$ (Easy)

4. Evaluate $\int \left(\sqrt[3]{x} + \frac{1}{\sqrt[3]{x}}\right)dx$ (Easy)

5. Find $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 dx.$ (Average)

6. Find: $\int xe^x dx$ (Average)

7. Evaluate $\int xe^{(x^2+1)}dx$ (Average)

8. Find: $\int (4e^{3x}+1)dx$ (Easy)

9. Find: $\int (ax^2+bx+c)dx$ (Easy)

10. Find: $\int \left(7x^6 + e^{3x} + \frac{1}{\sqrt{1-x^2}}\right)dx$ (Average)

11. Find: $\int \frac{x^3+5x^2-4}{x^2}dx$ (Average)

12. Find: $\int \frac{x^3+3x+4}{\sqrt{x}}dx$ (Average)

13. Find: $\int \frac{x^3-x^2+x-1}{x-1}dx$ (Average)

14. Find: $\int \log x dx$ (Average)

15. Evaluate $\int x^2 logx\,dx$ (Difficult)

16. Find: $\int \sqrt{ax+b}dx$ (Average)

17. Find: $\int e^{2x+3}dx$ (Easy)

18. Find $\int \sqrt{x}(3x^2+2x+3)dx$ (Average)

19. Find $\int (2x-3\cos x+e^x)dx$ (Average)

20. Find $\int (2x^2-3\sin x+5\sqrt{x})dx$ (Average)

21. Find $\int \sec x\,(\sec x + \tan x)dx$ (Average)

22. Find $\int \frac{\sec^2 x}{\cos ec^2 x}dx$ (Average)

23. Find: $\int \sin^{-1}(\cos x)dx$ (Difficult)

24. Find $\int \sqrt{1+\cos 2x}dx$ (Difficult)

25. Find $\int \sqrt{1-\cos 2x}dx$ (Average)

26. Find $\int \sqrt{1+\sin 2x}dx$ (Average)

27. Evaluate: $\int (a^x e^x)\,dx$ (Average)

28. Evaluate: $\int \left(e^{2\log \sec x}\right) dx$ (Average)

29. Evaluate: $\int (e^x - x^e + e^e)\, d$ (Average)

30. Find $\int \frac{\cos 2x}{sin^2x+cos^2x}\,dx$ (Difficult)

31. Find $\int \frac{\cos 2x-\sin 2\alpha}{\cos x-\sin\alpha}\,dx$ (Difficult)

32. Find $\int 2x\sin(x^2+1)dx$ (Average)

33. Find $\int \frac{\sin(\tan^{-1}x)}{1+x^2}dx$ (Average)

34. Find $\int \tan x dx$ (Average)

35. Find $\int \cot x dx$ (Average)

36. Find $\int \sec x dx$ (Difficult)

37. Find $\int \cos ecxdx$ (Difficult)

38. Find : $\int \frac{10x^9+10^x\log_e 10}{x^{10}+10^x}dx$ (Average)

39. Find: $\int \frac{dx}{x^2-6x+13}$ (Average)

40. Find: $\int x^2 e^{x^3}dx$ (Average)

41. Find $\int \frac{2-3\sin x}{\cos^2 x}dx$ (Average)

42. Find: $\int \frac{dx}{3x^2+13x-10}$ (Difficult)

43. Find $\int \frac{1-\cos 2x}{1+\cos 2x}dx$ (Difficult)

44. Find $\int \frac{dx}{\sqrt{5x^2-2x}}$ (Difficult)

45. Find $\int \tan^{-1}\left(\frac{\sin 2x}{1+\cos 2x}\right)dx$ (Average)

46. Find: $\int\left(\sqrt{x}-\frac{1}{\sqrt{x}}\right)^2 dx$ (Difficult)

47. Find $\int \frac{1-\sin x}{\cos^2 x}dx$ (Difficult)

48. Find $\int \frac{3\cos x+4}{\sin^2 x}dx$ (Average)

49. Find $\int \frac{1}{1-\cos x}dx$ (Difficult)

50. Find $\int \frac{2x}{1+x^2}dx$ (Average)

51. Find $\int \frac{(\log x)^2}{x}dx$ (Average)

52. Find $\int \sin x\sin(\cos x)dx$ (Difficult)

53. Find $\int \sin(ax+b)\cos(ax+b)dx$ (Difficult)

54. Find $\int (4x+2)\sqrt{x^2+x+1}dx$ (Difficult)

55. Find $\int \frac{x}{\sqrt{x+4}}dx$ (Difficult)

56. Find $\int \frac{x+1}{\sqrt{x+5}}$ (Difficult)

57. Find $\int \frac{dx}{(2x+1)^2-16}$ (Average)

58. Find $\int \frac{x^2}{(2+3x^3)^3}dx$ (Difficult)

59. Find $\int \frac{dx}{x(\log x)^m}, x>0, m\neq 1$ (Difficult)

60. Find $\int \frac{x}{9-4x^2}dx$ (Difficult)

61. Find $\int \frac{x}{e^{x^2}}dx$ (Difficult)

62. Find $\int x\sqrt{1+2x^2}dx$ (Difficult)

63. Find $\int \frac{e^{\tan^{-1}x}}{1+x^2}dx$ (Easy)

64. Find $\int \frac{e^{2x}-1}{e^{2x}+1}dx$ (Difficult)

65. Find $\int \tan^2(2x-3)dx$ (Difficult)

66. Find $\int \sec^2(7-4x)dx$ (Difficult)

67. Find $\int \frac{\sin^{-1}x}{\sqrt{1-x^2}}dx$ (Easy)

68. Find $\int \frac{1}{\cos^2 x(1-\tan x)^2}dx$ (Difficult)

69. Find $\int \frac{2\cos x-3\sin x}{6\cos x+4\sin x}dx$ (Difficult)

70. Find $\int \frac{\cos\sqrt{x}}{\sqrt{x}}dx$ (Average)

71. Find $\int \sqrt{\sin 2x}\cos 2x dx$ (Difficult)

72. Find $\int \frac{\cos x}{\sqrt{1+\sin x}}dx$ (Difficult)

73. Find $\int \cot x\log\sin x dx$ (Average)

74. Find $\int \cos^2 x dx$ (Average)
75. Find $\int \sin 2x \cos 3x dx$ (Difficult)
76. Find $\int \sin^3 x dx$ (Difficult)
77. Find $\int \log x dx$ (Average)
78. Find $\int e^x \left[\sec x(1+\tan x)\right] dx$ (Difficult)
79. Find $\int \frac{\cos 2x}{(\sin x+\cos x)^2} dx$ (Difficult)
80. Find $\int \tan^{-1} x dx$ (Average)
81. Find $\int \sin^3 x \cos^2 x dx$ (Difficult)
82. Find $\int \frac{3x^2}{x^6+1} dx$ (Average)
83. Find $\int \frac{1}{\sqrt{1+4x^2}} dx$ (Difficult)
84. Find $\int \frac{1}{\sqrt{(2-x)^2+1}} dx$ (Difficult)
85. Find $\int \frac{1}{\sqrt{9-25x^2}} dx$ (Average)
86. Find $\int \frac{3x}{1+2x^4} dx$ (Difficult)
87. Find $\int \frac{x^2}{1-x^6} dx$ (Difficult)
88. Find $\int \frac{x-1}{\sqrt{x^2-1}} dx$ (Difficult)
89. Find $\int \frac{x^2}{\sqrt{x^6+a^6}} dx$ (Difficult)
90. Find $\int \frac{\sec^2 x}{\sqrt{\tan^2 x+4}} dx$ (Average)
91. Find $\int \frac{dx}{\sqrt{x^2+2x+2}}$ (Average)
92. Find $\int \frac{dx}{9x^2+6x+5}$ (Difficult)
93. Find $\int \frac{dx}{\sqrt{7-6x-x^2}}$ (Difficult)
94. Find $\int \frac{dx}{\sqrt{(x-1)(x-2)}}$ (Difficult)
95. Find $\int \frac{dx}{\sqrt{8-3x-x^2}}$ (Difficult)
96. Find $\int \frac{dx}{x^2+2x+2}$ (Average)
97. Find $\int \frac{dx}{\sqrt{9x-4x^2}}$ (Difficult)
98. Find $\int x \sin x dx$ (Average)
99. Find $\int x \sin 3x dx$ (Average)
100. Find $\int x^2 e^x dx$ (Average)
101. Find $\int x \log x dx$ (Average)
102. Find $\int x \log 2x dx$ (Difficult)
103. Find $\int x^2 \log x dx$ (Average)
104. Find $\int x \sec^2 x dx$ (Difficult)
105. Find $\int \sqrt{x^2+2x+5} dx$ (Difficult)
106. Find $\int \sqrt{3-2x-x^2} dx$. (Difficult)
107. Find $\int \sqrt{4-x^2} dx$ (Average)
108. Find $\int \sqrt{1-4x^2} dx$ (Difficult)
109. Find $\int \sqrt{x^2+4x+6}\ dx$ (Difficult)
110. Find $\int \sqrt{x^2+4x+1}\ dx$ (Difficult)
111. Find $\int \sqrt{1-4x-x^2} dx$ (Difficult)
112. Find $\int \sqrt{1+3x-x^2} dx$ (Difficult)
113. Find $\int \sqrt{x^2+3x} dx$ (Difficult)
114. Find $\int \sqrt{1+x^2} dx$ (Average)
115. Find $\int \sqrt{7-8x+x^2} dx$ (Difficult)
116. Find $\int \sqrt{1+\frac{x^2}{9}} dx$ (Difficult)
117. Evaluate: $\int_{-\pi/2}^{\pi/2} \sin^7 x dx$ (Easy)
118. Evaluate: $\int_0^{2\pi} \cos^5 x dx$ (Difficult)
119. Evaluate: $\int_{-\pi/2}^{\pi/2} \sin^3 x dx$ (Easy)
120. Evaluate: $\int_a^b x dx$ (Easy)
121. Evaluate: $\int_0^5 (x+1) dx$ (Average)
122. Evaluate: $\int_2^3 x^2 dx$ (Easy)

123. Evaluate: $\int_1^4 (x^2 - x)dx$ (Average)

124. Evaluate: $\int_{-1}^1 e^x dx$ (Easy)

125. Evaluate: $\int_0^4 (x + e^{2x})dx$ (Average)

126. Evaluate: $\int_0^4 \frac{dx}{16 + x^2}$ (Average)

127. Evaluate : $\int_1^{\sqrt{3}} \frac{dx}{1 + x^2}$ (Difficult)

128. Evaluate: $\int_0^{\pi} (\sin^2 \frac{x}{2} - \cos^2 \frac{x}{2})dx$ (Difficult)

129. Evaluate: $\int_2^3 \frac{dx}{x^2 - 1}$ (Average)

130. Evaluate: $\int_0^{\pi/4} \sin 2x dx$ (Average)

131. Evaluate: $\int_0^{\pi/2} \cos 2x dx$ (Average)

132. Evaluate: $\int_0^{\pi/4} \tan x dx$ (Average)

133. Evaluate: $\int_0^1 \frac{dx}{\sqrt{1 - x^2}}$ (Average)

134. Evaluate $\int_1^2 (4x^3 - 5x^2 + 6x + 9)dx$ (Average)

135. Evaluate $\int_0^{\pi/4} \sin 2x dx$ (Average)

136. Evaluate $\int_0^{\pi/2} \cos 2x dx$ (Difficult)

137. Evaluate $\int_0^{\pi/2} \cos^2 x dx$ (Difficult)

138. Evaluate $\int_2^3 \frac{x dx}{x^2 + 1}$ (Difficult)

139. Evaluate $\int_0^1 x e^{x^2} dx$ (Average)

140. Evaluate $\int_0^{2/3} \frac{dx}{4 + 9x^2}$ (Difficult)

141. Evaluate $\int_2^3 \frac{x dx}{x^2 + 1}$ (Average)

142. Evaluate $\int_{-\pi/4}^{\pi/4} \sin^2 x dx$ (Difficult)

143. Evaluate $\int_{-1}^1 \sin^5 x \cos^4 x dx$ (Easy)

144. Evaluate $\int_{-\pi/2}^{\pi/2} \sin^7 x dx$ (Easy)

145. Evaluate $\int_0^{2\pi} \cos^5 x dx$ (Difficult)

146. Evaluate $\int_{-\pi/2}^{\pi/2} (x^3 + x\cos x + \tan^5 x + 1)dx$ (Difficult)

147. Find $\int \cos 6x \sqrt{1 + \sin 6x} dx$ (Difficult)

THREE MARKS QUESTION

1. *Find* the antiderivative of $f(x)=4x^3 - \frac{3}{x^4}$ such that f(2)=0 (Difficult)

2. Find the antiderivative of F of f defined by $f(x)=4x^3-6$, where F(0)=3 (Average)

3. *Find* $\int \frac{dx}{x + x\log x}$ (Average)

4. Find $\int \frac{\tan^4 \sqrt{x} \sec^2 \sqrt{x}}{\sqrt{x}} dx$ (Difficult)

5. Find $\int \frac{\sin x}{\sin(x + a)} dx$ (Difficult)

6. Find $\int \frac{1}{1 + \tan x} dx$ (Average)

7. Find $\int \frac{e^{2x} - 1}{e^{2x} + 1} dx$ (Difficult)

8. Find $\int \tan^2 (2x - 3)dx$ (Difficult)

9. Find $\int \frac{1}{\cos^2 x(1 - \tan x)^2} dx$ (Average)

10. Find $\int \frac{1}{1 - \tan x} dx$ (Difficult)

11. Find $\int \frac{1}{1 + \cot x} dx$ (Difficult)

12. Find $\int \frac{(x + 1)(x + \log x)^2}{x} dx$ (Average)

13. Find $\int \frac{\sqrt{\tan x}}{\sin x \cos x} dx$ (Difficult)

14. Find $\int \frac{x^3 \sin(\tan^{-1} x^4)}{1+x^8} dx$ (Difficult)

15. Find $\int \frac{(1+\log x)^2}{x} dx$ (Average)

16. Find $\int \sqrt{\sin 2x} \cos 2x dx$ (Average)

17. Find $\int \frac{\sin x}{1+\cos x} dx$ (Average)

18. Find $\int \frac{\sin x}{(1+\cos x)^2} dx$ (Average)

19. Find $\int \frac{1}{1+\cot x} dx$ (Difficult)

20. Find $\int \frac{(\sin^2 x - \cos^2 x)}{\sin^2 x \cos^2 x} dx$ (Average)

21. Find $\int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x} dx$ (Difficult)

22. Find $\int x\sqrt{x+2} dx$ (Difficult)

23. Find $\int \frac{x+2}{2x^2+6x+5} dx$ (Difficult)

24. Find $\int \frac{x+3}{\sqrt{5-4x+x^2}} dx$ (Difficult)

25. Find $\int \frac{dx}{\sqrt{(x-a)(x-b)}}$ (Difficult)

26. Find $\int \frac{4x+1}{\sqrt{2x^2+x-3}} dx$ (Difficult)

27. Find $\int \frac{x+2}{\sqrt{4x-x^2}} dx$ (Difficult)

28. Find $\int \frac{x+2}{\sqrt{x^2+2x+3}} dx$ (Difficult)

29. Find $\int \frac{x+3}{x^2-2x-5} dx$ (Difficult)

30. Find $\int \frac{5x+3}{\sqrt{x^2+4x+10}} dx$ (Difficult)

31. Find $\int \frac{dx}{(x+1)(x+2)}$ (Average)

32. Find $\int \frac{x^2+1}{x^2-5x+6} dx$ (Difficult)

33. Find $\int \frac{3x-2}{(x+1)^2(x+3)} dx$ (Difficult)

34. Find $\int \frac{x^2}{(x^2+1)(x^2+4)} dx$ (Difficult)

35. Find $\int \frac{(3\sin\phi - 2)\cos\phi}{5-\cos^2\phi - 4\sin\phi} d\phi$ (Difficult)

36. Find $\int \frac{x^2+x+1}{(x+2)(x^2+1)} dx$ (Difficult)

37. Find $\int \frac{x}{(x+1)(x+2)} dx$ (Average)

38. Find $\int \frac{dx}{x^2-9}$ (Average)

39. Find $\int \frac{3x-1}{(x-1)(x-2)(x-3)} dx$ (Difficult)

40. Find $\int \frac{3x-1}{(x-1)(x-2)(x-3)} dx$ (Difficult)

41. Find $\int \frac{2x}{x^2+3x+2} dx$ (Average)

42. Find $\int \frac{1-x^2}{x(1-2x)} dx$ (Difficult)

43. Find $\int \frac{x}{(x^2+1)(x-1)} dx$ (Difficult)

44. Find $\int \frac{3x+5}{x^3-x^2-x+1} dx$ (Difficult)

45. Find $\int \frac{2x-3}{(x^2-1)(2x+3)} dx$ (Difficult)

46. Find $\int \frac{5x}{(x+1)(x^2-4)} dx$ (Difficult)

47. Find $\int \frac{x^3+x+1}{x^2-1} dx$ (Difficult)

48. Find $\int \frac{2}{(1-x)(1+x^2)} dx$ (Difficult)

49. Find $\int \frac{3x-1}{(x+2)^2} dx$ (Difficult)

50. Find $\int \frac{dx}{x^4-1}$ (Difficult)

51. Find $\int \frac{1}{x(x^n+1)} dx$ (Difficult)

52. Find $\int \frac{\cos x}{(1-\sin x)(2-\sin x)} dx$ (Difficult)

53. Find $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)} dx$ (Difficult)

54. Find $\int \frac{2x}{(x^2+1)(x^2+3)} dx$ (Average)

55. Find $\int \frac{dx}{x(x^4-1)}$ (Difficult)

56. Find $\int \frac{dx}{e^x-1}$ (Difficult)

57. Find $\int \frac{xdx}{(x-1)(x-2)}$ (Average)

58. Find $\int \frac{dx}{x(x^2+1)}$ (Difficult)

59. Find $\int \frac{x\sin^{-1}x}{\sqrt{1-x^2}}dx$ (Average)

60. Find $\int e^x \sin x dx$ (Average)

61. Prove that (Easy)
$\int e^x\left(f(x)+f^{|}(x)\right)dx = e^x f(x) = c$

62. Find $\int x\sin^{-1}xdx$ (Difficult)

63. Find $\int x\tan^{-1}xdx$ (Difficult)

64. Find $\int x\cos^{-1}xdx$ (Difficult)

65. Find $\int x(\log x)^2 dx$ (Difficult)

66. Find $\int (x^2+1)\log xdx$ (Difficult)

67. Find $\int e^x(\sin x+\cos x)dx$ (Difficult)

68. Find $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx$
(Average)

69. Find $\int \frac{xe^x}{(1+x)^2}dx$ (Average)

70. Find $\int e^x\left(\frac{1}{x}-\frac{1}{x^2}\right)dx$ (Average)

71. Find $\int \frac{(x-3)e^x}{(x-1)^3}dx$ (Difficult)

72. Find $\int e^{2x}\sin xdx$ (Difficult)

73. Find $\int \sin^{-1}\left(\frac{2x}{1+x^2}\right)dx$ (Difficult)

74. Find $\int e^x\sec x(1+\tan x)dx$ (Average)

75. Find $\int \frac{\cos 2x}{(\sin x+\cos x)^2}dx$ (Difficult)

76. Find $\int \frac{dx}{e^x+e^{-x}}$ (Difficult)

77. Find $\int \tan^{-1}\sqrt{\frac{1-x}{1+x}}dx$ (Difficult)

78. Find $\int \frac{\sqrt{(x^2+1)}\left[\log(x^2+1)-2\log x\right]}{x^4}dx$
(Difficult)

79. Find $\int \frac{x^2+x+1}{(x+1)^2(x+2)}dx$ (Difficult)

80. Find $\int \frac{2+\sin 2x}{1+\cos 2x}dx$ (Difficult)

81. Find $\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}dx$ (Difficult)

82. Evaluate $\int_4^9 \frac{\sqrt{x}}{(30-x^{3/2})^2}dx$ (Difficult)

83. Evaluate $\int_1^2 \frac{xdx}{9(x+1)(x+2)}$ (Average)

84. Evaluate $\int_0^{\pi/4} \sin^3 2t\cos 2tdt$ (Difficult)

85. Evaluate $\int_0^1 \frac{2x+3}{5x^2+1}dx$ (Difficult)

86. Evaluate $\int_1^2 \frac{5x^2}{x^2+4x+3}dx$ (Difficult)

87. Evaluate $\int_0^{\pi/4} (2\sec^2 x+x^3+2)dx$ (Difficult)

88. Evaluate $\int_0^2 \frac{6x+3}{x^2+4}dx$ (Difficult)

89. Evaluate $\int_0^1 (xe^x+\sin\frac{\pi x}{4})dx$ (Difficult)

90. Evaluate $\int_{-1}^1 5x^4\sqrt{x^5+1}dx$ (Average)

91. Evaluate $\int_0^1 \frac{\tan^{-1}x}{1+x^2}dx$ (Average)

92. Evaluate $\int_0^{\pi/2} \sqrt{\sin\phi}\cos^5\phi d\phi$ (Difficult)

93. Evaluate $\int_0^1 \sin^{-1}\left(\frac{2x}{1+x^2}\right)dx$ (Difficult)

94. Evaluate $\int_0^2 x\sqrt{x+2}dx$ (Difficult)

95. Evaluate $\int_0^{\pi/2} \frac{\sin x}{1+\cos^2 x}dx$ (Average)

96. Evaluate $\int_0^2 \frac{dx}{x+4-x^2}$ (Difficult)

97. Evaluate $\int_{-1}^1 \frac{dx}{x^2+2x+5}$ (Difficult)

98. Evaluate $\int_0^2 \left(\frac{1}{x}-\frac{1}{2x^2}\right)e^{2x}dx$ (Difficult)

99. Evaluate $\int_{1/3}^{1} \frac{(x-x^3)^{1/3}}{x^4}dx$ (Difficult)

100. *If* f(x)=$\int_0^x t\sin t dt$, then find the value of f '(x) (Difficult)

101. Prove that

$$\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx \text{ if f(2a-x) =f(x)} \\ 0 \text{ if f(2a-x) =-f(x)} \end{cases}$$

(Difficult)

102. Prove that $\int_0^{2a} f(x)dx = \int_0^a f(x)dx + \int_0^a f(2a-x)dx$ (Difficult)

103. Find $\int \frac{(x^4-x)^{1/4}}{x^5}dx$. (Difficult)

104. Find $\int \frac{x^4dx}{(x-1)(x^2+1)}$. (Difficult)

105. Find $\int \left[\log(\log x)+\frac{1}{(\log x)^2}\right]dx$ (Difficult)

106. Find $\int \left[\sqrt{\cot x}+\sqrt{\tan x}\right]dx$. (Difficult)

107. Find $\int \frac{\sin 2x\cos 2x}{\sqrt{9-\cos^4(2x)}}dx$ (Difficult)

108. Find $\int \frac{1}{x-x^3}dx$ (Difficult)

109. Find $\int \frac{1}{\sqrt{x+a}+\sqrt{x+b}}dx$ (Difficult)

110. Find $\int \frac{5x}{(x+1)(x^2+9)}dx$ (Difficult)

111. Find $\int \frac{\sin x}{\sin(x-a)}dx$ (Difficult)

112. Find $\int \frac{e^{5\log x}-e^{4\log x}}{e^{3\log x}-e^{2\log x}}dx$ (Average)

113. Find $\int \frac{\sin^8 x-\cos^8 x}{1-2\sin^2 x\cos^2 x}dx$ (Difficult)

114. Find $\int \frac{1}{\cos(x+a)\cos(x+b)}dx$ (Difficult)

115. Find $\int \frac{x^3}{\sqrt{1-x^8}}dx$ (Difficult)

116. Find $\int \frac{e^x}{(1+e^x)(2+e^x)}dx$ (Difficult)

117. Find $\int \frac{1}{(x^2+1)(x^2+4)}dx$ (Difficult)

118. Find $\int \cos^3 x e^{\log\sin x}dx$ (Difficult)

119. Find $\int e^{3\log x}(x^4+1)^{-1}dx$ (Difficult)

120. Prove that $\int_0^1 \sin^{-1} x dx = \frac{\pi}{2}-1$ (Difficult)

121. Find $\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}dx$ (Difficult)

122. Evaluate $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx$ (Difficult)

123. *If* f(a+b-x)=f(x), then find $\int_b^a xf(x)dx$ (Average)

124. Evaluate Prove that

$\int_0^{\pi/4} 2\tan^3 x dx = 1-\log 2$ (Difficult)

125. Find $\int_{\pi/2}^{\pi} e^x\left(\frac{1-\sin x}{1-\cos x}\right)dx$ (Difficult)

126. Find $\int_0^{\pi/4} \frac{\sin x\cos x}{\cos^4 x+\sin^4 x}dx$ (Difficult)

127. Find $\int_0^{\pi/2} \frac{\cos^2 x}{\cos^2 x+4\sin^2 x}dx$ (Difficult)

128. Find $\int_{\pi/6}^{\pi/3} \frac{\sin x+\cos x}{\sqrt{\sin 2x}}dx$ (Difficult)

129. Find $\int_0^1 \frac{dx}{\sqrt{1+x}-\sqrt{x}}$ (Difficult)

130. Find $\int_0^{\pi/4} \frac{\sin x+\cos x}{9+16\sin 2x}dx$ (Difficult)

131. Find $\int_1^4 \left[|x-1|+|x-2|+|x-3|\right]dx$ (Difficult)

132. Prove that $\int_1^3 \frac{dx}{x^2(x+1)} = \frac{2}{3}+\log\frac{2}{3}$ (Difficult)

133. Prove that $\int_0^1 xe^x dx = 1$ (Difficult)

FIVE MARKS QUESTION

1. *Find* the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{2x-x^2}}$ (Difficult)
2. *Find* the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{9-25x^2}}$ (Average)
3. *Find* the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{9x-4x^2}}$ (Difficult)
4. *Find* the integral of $\frac{1}{x^2-a^2}$ with respect to x and evaluate $\int\frac{dx}{x^2-16}$ (Average)
5. *Find* the integral of $\frac{1}{x^2-a^2}$ with respect to x and evaluate $\int\frac{dx}{x^2-16}$ (Average)
6. *Find* the integral of $\frac{1}{a^2-x^2}$ with respect to x and evaluate $\int\frac{x^2dx}{1-x^6}$ (Difficult)
7. *Find* the integral of $\frac{1}{a^2-x^2}$ with respect to x and evaluate $\int\frac{\sin xdx}{1-4\cos^2 x}$ (Difficult)
8. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{dx}{x^2+16}$ (Average)
9. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{dx}{9x^2+4}$ (Average)
10. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{3x^2dx}{x^6+1}$ (Average)
11. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{3xdx}{1+2x^4}$ (Difficult)
12. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{\sin xdx}{1+\cos^2 x}$ (Difficult)
13. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{\cos xdx}{1+\sin^2 x}$ (Average)
14. *Find* the integral of $\frac{1}{\sqrt{x^2-a^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{5x^2-2x}}$ (Difficult)
15. *Find* the integral of $\frac{1}{\sqrt{x^2+a^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{1+4x^2}}$ (Average)
16. Prove that $\int\frac{dx}{\sqrt{x^2+a^2}} = log\left|x+\sqrt{x^2+a^2}\right|+c$ and hence find $\int\frac{x^2}{\sqrt{x^6+a^6}}dx$. (Average)
17. Prove that $\int\frac{dx}{\sqrt{x^2+a^2}} = log\left|x+\sqrt{x^2+a^2}\right|+c$ and hence find $\int\frac{sec^2x}{\sqrt{tan^2x+4}}dx$. (Average)

ADDITONAL QUESTIONS:

1. *Find* the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{8+3x-x^2}}$ (Difficult)
2. *Find* the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int\frac{dx}{\sqrt{7-6x-x^2}}$ (Difficult)
3. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{dx}{x^2+2x+2}$ (Average)
4.
5. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int\frac{dx}{x^2-6x+13}$ (Difficult)

6. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int \frac{dx}{9x^2+6x+5}$ (Difficult)

7. *Find* the integral of $\frac{1}{x^2+a^2}$ with respect to x and evaluate $\int \frac{dx}{a^2\cos^2 x+b^2\sin^2 x}$ (Difficult)

8. *Find* the integral of $\frac{1}{\sqrt{x^2-a^2}}$ with respect to x and evaluate $\int \frac{dx}{\sqrt{(x-1)(x-2)}}$ (Difficult)

9. *Find* the integral of $\frac{1}{\sqrt{x^2-a^2}}$ with respect to x and evaluate $\int \frac{dx}{\sqrt{(x-a)(x-b)}}$ (Difficult)

10. *Find* the integral of $\frac{1}{x^2-a^2}$ with respect to x and evaluate $\int \frac{dx}{3x^2+13x-10}$ (Difficult)

11. Prove that $\int \frac{dx}{\sqrt{x^2+a^2}} = log\left|x+\sqrt{x^2+a^2}\right| + c$ and hence find $\int \frac{1}{\sqrt{(2-x)^6+1}}dx$. (Difficult)

12. Prove that $\int \frac{dx}{\sqrt{x^2+a^2}} = log\left|x+\sqrt{x^2+a^2}\right| + c$ and hence find $\int \frac{1}{\sqrt{x^2+2x+2}}dx$. (Difficult)

SIX MARKS QUESTION

1. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/4} \log(1+\tan x)dx$ (Average)

2. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$ (Average)

3. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\sin^{3/2} x}{\sin^{3/2} x+\cos^{3/2} x}dx$ (Average)

4. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\cos^5 x}{\sin^5 x+\cos^5 x}dx$ (Average)

5. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\sin^4 x}{\sin^4 x+\cos^4 x}dx$ (Average)

6. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^a \frac{\sqrt{x}}{\sqrt{x}+\sqrt{a-x}}dx$ (Difficult)

7. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\sin x-\cos x}{1+\sin x\cos x}dx$ (Difficult)

8. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi} \frac{x\sin x}{1+\cos^2 x}dx$ (Difficult)

9. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi} \frac{x}{1+\sin x}dx$ (Difficult)

10. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/4} \log(1+\tan x)dx$ (Difficult)

11. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \log\left(\frac{4+3\sin x}{4+3\cos x}\right)dx$ (Difficult)

12. Prove that $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$ and hence evaluate $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\tan x}}$. (Average)

13. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ *hence* evaluate $\int_{-\pi/2}^{\pi/2} \sin^7 x dx$. (Average)

ADDITIONAL QUESTIONS:

14. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \log\sin x dx$ (Difficult)

15. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi} \log(1+\cos x)dx$ (Difficult))

16. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} (2\log\sin x - \log\sin 2x)dx$ (Difficult)

17. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi} \frac{x\tan x}{\sec x + \tan x}dx$ (Difficult)

18. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi} \frac{x}{a^2\cos^2 x + b^2\sin^2 x}dx$ (Difficult)

19. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ hence evaluate $\int_{-\pi/4}^{\pi/4} \sin^2 x dx$ (Difficult)

20. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ hence evaluate $\int_{-1}^{1} x^{17}\cos^4 x dx$. (Difficult)

21. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ hence evaluate $\int_{-1}^{1} \sin^5 x\cos^4 x dx$. (Difficult)

22. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ hence evaluate $\int_{-\pi/2}^{\pi/2} (x^3 + x\cos x + \tan^5 x)dx$.

(Difficult)

23. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_{0}^{a} f(x)dx \text{ if f(x) is even} \\ 0 \text{ if f(x) is odd} \end{cases}$ hence evaluate $\int_{-\pi/2}^{\pi/2} \sin^2 x dx$. (Difficult)

24. Prove that $\int_b^a f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ hence evaluate $\int_{-1}^{2} |x^3 - x| dx$. (Difficult)

25. Prove that $\int_b^a f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ hence evaluate $\int_{-5}^{5} |x+2| dx$. (Difficult)

26. Prove that $\int_b^a f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ hence evaluate $\int_{2}^{8} |x-5| dx$. (Difficult)

27. Prove that $\int_b^a f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ hence evaluate $\int_{-1}^{3/2} |x\sin(\pi x)| dx$ (Difficult)

28. Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx \text{ if } f(2a-x)=f(x) \\ 0 \text{ if } f(2a-x)=-f(x) \end{cases}$ hence evaluate $\int_0^{\pi} \frac{x}{a^2\cos^2 x + b^2\sin^2 x} dx$ (Difficult)

29. Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx \text{ if } f(2a-x)=f(x) \\ 0 \text{ if } f(2a-x)=-f(x) \end{cases}$ hence evaluate $\int_0^{\pi} \frac{x\tan x}{\sec x + \tan x} dx$. (Difficult)

30. Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx \text{ if } f(2a-x)=f(x) \\ 0 \text{ if } f(2a-x)=-f(x) \end{cases}$ hence evaluate $\int_0^{\pi} \log(1+\cos x)dx$ (Difficult)

ADDITIONAL QUESTIONS:

1. *Find* the integral of $\sqrt{x^2-a^2}$ with respect to x and evaluate $\int\sqrt{x^2+4x+1}dx$ (Difficult)

2. *Find* the integral of $\sqrt{x^2-a^2}$ with respect to x and evaluate $\int\sqrt{x^2+3x}dx$ (Difficult)

3. *Find* the integral of $\sqrt{x^2-a^2}$ with respect to x and evaluate $\int\sqrt{x^2-8x+7}dx$ (Difficult)

4. *Find* the integral of $\sqrt{x^2+a^2}$ with respect to x and evaluate $\int\sqrt{x^2+4x+6}dx$ (Difficult)

5. *Find* the integral of $\sqrt{x^2+a^2}$ with respect to x and evaluate $\int\sqrt{x^2+2x+5}dx$ (Difficult)

6. *Find* the integral of $\sqrt{x^2+a^2}$ with respect to x and evaluate $\int\sqrt{1+\frac{x^2}{9}}dx$ (Difficult)

7. *Find* the integral of $\sqrt{a^2-x^2}$ with respect to x and evaluate $\int\sqrt{4-x^2}dx$ (Difficult)

8. *Find* the integral of $\sqrt{a^2-x^2}$ with respect to x and evaluate $\int\sqrt{3-2x-x^2}dx$ (Difficult)

9. *Find* the integral of $\sqrt{a^2-x^2}$ with respect to x and evaluate $\int\sqrt{1-4x-x^2}dx$ (Difficult)

10. *Find* the integral of $\sqrt{a^2-x^2}$ with respect to x and evaluate $\int\sqrt{1+3x-x^2}dx$ (Difficult)

11. *Find* the integral of $\sqrt{a^2-x^2}$ with respect to x and evaluate $\int\sqrt{1-4x^2}dx$ (Difficult)

CHAPTER -08

APPLICATION OF INTEGRALS

FIVE MARK QUESTIONS

1. Find the area enclosed by the circle $x^2+y^2=a^2$. (Easy)
2. Find the area lying in the first quadrant and bounded by the circle $x^2+y^2=4$ and the lines $x=0$ and $x=2$ (Average)
3. Find the area enclosed by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. (Easy)
4. Find the area of the region bounded by the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ (Easy)
5. Find the area of the region bounded by the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ (Easy)
6. Find the area of the region bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = -1$ and $x = 1$. (Average)
7. Find the area of the region bounded by the curve $y^2=4x$, y-axis and the line y=3. (Easy)
8. Find the area bounded by the curve y=cosx between x=0 and x=2π. (Average)
9. Find the area bounded by the curve y=sinx between x=0 and x=2π. (Average)

ADDITIONAL QUESTIONS:

10. Find the area of the region bounded by the curve $y^2=x$ and the lines x=1, x=4 and the x-axis in the first quadrant. (Average)
11. Find the area of the region bounded by $y^2=9x$ and the lines x=2, x=4 and the x-axis in the first quadrant. (Average)
12. Find the area of the region bounded by $x^2=4y$, y=2, y=4 and the y-axis in the first quadrant. (Average)
13. Find the area of the region bounded by the curve $y=x^2$ and the line y=4. and the y-axis in the first quadrant. (Average)
14. Find the area of the region bounded by the curve $y^2=4x$ and the line x=3. (Easy)
15. Find the area of the region bounded by the curve $y^2= 4x$, y-axis and the line y= 3. (Easy)
16. Find the area of the parabola $y^2=4ax$ bounded by its latus rectum. (Average)
17. Find the area under the given curves and given lines $y=x^2$, x=1,x=2 and x-axis. (Easy)
18. Find the area under the given curves and given lines $y=x^4$, x=1,x=5 and x-axis. (Easy)
19. Find the area bounded by the curve $y=x^3$, the x-axis and the ordinates x=-2 and x=1. (Easy)
20. Find the area bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and the ordinates x=0 and x=ae, where $b^2=a^2(1-e^2)$ and e<1. (Average)
21. Find the area of the region lying in the first quadrant and bounded by $y=4x^2$. x=0, y=1 and y=4. (Average)
22. Find the area bounded by the curve $y = x\,|\,x\,|$, x-axis and the ordinates $x = -1$ and $x = 1$ (Difficult)
23. Sketch the graph of $y=|x+3|$ and evaluate $\int_{-6}^{0}|x+3|dx$. (Difficult)

CHAPTER -09
DIFFERENTIAL EQUATIONS

MCQ /FB questions.

1. The Order and Degree of the differential equation $\frac{dy}{dx} - \cos x = 0$ is (Easy)
(a) 1,2 (b) 2,1 (c) 1,1 (d) 1,0

2. The Order and Degree of the differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ is (Easy)
(a) 1,2 (b) 2,2 (c) 2,1 (d) 1,1

3. The Order and Degree of the differential equation $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + e^{\frac{dy}{dx}} = 0$ is (Average)
(a) 3,1 (b) 3,2 (c) 1,3 (d) 3, not defined

4. Find the Order and Degree of the differential equation $\frac{d^4y}{dx^4} + \sin\left(\frac{d^2y}{dx^2}\right) = 0$ is (Average)
(a) 4,1 (b) 4,2 (c) 2,4 (d) 4, not defined

5. Find the order and degree of the differential equation $\frac{dy}{dx} + 5y = 0$ is (Easy)
(a) 1,2 (b) 2,1 (c) 1,1 (d) 1,5

6. Find the order and degree of the differential equation $\left(\frac{ds}{dt}\right)^4 + 3s\frac{d^2s}{dt^2} = 0$ is (Easy)
(a) 1,4 (b) 2,1 (c) 2,4 (d) 4,2

7. Find the order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0$ is (Easy)
(a) 2,2 (b) 1,2 (c) 2,2 (d) 2, not defined

8. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} = \cos 3x + \sin 3x$ is (Average)
(a) 2,1 (b) 1,2 (c) 2,2 (d) 2, not defined

9. Find the order and degree of the differential equation (Easy)
$(y^{111})^2 + (y^{11})^3 + (y^1)^4 + y^5 = 0$ is
(a) 3,5 (b) 3,2 (c) 3,3 (d) 3,4

10. Find the order and degree of the differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ is (Easy)
(a) 3,1 (b) 3,2 (c) 1,3 (d) 3, 3

11. Find the order and Degree of the differential equation $\frac{dy}{dx} + y = e^x$ is (Easy)
(a) 1,2 (b) 2,1 (c) 1,1 (d) 1, not defined.

12. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 2y = 0$ is (Easy)
(a) 2,1 (b) 1,2 (c) 2,2 (d) 2, 0

13. Find the order and degree of the differential equation $y'' + 2y' + \sin y = 0$ is (Easy)
(a) 1,2 (b) 2,1 (c) 2,2 (d) 2, not defined.

14. Find the order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is (Difficult)
(a) 2,3 (b) 3,2 (c) 3, not defined (d) 2, not defined

15. Find the order and degree of the differential equation $2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$ is (Easy)
(a) 2,1 (b) 1,2 (c) 2,3 (d) 2, 0.

16. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} + 5x\left(\frac{dy}{dx}\right)^2 - 6y = \log x$ is (Easy)
(a) 1,2 (b) 2,1 (c) 2,2 (d) 2, not defined.

17. Find the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^3 - 4\left(\frac{dy}{dx}\right)^2 + 7y = \sin x$ is (Easy)
(a) 1,3 (b) 2,1 (c) 2,2 (d) 2, not defined

18. The order of the differential equation $\frac{dy}{dx} = e^{2x}$ is (Easy)
(a) 1,1 (b) 1,2 (c) not defined, 1 (d) 1, not defined.

19. The order of the differential equation $\frac{d^2y}{dx^2} + 2y = 0$ is (Easy)
(a) 2,1 (b) 1,2 (c) 2, 2 (d) 2, not defined.

20. The order of the differential equation $\left(\frac{d^3y}{dx^3}\right) + x^2\left(\frac{d^2y}{dx^2}\right)^3 = 0$ is (Easy)
(a) 3 (b) 2 (c) 1 (d) not defined.

21. The degree of the differential equation $\left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right)^3 = 0$ is (Average)
(a) 3 (b) 2 (c) 1 (d) not defined.

22. The degree of the differential equation $\left(\frac{d^3y}{dx^3}\right) + 2\left(\frac{d^2y}{dx^2}\right)^2 - \frac{dy}{dx} + y = 0$ is (Easy)
(a) 3 (b) 2 (c) 1 (d) not defined.

23. The degree of the differential equation $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} - sin^3 y = 0$ is (Easy)
(a) 3 (b) 2 (c) 1 (d) not defined.

24. A differential equation of the form $\frac{dy}{dx}$= F (x, y) is said to be *homogenous* if F(x, y) is a homogenous function of degree (Average)
(a) 1 (b) 0 (c) 2 (d) 2, not defined

25. What is the order of differential equation y" + 5(y')^3 + 6 = 0 (Easy)
(a) 0 (b) 1 (c) 2 (d) 3

26. What is the degree of differential equation $\left(y^{111}\right)^4 + \left(y^{11}\right)^3 + \left(y^1\right)^2 + y^5 = 0$ (Easy)
(a) 2 (b) 3 (c) 4 (d) 5

27. Find the number of arbitrary constants in the particular solution of a differential equation of third order is: (Average)
(a) 3 (b) 2 (c) 1 (d) 0

28. Which of the following is a homogeneous differential equation? (Average)
(a) (4x + 6y + 5) dy – (3y + 2x + 4) dx = 0 (b) (xy) dx – ($x^3 + y^3$)dy = 0
(c) ($x^3 + 2y^2$) dx + 2xy dy = 0 (d) y^2 dx + (x^2 – xy – y^2) dy = 0

29. Find the Integrating Factor of the differential equation $x\frac{dy}{dx} + 2y = x^2 \ (x \neq 0)$ (Easy)
(a) $\log x$ (b) x^2 (c) $2\log x$ (d) x

30. The general solution of the differential equation $\frac{ydx - xdy}{y} = 0$ is (Average)
(a) xy = C (b) x = Cy^2 (c) y = Cx (d) y = Cx^2

31. The number of arbitrary constants in the general solution of a differential equation of fourth order are … (Easy)

32. A homogeneous differential equation of the from $\frac{dy}{dx} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution …….. (Average)
(a) y=vx (b) v=yx (c) x=vy (d) x=v

33. The Integrating Factor of the differential equation $x\frac{dy}{dx} - y = 2x^2$ *is* $\frac{k}{x}$, then k is… (Easy)

34. The Integrating Factor of the differential equation $(1 - y^2)\frac{dx}{dy} + yx = ay$ *is* …… (Average)
(a) $\frac{1}{y^2 - 1}$ (b) $\frac{1}{\sqrt{y^2 - 1}}$ (c) $\frac{1}{1 - y^2}$ (d) $\frac{1}{\sqrt{1 - y^2}}$

35. The Integrating Factor of the differential equation $e^x\ dy + (y\ e^x + 2x)\ dx = 0$ is e^{kx}, then k is … (Average)

36. The Integrating Factor of the differential equation $\frac{dy}{dx} - y = cosx$ *is* e^{kx}, *then k is* …. (Average)

37. The Integrating Factor of the differential equation $x\frac{dy}{dx} + 2y = x^2$ *is* x^k, *then k is* …… (Difficult)

38. The Integrating Factor of the differential equation ydx - $(x + 2y^2)\ dy = 0$ *is* $\frac{k}{y}$, then k is …… (Average)

39. The Integrating Factor of the differential equation $\frac{dy}{dx} = x + xy$ *is* e^{kx^2}, *then k is* …. (Difficult)

40. The order of a differential equation whose general solution is y =Asinx + Bcosx is _____ (A, B are arbitrary constants) (Easy)

(a)4 (b) 2 (c) 0 (d) 3

41. The differential equation $\frac{dy}{dx} = \frac{x+y}{1+x^2}$ is (Easy)

a) of variable separable form (b) homogeneous

(c) linear (d) Exact differential equation

42. **Statement 1:** The Integrating factor of the differential equation $\frac{dy}{dx} + (tanx)y = secx$ is $secx$.

Statement 2: The Integrating factor of the differential equation $\frac{dy}{dx} + Py = Q$ is $e^{\int pdx}$.(Easy)

(a) Statement 1 is false and Statement 2 is true

(b) Statement 1 is true and Statement 2 is false

(c) Statement 1 is true, statement 2 is true and statement 2 is a correct explanation for statement 1

(d) Statement 1 is true, statement 2 is true and statement 2 is not a correct explanation for statement 1.

43. **Statement 1:** The general solution of the differential equation $\frac{dy}{dx} + Py = Q$ is y(IF)=$\int Q(IF)dx + C$

Statement 2: The Integrating factor of the differential equation $\frac{dx}{dY} + Px = Q$ is $e^{\int pdy}$. (Easy)

(a) Statement 1 is false and Statement 2 is true

(b) Statement 1 is true and Statement 2 is false

(c) Statement 1 is true, statement 2 is true and statement 2 is a correct explanation for statement 1

(d) Statement 1 is true, statement 2 is true and statement 2 is not a correct explanation for statement 1

44. **Statement 1:** The order of the differential equation is the order of the highest order derivative present in the equation.

Statement 2: The order of the differential equation $\left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right)^3 = 0$ is 1. (Easy)

a) Statement 1 is true and 2 is false. b) Statement 1 is true and 2 is true

c) Statement 1 and 2 are false. d) Statement 1 is false and 2 is true.

45. **Statement 1:** A function that satisfies the given differential equation is called its solution.

Statement 2: Order and degree (if defined) of a differential equation are always positive integers. (Easy)

a) Statement 1 is true and 2 is false. b) Statement 1 is true and 2 is true

c) Statement 1 and 2 are false. d) Statement 1 is false and 2 is true.

46. **Statement 1:** The degree of the differential equation is represented by the power of the highest order derivative in the given differential equation.

Statement 2: The degree of any differential equation can be found when it is in the form of a polynomial; otherwise, the degree cannot be defined.

Statement 3: The degree of $\tan\left(\frac{dy}{dx}\right)$ = x + y is 1. (Easy)

a) Statement 1 is true and Statement 2 and 3 are false.

b) Statement 1 and 2 are true but Statement 3 is false.

c) Statement 1 and 3 are true but Statement 2 is false.

d) Statement 2 and 3 are true but Statement 1 is false

47. The order of the differential equation is always (Easy)

(a) Rational number (b) Whole number (c) Negative integer (d) Positive integer

48. The equation y = mx +c is general solution of (Easy)

(a) x $\frac{dy}{dx} = y$ (b) y $\frac{dy}{dx} = x$ (c) $\frac{d^2y}{dx^2} = 0$ (d) $\frac{d^2x}{dy^2} = 0$

TWO MARKS QUESTIONS

1. Find order and degree (if defined) of the following differential equations (Each sub question carries 2 marks)

(i) $\frac{dy}{dx}-\cos x=0$ (Easy)

(ii) $xy\frac{d^2y}{dx^2}+x\left(\frac{dy}{dx}\right)^2-y\frac{dy}{dx}=0$ (Easy)

(iii) $y'''+y^2+e^{y'}=o$ (Easy)

(iv) $\left(\frac{d^2y}{dx^2}\right)^2+\sin\left(\frac{d^3y}{dx^3}\right)=0$ (Average)

(v) $\left(\frac{ds}{dt}\right)^4+3s\frac{d^2s}{dt^2}=0$ (Easy)

(vi) $\left(\frac{d^2y}{dx^2}\right)^2+\cos\left(\frac{dy}{dx}\right)=0$ (Average)

(vii) $y'+5y=0$ (Easy)

(viii) $\frac{d^2y}{dx^2}=\cos 3x+\sin 3x$ (Easy)

(ix) $\left(y'''\right)^2+\left(y''\right)^3+\left(y'\right)^4+y^5=0$ (Easy)

(x) $y'+y=e^x$ (Easy)

(xi) $y'''+(y')^2+2y=0$ (Easy)

(xii) $y''+2y'+\sin y=0$ (Easy)

(xiii) $\frac{d^2y}{dx^2}+5x\left(\frac{dy}{dx}\right)^2-6y=\log x$ (Easy)

(xiv) $2x^2\left(\frac{d^2y}{dx^2}\right)-3\left(\frac{dy}{dx}\right)+y=0$ (Easy)

(xv) $\left(\frac{dy}{dx}\right)^3-4\left(\frac{dy}{dx}\right)^2+7y=\sin x$ (Easy)

(xvi) $\frac{d^4y}{dx^4}-\sin\left(\frac{d^3y}{dx^3}\right)=0$ (Average)

(xvii) $\left(\frac{d^2y}{dx^2}\right)^3+\left(\frac{dy}{dx}\right)^2+\sin\left(\frac{dy}{dx}\right)+1=0$ (Average)

2. Find the number of arbitrary constants in the general solution of differential equation of fourth order also find the number of arbitrary constants in the particular solution of differential equation of third order. (Average)

3. Find the general solution of a differential equation: $\frac{dx}{dy}+P_1x=Q_1$. (Easy)

4. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: (Each sub question carries 2 marks)

(i) $y=e^{-3x}$: $\frac{d^2y}{dx^2}+\frac{dy}{dx}-6y=0$ (Easy)

(ii) $y=a\cos x+b\sin x$, where a,b$\in$R : $\frac{d^2y}{dx^2}+y=0$ (Easy)

(iii) y= e^x+1 : $y''-y'=0$ (Easy)

(iv) $y=x^2+2x+c$: y'-2x-2=0 (Easy)

(v) y=cosx+C : y’+sinx=0 (Easy)

(vi) $y=\sqrt{1+x^2}$: y'= $\frac{xy}{1+x^2}$ (Easy)

(vii) $y=x\sin x$: xy'=y+x$\sqrt{x^2-y^2}$ ($x\neq 0$ and x>y or x<-y) (Average)

(viii) y=Ax : xy’=y(x$\neq$0). (Easy)

(ix) xy=logy+C : y'= $\frac{y^2}{1-xy}$ (xy$\neq$1) (Easy)

(x) y- cosy =x : (ysiny+cosy+x)y’=y (Average)

(xi) x+y=$\tan^{-1}y$: $y^2y'+y^2+1=0$ (Easy)

(xii) $y=\sqrt{a^2-x^2}$ $x\in(-a,a)$: $x+y\frac{dy}{dx}=0(y\neq 0)$ (Easy)

(xiii) $y=ae^x+be^{-x}+x^2$: $x\frac{d^2y}{dx^2}+2\frac{dy}{dx}-xy+x^2-2=0$ (Average)

(xiv) y=xsin3x : $\frac{d^2y}{dx^2}+9y-6\cos 3x=0$ (Average)

(xv) $y=e^x(a\cos x+b\sin x)$: $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$ (Average)

(xvi) $x^2=2y^2\log y$: $(x^2+y^2)\frac{dy}{dx}-xy=0$ (Average)

THREE MARKS QUESTIONS

1. Find the general solution of the following differential equations (Each sub question carries 3 marks)

(i) $\frac{dy}{dx}=\frac{x+1}{2-y},(y\neq 2)$ (Easy)

(ii) $\frac{dy}{dx}=\frac{1+y^2}{1+x^2}$ (Easy)

(iii) $\frac{dy}{dx}=\frac{1-\cos x}{1+\cos x}$ (Average)

(iv) $\frac{dy}{dx}=\sqrt{4-y^2}\,(-2<y<2)$ (Easy)

(v) $\frac{dy}{dx}+y=1(y\neq 1)$ (Easy)

(vi) $\frac{dy}{dx}=(1+x^2)(1+y^2)$ (Easy)

(vii) $(e^x+e^{-x})dy-(e^x-e^{-x})dx=0$ (Average)

(viii) $\sec^2 x\tan y\,dx+\sec^2 y\tan x\,dy=0$ (Average)

(ix) $y\log y\,dx-x\,dy=0$ (Average)

(x) $x^5\frac{dy}{dx}=-y^5$ (Easy)

(xi) $\frac{dy}{dx}=\sin^{-1}x$ (Easy)

(xii) $e^x\tan y\,dx+(1-e^x)\sec^2 y\,dy=0$ (Average)

(xiii) $\frac{dy}{dx}+\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}=0$ (Average)

(xiv) $\frac{dy}{dx}=e^{x+y}$ (Average)

2. Find the particular solution satisfying the given condition of the following differential equations (Each sub question carries 3 marks)

(i) $\frac{dy}{dx}=-4xy^2$ given that y=1, when x=0. (Easy)

(ii) $(x^3+x^2+x+1)\frac{dy}{dx}=2x^2+x; y=1$ when x=0 (Difficult)

(iii) $x(x^2-1)\frac{dy}{dx}=1; y=0$ when x=2 (Difficult)

(iv) $\cos\left(\frac{dy}{dx}\right)=a(a\in R); y=2$ when x=0 (Average)

(v) $\frac{dy}{dx}=y\tan x; y=1$ when x=0 (Average)

(vi) $(1+e^{2x})dy+(1+y^2)e^x dx$, given that y=1 when x=0 (Difficult)

(vii) $(x-y)(dx+dy)=dx-dy$, given that y=-1, when x=0. (Difficult)

3. Find the equation of the curve passing through the point (1, 1) whose differential equation is $xdy=(2x^2+1)dx(x\neq 0)$. (Average)

4. Find the equation of a curve passing through the point (-2, 3), given that the slope of the tangent to the curve at any point (x, y) is $\frac{2x}{y^2}$. (Average)

5. In a bank, principal increases continuously at the rate of 5% per year. In how many years Rs.1000 double itself? (Difficult)
6. Find the equation of a curve passing through the point(0,0) and whose differential equation is $y' = e^x \sin x$. (Difficult)
7. For the differential equation $xy\frac{dy}{dx} = (x+2)(y+2)$, find the solution curve passing through the point (1,-1). (Difficult)
8. Find the equation of curve passing through the point (0,-2) given that at any point (x,y) on the curve, the product of the slope of its tangent and y coordinate of the point is equal to the x coordinate of the point. (Difficult)
9. At any point (x,y) of a curve, the slope of the tangent is twice the slope of the line segment joining the point of contact to the point (-4,-3). Find the equation of the curve given that it passes through (-2,1). (Difficult)
10. The volume of spherical balloon being inflated changes at a constant rate. If initially its radius is 3 units and after 3 seconds it is 6 units. Find the radius of balloon after t seconds. (Difficult)
11. In a bank, principal increases continuously at the rate of r% per year. Find the value of r if Rs.100 if Rs.100 double itself in 10 years ($\log_e 2=0.6931$). (Difficult)
12. In a bank principal increases continuously at the rate of 5% per year. An amount of Rs.1000 is deposited with this bank, how much will it worth after 10 years ($e^{0.5}=1.648$). (Difficult)
13. In a culture, the bacteria count is 1,00,000. The number is increased by 10% in 2 hours. In how many hours will the count reach 2,00,000, if the rate of growth of bacteria is proportional to the number present? (Difficult)

FIVE MARKS QUESTIONS

1. Find the general solution of the following differential equations (Each sub question carries 5 marks)

(i) $\frac{dy}{dx} - y = \cos x$. (Easy)

(ii) $x\frac{dy}{dx} + 2y = x^2 (x \neq 0)$ (Average)

(iii) $ydx - (x+2y^2)dy = 0$ (Average)

(iv) $\frac{dy}{dx} + 2y = \sin x$ (Easy)

(v) $\frac{dy}{dx} + 3y = e^{-2x}$ (Easy)

(vi) $\frac{dy}{dx} + \frac{y}{x} = x^2$ (Easy)

(vii) $x\frac{dy}{dx} + 2y = x^2 \log x$ (Average)

(viii) $x\frac{dy}{dx} - y = 2x^2$ (Average)

(ix) $x\log x\frac{dy}{dx} + y = \frac{2}{x}\log x$ (Average)

(x) $\frac{dy}{dx} + (\sec x)y = \tan x (0 \le x \le \pi/2)$ (Difficult)

(xi) $(1+x^2)dy + 2xydx = \cot x dx (x \neq 0)$ (Difficult)

(xii) $x\frac{dy}{dx} + y - x + xy\cot x = 0 (x \neq 0)$ (Difficult)

(xiii) $(x+y)\frac{dy}{dx} = 1$ (Average)

(xiv) $ydx + (x - y^2)dy = 0$ (Difficult)

(xv) $(x+3y^2)\frac{dy}{dx} = y (y > 0)$ (Difficult)

(xvi) $\cos^2 x\frac{dy}{dx} + y = \tan x (0 \le x \le \pi/2)$ (Difficult)

(xvii) $(1-y^2)\frac{dx}{dy} + yx = ay (-1 < y < 1)$ (Difficult)

2. Find the particular solution satisfying the given condition of the following differential equations (Each sub question carries 5 marks)

(i) $\frac{dy}{dx}+2y\tan x=\sin x$, y=0 when x=$\frac{\pi}{3}$ (Average)

(ii) $(1+x^2)\frac{dy}{dx}+2xy=\frac{1}{1+x^2}$, y=0 when x=1 (Difficult)

(iii) $\frac{dy}{dx}-3y\cot x=\sin 2x$, y=2 when x=$\frac{\pi}{2}$ (Average)

3. Find the equation of a curve passing through the origin given that the slope of the tangent to the curve at any point (x,y) is equal to the sum of the coordinates of the point. (Average)

4. Find the equation of a curve passing through the point (0,2) given that the sum of the coordinates of any point on the curve exceeds the magnitude of the slope of the tangent to the curve at that point by 5. (Average)

ADDITIONAL QUESTIONS

1. Solve the differential equation: $(xdy-ydx)y\sin\left(\frac{y}{x}\right)=(ydx+xdy)x\cos\left(\frac{y}{x}\right)$. (Difficult)

2. Solve the differential equation: $(\tan^{-1}y-x)dy=(1+y^2)dx$. (Difficult)

3. Find the particular solution of the differential equation: $(1+e^{2x})dy+(1+y^2)e^x dx=0$ given that y=1 when x=0. (Difficult)

4. Find a particular solution of the differential equation (x-y)(dx+dy)=dx-dy, given that y=-1, when x=0. (Average)

5. Find a particular solution of the differential equation :
$\frac{dy}{dx}+y\cot x=4x\cos ecx(x\neq 0)$, given that y=0 when x=$\frac{\pi}{2}$. (Average)

6. Show that the differential equation $(x-y)\frac{dy}{dx}=x+2y$ is homogeneous and solve it. (Difficult)

7. Show that the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx}=y\cos\left(\frac{y}{x}\right)+x$ is homogeneous and solve it. (Difficult)

8. Show that the differential equation $2ye^{\frac{x}{y}}dx+(y-2xe^{\frac{x}{y}})dy=0$ is homogeneous and find its particular solution, given that, x=0 when y=1. (Difficult)

9. Show that the family of curves for which the slope of the tangent at any point (x,y) on it is $\frac{x^2+y^2}{2xy}$, is given by $x^2-y^2=cx$ (Difficult)

10. Show that the differential equation $(x^2+xy)dy=(x^2+y^2)dx$ is homogeneous and solve it. (Difficult)

11. Show that the differential equation $y'=\frac{x+y}{x}$ is homogeneous and solve it. (Average)

12. Show that the differential equation $(x-y)dy-(x+y)dx=0$ is homogeneous and solve it. (Easy)

13. Show that the differential equation $(x^2-y^2)dx+2xydy=0$ is homogeneous and solve it. (Easy)

14. Show that the differential equation $x^2\frac{dy}{dx}=x^2-2y^2+xy$ is homogeneous and solve it. (Easy)

15. Show that the differential equation $xdy-ydx=\sqrt{x^2+y^2}dx$ is homogeneous and solve it. (Easy)

16. Show that the differential equation $\left\{x\cos\left(\frac{y}{x}\right)+y\sin\left(\frac{y}{x}\right)\right\}ydx=\left\{y\sin\left(\frac{y}{x}\right)-x\cos\left(\frac{y}{x}\right)\right\}xdy$ is homogeneous and solve it. (Average)

17. Show that the differential equation $x\frac{dy}{dx}-y+x\sin\left(\frac{y}{x}\right)=0$ is homogeneous and solve it. (Average)

18. Show that the differential equation $ydx+x\log\left(\frac{y}{x}\right)dy-2xdy=0$ is homogeneous and solve it. (Average)

19. Show that the differential equation $(1+e^{\frac{x}{y}})dx+e^{\frac{x}{y}}(1-\frac{x}{y})dy=0$ is homogeneous and solve it. (Difficult)

20. For, (x+y)dy+(x-y)dx=0, find the particular solution satisfying the given condition, y=1 when x=1. (Average)

21. For $x^2dy+(xy+y^2)dx$,find the particular solution satisfying the given condition, y=1 when x=1. (Average)

22. For, $\left[x\sin^2\left(\frac{y}{x}\right)-y\right]dx+xdy=0;$ find the particular solution satisfying the given condition, $y=\pi/4$ when x=1. (Difficult)

23. For, $\frac{dy}{dx}-\frac{y}{x}+\cos ec\left(\frac{y}{x}\right)=0;$ find the particular solution satisfying the given condition, y=0 when x=1. (Difficult)

24. For, $2xy+y^2-2x^2\frac{dy}{dx}=0;$ find the particular solution satisfying the given condition, y=2 when x=1. (Difficult)

CHAPTER-10
VECTOR ALGEBRA

MCQ /FB questions.

1. Which of the following measures as vectors. (Easy)
(A)$1000cm^3$ (B) 30 km/hr (C) 10 g/cm^3 (D) 20 m/s towards north.

2. Which of the following measures as scalar. (Easy)
(A) 10 Newton (B) force (C) work done (D) velocity.

3. Which of the following is not true: (Easy)
(A) Time – scalar. (B) Density-scalar (C) Speed-scalar (D) Force- scalar

4. Which of the following is true: (Difficult)
(A) $\vec{a}$ and $-\vec{a}$ are collinear.
(B) Two collinear vectors are always equal in magnitude.
(C) Two collinear vectors are always same direction.
(D) Two collinear vectors having the same magnitude are equal.

5. If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following is incorrect: (Easy)
(A) $\vec{b} = \lambda\vec{a}$, where $\lambda \in R$.. (B) $\vec{a} = \pm\vec{b}$.
(C) The direction ratios of $\vec{a}$ and $\vec{b}$ are not proportional.
(D) Both the vectors $\vec{a}$ and $\vec{b}$ have same direction, but different magnitudes.

6. The values of x, y and z. so that the vectors $\vec{a} = x\,\hat{\imath} + 2\hat{\jmath} + z\,\hat{k}$ and $\vec{b} = 2\hat{\imath} + y\hat{\jmath} + \hat{k}$ are equal (Easy)
(A) 1, 2, 2 (B) 2, 1, 2 (C) 2, 2, 1 (D) 1, 1, 2

7. In vector addition, which of the following is not true: (Average)
(A) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$ (B) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$
(C) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \vec{0}$ (D) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \vec{0}$

8. If $\vec{a}$ is a nonzero vector of magnitude 'a' and λ a nonzero scalar, then $\lambda\vec{a}$ is unit vector if (Easy)
(A) $\lambda = 1$ (B) $\lambda = -1$ (C) $a = |\lambda|$ (D) $a = \frac{1}{|\lambda|}$

9. A unit vector in the direction of vector $\vec{a} = 2\,\hat{\imath} + 3\hat{\jmath} + \hat{k}$ *is* (Easy)
(A) $\frac{2\,\hat{\imath}+3\hat{\jmath}+\hat{k}}{\sqrt{14}}$ (B) $-\frac{2\,\hat{\imath}+3\hat{\jmath}+\hat{k}}{\sqrt{14}}$ (C)$\frac{2\,\hat{\imath}+3\hat{\jmath}+\hat{k}}{\sqrt{6}}$ (D) $-\frac{2\,\hat{\imath}+3\hat{\jmath}+\hat{k}}{\sqrt{6}}$

10. The direction ratio's of the vector $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ *are* (Easy)
(A) 1,1,2 (B) -1,1,-2 (C)$-1,1,-2$ (D) -1,-1,2

11. The direction cosin's of the vector $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ *are* (Easy)
(A)$\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{3}{\sqrt{6}}$ (B) $\frac{-1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}$ (C)$\frac{-1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}, \frac{-3}{\sqrt{6}}$ (D) $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

12. The direction ratio's of the line joining the points A(1,2,-3) and B(-1,-2,1), directed from A to B are (Easy)
(A) (2,4,-4) (B) (0,0,2) (C) (-2,-4,4) (D) (0,0,-2).

13. The magnitude of the vector $\frac{1}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\hat{\jmath} - \frac{1}{\sqrt{3}}\hat{k}$ is (Easy)
(A) 3 (B) $\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) 1.

14. The vector with initial point P $(2,3,0)$ and terminal point Q $(-1,-2,-4)$ is (Easy)
(A) $3\hat{\imath} + 5\hat{\jmath} + 4\hat{k}$ (B) $-3\hat{\imath} - 5\hat{\jmath} - 4\hat{k}$ (C) $\hat{\imath} + \hat{\jmath} - 4\hat{k}$ (D) $-3\hat{\imath} - 5\hat{\jmath} + 4\hat{k}$

15. The unit vector in the direction of $\overrightarrow{PQ}$ where P and Q are the points (1, 2, 3) and (4, 5, 6), respectively is (Easy)
(A) $3\hat{\imath} + 3\hat{\jmath} + 3\hat{k}$ (B) $\hat{\imath} + \hat{\jmath} - \hat{k}$ (C) $-\hat{\imath} - \hat{\jmath} - \hat{k}$ (D) $\frac{1}{\sqrt{3}}\vec{i} + \frac{1}{\sqrt{3}}\vec{j} + \frac{1}{\sqrt{3}}\vec{k}$

16. The value of x for which $x(\hat{\imath} + \hat{\jmath} + \hat{k})$ is a unit vector. (Average)
(A) 3 (B) $\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) 1

17. The unit vector in the direction of $\vec{a} + \vec{b}$ where $\vec{a} = 2\hat{\imath} - \hat{\jmath} + 2\hat{k}$ and $\vec{b} = -\hat{\imath} + \hat{\jmath} - \hat{k}$ is (Easy)
(A) $\hat{\imath} + \hat{k}$ (B) $\frac{1}{\sqrt{2}}(\hat{\imath} + \hat{k})$ (C) $-3\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ (D)$\frac{1}{\sqrt{22}}(-3\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$

18. The position vector of the mid-point of the vector joining the points P(2, 3, 4) and Q(4, 1, –2) is (Easy)

(A) $3\hat{\imath} + 2\hat{\jmath} + \hat{k}$ (B) $3\hat{\imath} + 2\hat{\jmath} - \hat{k}$ (C) $\hat{\imath} - \hat{\jmath} - 3\hat{k}$ (D)- $\hat{\imath} + \hat{\jmath} + \widehat{3k}$

19. The position vector of a point which divides the join of points with position vectors $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ externally in the ratio 2:1 is (Easy)

(A)$\frac{5\vec{a}}{3}$ (B) $4\vec{b} - \vec{a}$ (C)$\overrightarrow{4a} + \vec{b}$ (D) $\overrightarrow{2a} + \vec{b}$

20. The value of λ for which the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + \lambda\hat{\jmath} - 8\hat{k}$ are collinear is (Easy)

(A) 3 (B) 6 (C)-3 (D)-6

21. If $\hat{\imath}$,$\hat{\jmath}$ *and* $\hat{k}$ are unit vectors, then which of the following is incorrect (Average)

(A) $\hat{\imath} \cdot i = \hat{\jmath} \cdot \hat{\jmath} = \hat{k} \cdot \hat{k} = 1$ (B) $\hat{\imath} \cdot \hat{\jmath} = \hat{\jmath} \cdot \hat{k} = \hat{k} \cdot \hat{\imath} = 0$

(C) $\hat{\imath} \times i = \hat{\jmath} \times \hat{\jmath} = \hat{k} \times \hat{k} = \vec{0}$ (D) $\hat{\imath} \times \hat{\jmath} = \hat{\jmath} \times \hat{k} = \hat{k} \times \hat{\imath} = 1$

22. The projection vector of $\overrightarrow{AB}$ on the directed line l, if angle $\theta = \pi$ will be. (Average)

(A) $Zero$ vector (B)$\overrightarrow{AB}$ (C)$\overrightarrow{BA}$ (D) $Unit$ vector.

23. The *projection vector* of $\overrightarrow{AB}$ on the directed line l, if angle $\theta = \frac{\pi}{2}$ or $\frac{3\pi}{2}$ will be. (Easy)

(A) $Zero$ vector. (B)$\overrightarrow{AB}$ (C)$\overrightarrow{BA}$ (D) $Unit$ vector.

24. The projection of $\vec{a} = 2i + 3j + 2k$ on $\vec{b} = i + 2j + k$ is (Easy)

(A) $\frac{10}{\sqrt{6}}$ (B)$\frac{5}{\sqrt{3}}$ (C) $\frac{10}{\sqrt{17}}$ (D)$\frac{10}{\sqrt{102}}$.

25. The projection of a vector $\vec{a} = \hat{\imath} + 3\hat{\jmath} + 7\hat{k}$ along $\vec{b} = 7\hat{\imath} - \hat{\jmath} + 8\hat{k}$ is (Easy)

(A) $\frac{60}{\sqrt{59}}$ (B) $\frac{60}{\sqrt{114}}$ (C) $\frac{63}{\sqrt{59}}$ (D) $\frac{63}{\sqrt{114}}$

26. The projection of a vector $\hat{\imath} + \hat{\jmath}$ along $\hat{\imath} - \hat{\jmath}$ is (Easy)

(A) 2 (B) $\sqrt{2}$ (C) 0 (D) $\frac{1}{\sqrt{2}}$.

27. Projection vector of $\vec{a}$ on $\vec{b}$ is (Easy)

(A) $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|^2}$ (B) $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|^2}\vec{b}$ (C) $\frac{\vec{a}\cdot\vec{b}}{|\vec{a}|}$ (D) $\frac{\vec{a}\cdot\vec{b}}{|\vec{a}|^2}$

28. If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\vec{a} \cdot \vec{b} \geq 0$ only when (Difficult)

(A) $0 < \theta < \frac{\pi}{2}$ (B) $0 \leq \theta \leq \frac{\pi}{2}$ (C) $0 < \theta < \pi$ (D) $0 \leq \theta \leq \pi$

29. The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and $\vec{a} \cdot \vec{b}$ =1 is (Average)

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

30. The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2 respectively and $\vec{a} \cdot \vec{b}$ =$\sqrt{6}$ is (Easy)

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

31. The magnitude of two vectors a and b, having the same magnitude and such that the angle between them is $\frac{\pi}{3}$ and their scalar product is $\frac{1}{2}$. (Average)

(A) 2 (B) -1 (C) 1 (D) -2

32. The value of λ for which the two vectors $2\hat{\imath} - \hat{\jmath} + 2\hat{k}$ and $3\hat{\imath} + \lambda\hat{\jmath} + \hat{k}$ are perpendicular is (Easy)

(A) 2 (B) 4 (C) 6 (D) 8

33. Let $\vec{a}$ and $\vec{b}$ be two unit vectors and θ is the angle between them. Then $\vec{a} + \vec{b}$ is a unit vector if (Average)

(A) $\theta = \frac{\pi}{4}$ (B) $\theta = \frac{\pi}{3}$ (C) $\theta = \frac{\pi}{2}$ (D) $\theta = \frac{2\pi}{3}$

34. The value of $\hat{\imath} \cdot (\hat{\jmath} \times \hat{k}) + \hat{\jmath} \cdot (\hat{\imath} \times \hat{k}) + \hat{k} \cdot (\hat{\imath} \times \hat{\jmath})$ is (Average)

(A) 0 (B) -1 (C) 1 (D) 3

35. A unit vector perpendicular to the both the vectors $\mathrm{i} + \mathrm{j}$ and $\mathrm{j} + \mathrm{k}$ is (Difficult)

(A) $\frac{-\mathrm{i}-\mathrm{j}+\mathrm{k}}{\sqrt{3}}$ (B) $\frac{\mathrm{i}+\mathrm{j}+\mathrm{k}}{\sqrt{3}}$ (C) $\frac{\mathrm{i}+\mathrm{j}-\mathrm{k}}{3}$ (D) $\frac{\mathrm{i}-\mathrm{j}+\mathrm{k}}{\sqrt{3}}$

36. If a unit vector $\vec{a}$ makes angles with $\frac{\pi}{3}$ with $\hat{\imath}$ $and \frac{\pi}{4}$ with $\hat{\jmath}$ and an acute angle θ with $\hat{k}$, then θ is θ (Average)
(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

37. If $|\vec{a}\cdot\vec{b}| = -|\vec{a}|\,|\vec{b}|$ then the angle between $\vec{a}$ & $\vec{b}$ is (Easy)
(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) π (D) $\frac{\pi}{3}$.

38. If $\vec{a}$ and $\vec{b}$ are vectors such that $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$, then the angle between vectors $\vec{a}\,\&\vec{b}$ is- (Easy)
(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) π (D) $\frac{\pi}{3}$.

39. If $\vec{a}$ and $\vec{b}$ are unit vectors and $\frac{\pi}{3}$ is the angle between them, then $|\vec{a}+\vec{b}|$ is (Easy)
(A) $\sqrt{3}$ (B) 3 (C) 1 (D) $\sqrt{2}$.

40. If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $|\vec{a}\cdot\vec{b}| = |\vec{a}\times\vec{b}|$ when θ is equal to (Easy)
(A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π

41. If $|\vec{a}| = 8$, $|\vec{b}| = 3$ and $|\vec{a}\times\vec{b}| = 12$, then value of $\vec{a}\cdot\vec{b}$ is (Easy)
(A) $6\sqrt{3}$ (B) $8\sqrt{3}$ (C)$12\sqrt{3}$ (D) $12\sqrt{8}$

42. The unit vector perpendicular to the vectors $\hat{\imath}-\hat{\jmath}$ and $\hat{\imath}+\hat{\jmath}$ forming a right handed system is (Easy)
(A) $\hat{k}$ (B) $-\hat{k}$ (C) $\frac{\hat{\imath}-\hat{\jmath}}{\sqrt{2}}$ (D) $\frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}$

43. The number of unit vectors perpendicular to the vectors $\vec{a} = 2\vec{i}+\vec{j} = 2\vec{k}\,\&\vec{b} = \vec{j}+\vec{k}$ is (Easy)
(A) one (B) two (C) three (D) infinite

44. If $\vec{a}\cdot\vec{b}$ =0 and $\vec{a}\times\vec{b}$ =0, then the vectors $\vec{a}$ and $\vec{b}$ are (Average)
(A) Perpendicular (B) collinear (C) either $\vec{a} = \vec{0}$ or $\vec{b} = \vec{o}$ (D) none of these.

45. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$, $|\vec{b}| = \frac{\sqrt{2}}{3}$ $\vec{a}\times\vec{b}$ is a unit vector. The angle between $\vec{a}$ and $\vec{b}$. (Easy)
(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) π (D) $\frac{\pi}{3}$.

46. The scalar components of vector with initial point (2,1) and terminal point $(-7,5)$. (Easy)
(A) -5, 6 (B) -9, 4 (C) 9, -4 (D) 5, 4

47. If $(\vec{a}-\vec{b})\times(\vec{a}+\vec{b}) = k(\vec{a}\times\vec{b})$,then k is (Average)
(A) 1 (B) 0 (C) 2 (D) -2

48. The value of $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a}) = 8$ (Easy)
(A) -3 (B) 3 (C) -9 (D) 9

49. The vectors $2i - 3\,j + 4k$ and $-4i + 6\,j - 8k$ are (Easy)
(A) Perpendicular B) collinear (C) Equal (D) Negative of each other.

50. The value of λ ,if $(2\hat{\imath}+6\hat{\jmath}+27\hat{k})\times(\hat{\imath}+\lambda\hat{\jmath}+\mu\hat{k}) = \vec{0}$ (Average)
(A) -3 (B) 3 (C) -9 (D) 9

51. If $(3\vec{a}-5\,\vec{b})\times(2\vec{a}+7\vec{b}) = k(\vec{a}\times\vec{b})$, then k is (Average)
(A) 11 (B) 10 (C) 21 (D)31

52. If $\vec{a}\cdot\vec{a} = 0$ and $\vec{a}\cdot\vec{b} = 0$, then the vector $\vec{b}$ is (Average)
(A) $\vec{0}$ (B) $\vec{b}\perp\vec{a}$ (C) collinear to $\vec{a}$ (D) any vector

53. If $\vec{a}\times\vec{b} = 0$ and $\vec{a}\cdot\vec{b} = 0$ .What can you conclude about the vectors $\vec{a}$ and $\vec{b}$? (Average)
(A) $|\vec{a}| = |\vec{b}|$ (B) $\vec{a}\perp\vec{b}$ (C) $\vec{a}$ and $\vec{b}$ are collinear (D)$|\vec{a}| = 0$ or $|\vec{b}| = 0$

54. **Statement 1:** The value of $\vec{i}.\left(\vec{j}\times\vec{k}\right)+\vec{j}.\left(\vec{i}\times\vec{k}\right)+\vec{k}.\left(\vec{i}\times\vec{j}\right)$ *is* 1

Statement 2: $\vec{i}.\vec{i}=\vec{j}.\vec{j}=\vec{k}.\vec{k}=0$ (Average)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

55. **Assertion (A):** The two vectors $\vec{a} = 2\hat{\imath}-\hat{\jmath}+2\hat{k}$ and $\vec{b} = -6\hat{\imath}+3\hat{\jmath}-6\hat{k}$ are collinear vectors.

Reason (R): If two vectors $\vec{a}$ and $\vec{b}$ are collinear, then $\vec{a} = \lambda\,\vec{b}$, where $\lambda \in R$. (Easy)

A) A is false and R is true
B) A is true and R is true
C) A is true and R is false
D) A is false and R is false.

56. **Statement 1:** The magnitude of vector $\vec{a}=\frac{1}{\sqrt{3}}\hat{\imath}+\frac{1}{\sqrt{3}}\hat{\jmath}-\frac{1}{\sqrt{3}}\hat{k}$. is 1

Statement 2: if $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ then $\left|\vec{r}\right|=x^2+y^2+r^2$ (Easy)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false.

57. **Assertion (A):** The two vectors $\vec{a} = 4\hat{\imath}+4\hat{\jmath}-2\hat{k}$ and $\vec{b} = 4\hat{\imath}-2\hat{\jmath}+4\hat{k}$ are perpendicular vectors.

Reason (R): If two vectors $\vec{a}$ and $\vec{b}$ are perpendicular, then $|\vec{a}| = |\vec{b}|$. (Easy)

A) A is false and R is true
B) A is true and R is true
C) A is true and R is false
D) A is false and R is false.

58. **Statement 1:** The vector joining the points A(1,0,-1) and B(2,1,0) in the directed from B to A is $\hat{\imath}+\hat{\jmath}+\hat{k}$

Statement 2: $\overrightarrow{PQ}=\overrightarrow{OQ}-\overrightarrow{OP}$ (Easy)

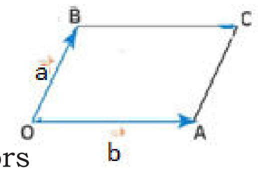
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is true.

59. **Statement 1:** If either $|\vec{a}| = 0$ or $|\vec{b}| = 0$ then $\vec{a}.\vec{b}=0$

Statement 2: If $\vec{a}\times\vec{b}=\vec{0}$, *then* $\vec{a}\perp$ *to* $\vec{b}$. (Average)

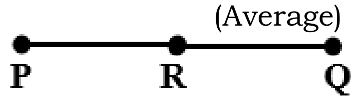
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true,
C) Statement 1 is true and Statement 2 is true,
D) Statement 1 is false and Statement 2 is false.

60. For the given figure, $\vec{a}-\vec{b}$ *is* (Average)



A) $\overrightarrow{OC}$ B) $\overrightarrow{CO}$ C) $\overrightarrow{BA}$ D) $\overrightarrow{AB}$

61. In the figure if R is the mid-point of P and Q and position vectors of R, Q are $\vec{a}$, $\vec{b}$ respectively then the position vector of P is (Average)



A) $\frac{\vec{a}-\vec{b}}{2}$ B) $\frac{\vec{a}+\vec{b}}{2}$ C) $2\vec{a}-\vec{b}$ D) $2\vec{a}+\vec{b}$

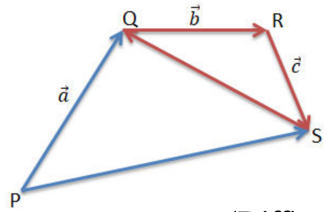
62. For the given figure, $\overrightarrow{PS}$ *and* $\overrightarrow{SQ}$ *respectively are* (Difficult)

A) $\vec{a}+\vec{b}+\vec{c}$, $\vec{b}-\vec{c}$

B) $\vec{a}+\vec{b}+\vec{c}$, $-\vec{b}-\vec{c}$

C) $-\vec{a}-\vec{b}-\vec{c}$, $\vec{b}+\vec{c}$

D) $\vec{a}+\vec{b}+\vec{c}$, $\overrightarrow{-b}+\vec{c}$



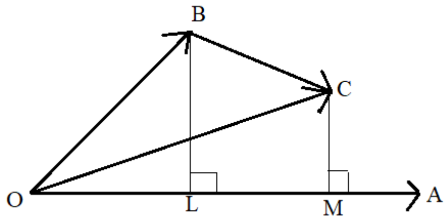
63. In the figure If $\overrightarrow{OA}=\vec{a}$, $\overrightarrow{OB}=\vec{b}$, $\overrightarrow{OC}=\vec{c}$ and $\overrightarrow{BC}=\vec{x}$ then LM is (Difficult)

A) $\frac{\vec{a}.\vec{c}}{|\vec{a}|}$

B) $\frac{\vec{a}.\vec{b}}{|\vec{a}|}$

C) $\frac{\vec{a}.(\vec{b}+\vec{c})}{|\vec{a}|}$

D) $\frac{\vec{a}.(\vec{c}-\vec{b})}{|\vec{a}|}$



64. If $(2\vec{a}-3\vec{b})\times(3\vec{a}-2\vec{b})=\lambda(\vec{a}\times\vec{b})$, then the value of λ is _____ (Average)

65. The projection of the vector $\vec{a}=2\hat{\imath}+3\hat{\jmath}+2\hat{k}$ on y-axis is --------- (Average)

66. The value of μ ,if $(2\hat{\imath}+6\hat{\jmath}+3\hat{k})\times(\hat{\imath}+3\hat{\jmath}+\mu\hat{k})=\vec{0}$ is --------- (Average)

67. If $|\vec{a}|=5$, $\vec{a}\cdot\vec{b}=8$ and $|\vec{a}\times\vec{b}|=6$, then value of $|\vec{b}|$ is --------- (Average)

68. The value of $\hat{\imath}\cdot(\hat{\jmath}+\hat{k})+\hat{\jmath}\cdot(\hat{\imath}+\hat{k})+\hat{k}\cdot(\hat{\imath}+\hat{\jmath})$ is --------- (Average)

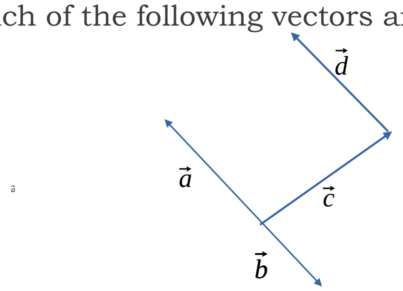
69. The value of $|\hat{\imath}\times(\hat{\jmath}+\hat{k})+\hat{\jmath}\times(\hat{\imath}+\hat{k})+\hat{k}\times(\hat{\imath}+\hat{\jmath})|$ is________ (Average)

70. The value of $|\vec{a}\times(\vec{b}+\vec{c})+\vec{b}\times(\vec{c}+\vec{a})+\vec{c}\times(\vec{a}+\vec{b})|$ is_________ (Difficult)

71. The projection on the y axis of the vector 3i+4k is_________ (Average)

72. The scalar product of λ i + j – 3k and 3i – 4j + 7k is -10, then the value of λ is_ (Average)

73. Which of the following vectors are collinear in the figure given below? (Average)



A) $\vec{a}$, $\vec{c}$ and $\vec{d}$ B) $\vec{a}$, $\vec{b}$ and $\vec{d}$ C) $\vec{a}$ and $\vec{d}$ D) $\vec{b}$ and $\vec{d}$

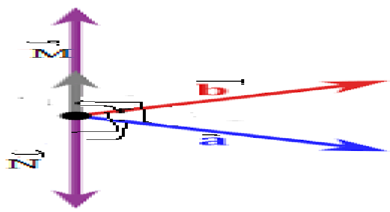
74. For the given figure $\vec{M}$ *and* $\vec{N}$ *are respectivly* (Difficult)

A) $\vec{a}\times\vec{b}$ and $-\vec{a}\times-\vec{b}$

B) $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$

C) $\vec{a}\times\vec{b}$ and $\vec{a}\cdot\vec{b}$

D) $\vec{a}\times\vec{b}$ and $\vec{b}\times\vec{a}$



Two mark questions:

1. Find the unit vector in the direction of the $\vec{a}=\hat{\imath}+\hat{\jmath}+2\hat{k}$ (Easy)

2. Find the unit vector in the direction of the $\vec{a}=2\hat{\imath}+3\hat{\jmath}+\hat{k}$ (Easy)

3. For what value of λ, is the vector $\frac{2}{3}\hat{\imath}-\lambda\hat{\jmath}+\frac{2}{3}\hat{k}$ a unit vector? (Easy)

4. Find the value of λ for which $\lambda(2\hat{\imath}+\hat{\jmath}-2\hat{k})$ is a unit vector. (Easy)

5. Show that the vectors $2\hat{\imath}-3\hat{\jmath}+4\hat{k}$ and $-4\hat{\imath}+6\hat{\jmath}-8\hat{k}$ are collinear. (Easy)

6. If $2\hat{\imath}-3\hat{\jmath}+4\hat{k}$ and $\lambda\,\hat{\imath}+6\hat{\jmath}-8\hat{k}$ are collinear then find λ. (Easy)

7. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and 2 respectively and $\vec{a}\ .\ \vec{b}=\sqrt{6}$. (Easy)

8. If $\vec{a}=x\hat{\imath}+2\hat{\jmath}-z\hat{k}$ and $\vec{b}=3\hat{\imath}-y\hat{\jmath}+\hat{k}$ are two equal vectors, then write the value of x+y+z. (Easy)

9. Find the direction cosines of the vector $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$. (Easy)

10. Write the scalar components and vector components of the vector joining the points $A = (x_1, y_1, z_1)$ and $B = (x_2, y_2, z_2)$. (Easy)

11. If vector $\overrightarrow{AB} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\overrightarrow{OB} = 3\hat{\imath} - 4\hat{\jmath} + 4\hat{k}$, find the position vector $\overrightarrow{OA}$. (Easy)

12. Find the scalar components of vector with initial point $(2,1)$ and terminal point $(-7,5)$. (Easy)

13. Find the unit vector in the direction of $\vec{a}+\vec{b}$, where $\vec{a}=2\hat{i}-\hat{j}+2\hat{k}$ and $\vec{b}=-\hat{i}+\hat{j}-\hat{k}$. (Easy)

14. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\hat{i}+2\hat{j}-\hat{k}$ and $-\hat{i}+\hat{j}+\hat{k}$ respectively, in the ratio 2 : 1 internally. (Easy)

15. Find the position vector of the mid point of the vector joining the points P (2, 3, 4) and Q (4, 1, –2). (Easy)

16. Show that $(\vec{a}-\vec{b})\times(\vec{a}+\vec{b})=2(\vec{a}\times\vec{b})$ (Average)

17. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ is equally inclined to the axes OX , OY and OZ. (Average)

18. Find the angle between the vectors $\hat{i}-2\hat{j}+3\hat{k}$ and $3\hat{i}-2\hat{j}+\hat{k}$. (Easy)

19. Find angle between the vectors $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}+\hat{k}$. (Easy)

20. If $\vec{a}=5\hat{i}-\hat{j}-3\hat{k}$ and $\vec{b}=\hat{i}+3\hat{j}-5\hat{k}$, then show that the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are perpendicular. (Easy)

21. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is 60° and their scalar product is $\frac{1}{2}$. (Average)

22. Find $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x}-\vec{a}).(\vec{x}+\vec{a})=12$ (Average)

23. If $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$, prove that $\vec{a}$ and $\vec{b}$, are perpendicular. (Average)

24. Find $|\vec{b}|$, if $(\vec{a}+\vec{b}).(\vec{a}-\vec{b})=8$ and $|\vec{a}|=8|\vec{b}|$. (Easy)

25. Find the projection of the vector $\hat{i}+3\hat{j}+7\hat{k}$ on the vector $7\hat{i}-\hat{j}+8\hat{k}$. (Easy)

26. Find the projection of the vector $\vec{a}=2\hat{i}+3\hat{j}+2\hat{k}$ on the vector $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$. (Easy)

27. If two vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}|=2$, $|\vec{b}|=3$ and $\vec{a}.\vec{b}=4$, find $|\vec{a}-\vec{b}|$. (Easy)

28. If $\vec{a}=4\hat{i}+3\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{k}$, then find $|2\vec{b}\times\vec{a}|$ (Average)

29. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a}=\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=2\hat{i}-7\hat{j}+\hat{k}$. (Easy)

30. Find the area of a parallelogram whose adjacent sides are given by the vectors $\vec{a}=3\hat{i}+\hat{j}+4\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$. (Easy)

31. Find the area of the parallelogram whose adjacent sides determine by the vectors $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$. (Easy)

32. Find the area of the triangle whose adjacent sides are determined by the vectors $\vec{a}=-2\hat{i}-5\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}-\hat{k}$. (Easy)

33. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}|=3$, $|\vec{b}|=\frac{\sqrt{2}}{3}$ and $\vec{a}\times\vec{b}$ is a unit vector. Find the angle between $\vec{a}$ and $\vec{b}$ (Easy)

34. Find λ and μ, if $(2\hat{i}+6\hat{j}+27\hat{k})\times(\hat{i}+\lambda\hat{j}+\mu\hat{k})=\vec{0}$. (Average)

35. If $\vec{a}\,.\,\vec{a}$ =0 and $\vec{a}.\vec{b}$ =0, then what can be concluded about the vector $\vec{b}$? (Average)

36. Show that $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$ is perpendicular to $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$, for any two nonzero vectors $\vec{a}$ and $\vec{b}$. (Average)

37. If either vector $\vec{a}=0$ or $\vec{b}=0$, then $\vec{a}\cdot\vec{b}=0$. But the converse need not be true. Justify your answer with an example. (Average)

38. Find $|\vec{a}\times\vec{b}|$, if $\vec{a}=\hat{i}-7\hat{j}+7\hat{k}$ and $\vec{b}=3\hat{i}-2\hat{j}+2\hat{k}$ (Easy)

39. Find the area of the triangle with vertices A(1,1,2), B(2,3,5) and C(1,5, 5) (Easy)

40. The two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$. Find the unit vector parallel to its diagonal. (Difficult)

41. Find the projection of $\vec{a}$ on $\vec{b}$ if $\vec{a}\cdot\vec{b}=8$ and $\vec{b}=2\hat{i}+6\hat{j}+3\hat{k}$ (Average)

Three mark questions:

1. Show that the position vector of the point P, which divides the line joining the points A and B having the position vectors $\vec{a}$ and $\vec{b}$ internally in the ratio $m:n$ is $\dfrac{m\vec{b}+n\vec{a}}{m+n}$. (Average)
2. Find a unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$, where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$ (Average)
3. If $\vec{a},\vec{b},\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$. (Average)
4. Show that the points $A\left(2\hat{i}-\hat{j}+\hat{k}\right)$, $B\left(\hat{i}-3\hat{j}-5\hat{k}\right)$ and $C\left(3\hat{i}-4\hat{j}-4\hat{k}\right)$ are the vertices of a right angled triangle (Difficult)
5. If the vertices A, B and C of a triangle are $(1,2,3)$, $(-1,0,0)$ and $(0,1,2)$ respectively, then find the $\angle ABC$. (Difficult)
6. Three vectors $\vec{a},\vec{b}$ **and** $\vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$,. Evaluate the quantity $= \vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$, if $|\vec{a}|=1, |\vec{b}|=4 \& |\vec{c}|=2$. (Average)
7. Find the vector of magnitude 5 units and parallel to the resultant of the vectors $\vec{a}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+\hat{k}$ (Average)
8. If $\vec{a},\vec{b}\&\vec{c}$ are three vectors such that $|\vec{a}|=3$, $|\vec{b}|=4$, $|\vec{c}|=5$ and each vector is orthogonal to sum of the other two vectors then find $|\vec{a}+\vec{b}+\vec{c}|$. (Average)
9. If $\hat{i}+\hat{j}+\hat{k}$, $2\hat{i}+5\hat{j}$, $3\hat{i}+2\hat{j}-3\hat{k}$ and $\hat{i}-6\hat{j}-\hat{k}$ are the position vectors of points A,B,C & D respectively then find the cosine angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$. (Difficult)
10. If $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+\hat{j}-2\hat{k}$ and $\vec{c}=\hat{i}+3\hat{j}-\hat{k}$ such that $\vec{a}$ is perpendicular to $(\lambda\vec{b}+\vec{c})$ then find λ. (Average)
11. The two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$, $\hat{i}-2\hat{j}-3\hat{k}$ then find the unit vector parallel to its diagonal. Also find area of the parallelogram. (Difficult)
12. The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of vectors $2\hat{i}+4\hat{j}-5\hat{k}$ & $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to one. Find the value of λ. (Difficult)
13. If $\vec{a}=\hat{i}+\hat{j}-\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$ & $\vec{c}=-\hat{i}+2\hat{j}-\hat{k}$ then find the unit vector perpendicular to both $\vec{a}+\vec{b}$ and $\vec{b}+\vec{c}$. (Average)
14. If $\vec{a}=\hat{i}+4\hat{j}+2\hat{k}$, $\vec{b}=3\hat{i}-2\hat{j}+7\hat{k}$ & $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$ then find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ **and** $\vec{b}$ and $\vec{c}.\vec{d}=15$. (Difficult)
15. If $\vec{a},\vec{b}$ and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes then prove that the vector $\vec{a}+\vec{b}+\vec{c}$ is equally inclined to $\vec{a},\vec{b}$ and $\vec{c}$. (Average)

CHAPTER-11
THREE DIMENSIONAL GEOMETRY

1. The direction cosines of x, -axis. (Easy)
(A) 0 , 1 , 0 (B) 0, 0 , 1 (C) 1 , 0 , 0 (D) 0 , 1 , 1

2. The direction cosines of y, -axis. (Easy)
(A) 0 , 1 , 0 (B) 0, 0 , 1 (C) 1, 0 , 0 (D) 1 , 0 , 1

3. The direction cosines of z, -axis. (Easy)
(A) 0 , 1 , 0 (B) 0 , 0 , 1 (C) 1 , 0 , 0 (D) 1 , 1 , 0

4. The direction cosines of negative Z - axis are (Easy)
(A) 0,0,1 (B) 0,0,-1 (C) -1,-1,0 (D) 0,1,0

5. If a line has the direction ratios 2, -1, –2, then its direction cosines (Easy)
(A) –2 , 1 , 2 (B) $\frac{2}{3}, -\frac{1}{3}, -\frac{2}{3}$ or $-\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$
(C) $-\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$ or $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$ (D) $\frac{2}{3}, -\frac{1}{3}, -\frac{2}{3}$ or $\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}$

6. The direction cosines of the line passing through the two points (– 2, 4, – 5) and (1, 2, 3) (Average)
(A) 3 , –2 , 8 (B) $\frac{3}{\sqrt{77}}, -\frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}}$ (C) $-3, 2, -8$ (D) $\frac{3}{77}, -\frac{2}{77}, \frac{8}{77}$.

7. Find the direction ratios of a line joining the points (-2, 4, 5) and (1, 2, 3). (Average)
(A) 3 , 2 , 2 (B) 3 , 2 , –2 (C) -3 , 2 , 2 (D) -3 , -2 , –2

8. For any line, if a, b, c are direction ratios of a line, then number of sets of direction ratios (Easy)
(A) 0 (B) 1 (C) 2 (D) infinitely many sets.

9. Let a, b, c direction ratios and l, m and n be the direction cosines of a line, such that $\frac{l}{a} = \frac{m}{b} = \frac{n}{c} = k$,then k is equal to (Easy)
(A) $\pm\frac{1}{\sqrt{a^2+b^2+c^2}}$ (B) $\pm\frac{1}{a^2+b^2+c^2}$ (C) $\pm a^2 + b^2 + c^2$ (D) $\pm\sqrt{a^2 + b^2 + c^2}$.

10. If a line makes $\frac{\pi}{2}, \frac{3\pi}{4}, \frac{\pi}{4}$ with x, y, z axes resply, then its direction cosines are (Easy)
(A) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ (B) $0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ (C) $1, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ (D) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

11. If a line makes $\frac{\pi}{2}, \frac{\pi}{3}, \frac{\pi}{6}$ with x, y, z axes resply, then its direction cosines are (Easy)
(A) $0, -\frac{\sqrt{3}}{2}, \frac{1}{2}$ (B) $0, \frac{1}{2}, \frac{\sqrt{3}}{2}$ (C) $0, \frac{\sqrt{3}}{2}, \frac{1}{2}$ (D) $1, \frac{1}{2}, \frac{\sqrt{3}}{2}$

12. If the line makes angles 90°, 60° and 45° with the positive direction of x , y and z-axes respectively. Find its direction cosines. (Easy)
(A) $0, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (B) $0, -\frac{1}{2}, -\frac{1}{\sqrt{2}}$ (C) $1, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (D) $0, \frac{\sqrt{3}}{2}, \frac{1}{\sqrt{2}}$

13. If the direction cosines of a line is k, k, k, then (Average)
(A) k> 0 (B) 0<k<1 (C) k = 1 (D) $k = \frac{1}{\sqrt{3}}$ or $-\frac{1}{\sqrt{3}}$

14. The equation of x-axis is (Easy)
(A) x = 0 (B) y = 0 and z=0 (C) x = 0 and y=0 (D) y = 0

15. If $\alpha, \beta, and\ \gamma$ are direction angles of a directed line $\overrightarrow{OP}$,then direction angles of the directed line $\overrightarrow{PO}$ are (Easy)
(A) α, β, γ (B) $-\alpha, -\beta, -\gamma$ (C) $\pi - \alpha, \pi - \beta, \pi - \gamma$ (D) $\frac{\pi}{2} - \alpha, \frac{\pi}{2} - \beta, \frac{\pi}{2} - \gamma$

16. If $\frac{\pi}{2}, \frac{3\pi}{4}$ and $\frac{\pi}{4}$ are direction angles of a directed line $\overrightarrow{OP}$,then direction angles of the directed line $\overrightarrow{PO}$ are (Difficult)
(A) $-\frac{\pi}{2}, -\frac{3\pi}{4}, -\frac{\pi}{4}$ (B) $\frac{\pi}{2}, \frac{\pi}{4}, \frac{3\pi}{4}$ (C) $\frac{\pi}{2}, \frac{-3\pi}{4}, \frac{-\pi}{4}$ (D) $\frac{\pi}{2}, \frac{3\pi}{4}, \frac{\pi}{4}$.

17. If the directed line $\overrightarrow{OP}$ makes angles 90°, 60° and 45° with the positive direction of x , y and z-axes respectively. Then its direction cosines of the directed line $\overrightarrow{PO}$ (Difficult)
(A) $0, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (B) $1, -\frac{1}{2}, -\frac{1}{\sqrt{2}}$ (C) $1, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (D) $0, -\frac{1}{2}, -\frac{1}{\sqrt{2}}$.

18. If l, m, n are the direction cosines of a line, then (Easy)
(A) $l^2+ m^2+ n^2 = 0$ (B) $l^2+ m^2+ n^2 = 2$ (C) $2l^2+2m^2+2n^2 = 2$ (D) $l^2+ m^2+ n^2 = -1$

19. If a line makes an angles α, β, γ with the positive direction of the co-ordinate axes. Then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$ (Average)
(A) 2 (B) 1 (C) 0 (D) -1

20. If a line makes an angles α, β, γ with the positive direction of the co-ordinate axes. Then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ (Easy)
(A) 2 (B) 1 (C) 0 (D) -1

21. A line makes equal angles with co–ordinate axes, then direction cosines of the lines are (Easy)
(A) $\pm1, \pm1, \pm1$ (B) $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$ (C) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ (D) $\pm\frac{1}{3}, \frac{\pm1}{3}, \pm\frac{1}{3}$

22. The direction ratios of x, -axis. (Easy)
(A) 0 , k , 0 (B) 0 , 0 , k (C) k , 0 , 0 (D) k , k , k

23. The equation of a line parallel to x-axis and passing through the origin is (Average)
(A) $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$ (B) $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$ (C) $\frac{x+5}{0} = \frac{y-2}{1} = \frac{z+3}{0}$ (D) $\frac{x-5}{0} = \frac{y+2}{0} = \frac{z-3}{1}$

24. The equation of the line through the point (5, 2, -4) and which is parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 8\hat{k}$ is (Easy)
(A) $\vec{r} = (5\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(3\hat{\imath} + 2\hat{\jmath} - 8\hat{k})$ (B) $\frac{x-3}{5} = \frac{y-2}{2} = \frac{z+8}{-4}$
(C) $\vec{r} = (3\hat{\imath} + 2\hat{\jmath} - 8\hat{k}) + \lambda(5\hat{\imath} + 2\hat{\jmath} - 4\hat{k})$ (D) $\frac{x+5}{3} = \frac{y+2}{2} = \frac{z+4}{-8}$

25. The equation of the line passing through origin with direction angles If $\frac{\pi}{2}, \frac{\pi}{4}$ and $\frac{3\pi}{4}$ is (Average)
(A) $\frac{x}{1} = \frac{y}{\sqrt{2}} = \frac{z}{-\sqrt{2}}$ (B) $\frac{x}{0} = \frac{y}{-1} = \frac{z}{-1}$ (C) $\frac{x}{0} = \frac{y}{1} = \frac{z}{-1}$ (D) $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$

26. The Cartesian equation of the line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$, then vector equation of the line is (Easy)
(A) $\vec{r} = (-5\hat{\imath} + 4\hat{\jmath} - 6\hat{k}) + \lambda(3\hat{\imath} + 7\hat{\jmath} + 2\hat{k})$ (B) $\vec{r} = (5\hat{\imath} + 4\hat{\jmath} - 6\hat{k}) + \lambda(3\hat{\imath} + 7\hat{\jmath} + 2\hat{k})$
(C) $\vec{r} = (5\hat{\imath} - 4\hat{\jmath} + 6\hat{k}) + \lambda(3\hat{\imath} + 7\hat{\jmath} + 2\hat{k})$ (D) $\vec{r} = (3\hat{\imath} + 7\hat{\jmath} + 2\hat{k}) + \lambda(5\hat{\imath} - 4\hat{\jmath} + 6\hat{k})$

27. Find the direction cosines of the line $\frac{x-5}{3} = \frac{y-2}{2} = \frac{z+4}{-8}$ (Average)
(A) 3 , 2 , −8 (B) $\frac{3}{\sqrt{77}}, \frac{2}{\sqrt{77}}, -\frac{8}{\sqrt{77}}$ (C) $\frac{5}{\sqrt{77}}, \frac{2}{\sqrt{77}}, -\frac{4}{\sqrt{77}}$ (D) $\frac{5}{\sqrt{45}}, \frac{2}{\sqrt{45}}, -\frac{4}{\sqrt{45}}$

28. The angle between the straight lines $\frac{x+1}{7} = \frac{y-2}{-5} = \frac{z+3}{1}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{3}$ is (Easy)
(A) 45^0 (B) 30^0 (C) 60^0 (D) 90^0

29. Lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ are perpendicular, then $k =$ (Easy)
(A) $-\frac{10}{7}$ (B) $\frac{10}{7}$ (C) $-\frac{7}{10}$ (D) $\frac{7}{10}$

30. Lines $\frac{x-1}{3} = \frac{y-2}{2p} = \frac{z-3}{2}$ and $\frac{x-1}{3p} = \frac{y-1}{1} = \frac{z-6}{5}$ are perpendicular, then $p =$ (Easy)
(A) $-\frac{10}{11}$ (B) $\frac{10}{11}$ (C) $-\frac{11}{10}$ (D) $\frac{11}{10}$

31. Find the angle between the lines whose direction ratios are a, b, c and $b - c$, $c - a$, $a - b$ is (Easy)
(A) 45^0 (B) 30^0 (C) 60^0 (D) 90^0

32. The angle between two diagonals of a cube is (Average)
(A) $\cos^{-1}\left(\frac{1}{3}\right)$ (B) $\cos^{-1}\left(\frac{2}{3}\right)$ (C) $\tan^{-1}\sqrt{2}$ (D) $\cos^{-1}\left(\frac{1}{2}\right)$

33. The measure of the angle between the lines x = k +1, y = 2k - 1, z = 2k + 3, k ∈R and $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{-1}$ is (Difficult)
(A) $\cos^{-1}\left(\frac{2}{3\sqrt{6}}\right)$ (B)$\cos^{-1}\left(\frac{2}{3}\right)$ (C)$\tan^{-1}\sqrt{2}$ (D)$\cos^{-1}\left(\frac{1}{2}\right)$

34. Two lines $\frac{x-1}{2} = \frac{y-1}{-1} = \frac{z}{1}$ and $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z-1}{2}$ are (Average)
(A) $||^r$ (B) $\perp^r$ (C) skew lines (D) lines

35. Two lines $\frac{x-1}{3} = \frac{y-1}{4} = \frac{z}{5}$ and $\frac{x-2}{3} = \frac{y-1}{4} = \frac{1-z}{5}$ are (Difficult)
(A) parallel (B) *perpendicular*
(C) skew lines (D) intersecting in an acute angle.

36. Two lines with direction ratios a_1, b_1, c_1 and a_2, b_2, c_2 are (Easy)

(A) perpendicular, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (B) parallel, if $a_1a_2 + b_1b_2 + c_1c_2 = 0$

(C) perpendicular if $\sqrt{a_1^2 + b_1^2 + c_1^2} = \sqrt{a_2^2 + b_2^2 + c_2^2}$ (D) parallel , if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

37. If the direction ratios of two parallel lines be a_1, a_2, a_3 and b_1, b_2, b_3, then $\frac{a_3}{a_1} =$ (Easy)

(A) $\frac{a_1}{a_2}$ (B) $\frac{b_1}{b_3}$ (C) $\frac{b_3}{b_1}$ (D) $\frac{b_1}{b_2}$

38. **Statement 1:** The angle between the straight lines $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{4}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{-3}$ is 90^o

Statement 2: Two lines with direction ratios a_1, b_1, c_1 and a_2, b_2, c_2 are perpendicular, if $a_1a_2 + b_1b_2 + c_1c_2 = 0$ (Easy)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

39. **Assertion(A) :** The equation of a line parallel to y-axis and passing through the origin is $\vec{r} = k\hat{j}$
Reason(R) : The direction ratios of y –axis is 0, k , 0. (Average)

A) A is false and R is true B) A is false and R is false
C) A is true and R is false D) A is true and R is true.

40. **Statement 1:** Skew lines are non - intersecting non - parallel lines

Statement 2: The distance between two Skew lines is $\left|\frac{(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2})}{|\vec{b_1}\times\vec{b_2}|}\right|$. (Average)

A) Statement 1 is true and Statement 2 is false
B) Statement 1 is false and Statement 2 is true
C) Statement 1 is true and Statement 2 is true
D) Statement 1 is false and Statement 2 is false

41. **Statement 1:** The angle between the lines whose d r's are given by 2,-3,3 and 3, 3, 1 is 90^o

Statement 2: Two lines with dr's a_1, b_1, c_1 and a_2, b_2, c_2 are perpendicular if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. (Easy)

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true.
C) Statement 1 is true and Statement 2 is true.
D) Statement 1 is false and Statement 2 is false.

42. **Assertion:** If the cartesian equation of a line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$, then its vector form is

$\vec{r} = 5\vec{i} - 4\vec{j} + 6\vec{k} + \lambda\left(3\vec{i} + 7\vec{j} + 2\vec{k}\right)$

Reason: The vector equation of the line which passes through the point (x_1, y_1, z_1) and parallel to the $\vec{b} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ is $\vec{r} = (x_1\hat{\imath} + y_1\hat{\jmath} + z_1\hat{k}) + \lambda(x\hat{\imath} + y\hat{\jmath} + z\hat{k})$. (Easy)

A) A is false and R is true B) A is false and R is false
C) A is true and R is false D) A is true and R is true

43. **Assertion (A):** If a line makes angles α, β, γ with positive direction of the coordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$

Reason (R): The sum of squares of the direction cosines of a line is 1, (Easy)

A) A is false and R is true B) A is false and R is false
C) Both A and R are true and R is the correct explanation of A.
D) Both A and R are true and R is not the correct explanation of A.

44. **Statement 1:** The acute angle between the line $\vec{r} = \vec{i} + \vec{j} + 2\vec{k} + \lambda(\vec{i} - \vec{j})$ and the x-axis is $\frac{\pi}{4}$

Statement 2: The acute angle between the lines $\vec{r} = x_1\vec{i} + y_1\vec{j} + z_1\vec{k} + \lambda(a_1\vec{i} + b_1\vec{j} + c_1\vec{k})$ and

$\vec{r} = x_2\vec{i} + y_2\vec{j} + z_2\vec{k} + \lambda(a_2\vec{i} + b_2\vec{j} + c_2\vec{k})$ is given by $\cos\theta = \frac{|a_1a_2 + b_1b_2 + c_1c_2|}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$ (Difficult)

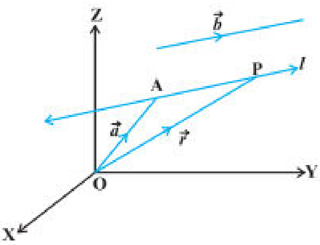
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

45. **Statement 1:** The lines $\vec{r}$ = $\hat{\imath}$ + 2 $\hat{\jmath}$ - 4 $\hat{k}$ + λ (2$\hat{\imath}$ + 3 $\hat{\jmath}$ + 6$\hat{k}$) and $\vec{r}$ = 3$\hat{\imath}$ + 3 $\hat{\jmath}$ -5 $\hat{k}$+ μ (2$\hat{\imath}$ + 3 $\hat{\jmath}$ + 6$\hat{k}$) are parallel.

Statement 2: Two lines with d. r. 's a_1, b_1, c_1 and a_2, b_2, c_2 are parallel if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. (Easy)

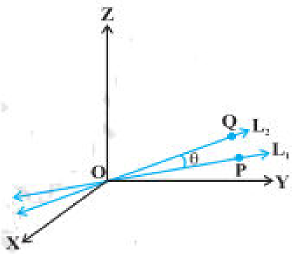
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true.
C) Statement 1 is true and Statement 2 is true.
D) Statement 1 is false and Statement 2 is false.

46. In the figure the equation of straight line l is (Easy)



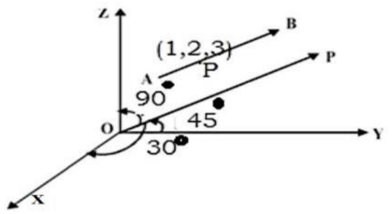
A) $\vec{r} = \lambda\vec{b}$, $\lambda \in R$
B) $\vec{r} = \lambda\vec{a} \times \vec{b}$, $\lambda \in R$
C) $\vec{r} = \vec{a} + \lambda\vec{b}$, $\lambda \in R$
D) $\vec{r} = \vec{b} + \lambda\vec{a}$, $\lambda \in R$

47. If L_1 *and* L_2 are in the direction of $\vec{a}$ and $\vec{b}$ respectively and θ is angle between $\vec{a}$ & $\vec{b}$ then $cos\theta$ = (Easy)



A) $\frac{|\vec{a}+\vec{b}|}{|\vec{a}||\vec{b}|}$
B) $\frac{|\vec{a}\times\vec{b}|}{|\vec{a}||\vec{b}|}$
C) $\frac{\vec{a}.\vec{b}}{|\vec{a}||\vec{b}|}$
D) 0

48. In the figure the equation of straight line AB is (Difficult)



(A) $\frac{2(x-1)}{\sqrt{3}} = \frac{\sqrt{2}(y-2)}{1} = \frac{z-3}{0}$
(B) $\frac{x-1}{\sqrt{3}} = \frac{y-2}{\sqrt{2}} = \frac{z-3}{0}$
(C) $\frac{x+1}{\frac{\sqrt{3}}{2}} = \frac{y+2}{1} = \frac{z+3}{1}$
(D) $\frac{(x-1)}{\sqrt{3}} = \frac{\sqrt{2}(y-2)}{1} = \frac{z-3}{0}$

49. The direction ratios of z–axis is a, b, c , then a= -------- (Easy)

50. The direction cosine of negative x, -axis is a,0,0 then a=------- (Easy)

51. Lines $\frac{x-1}{3} = \frac{2-y}{2} = \frac{z-3}{1}$ and $\frac{x-1}{3k} = \frac{y-1}{2} = \frac{z-6}{-5}$ are perpendicular, then $k = ------$ (Easy)

TWO MARKS QUESTIONS:

1. Find the direction ratios of the line $\frac{x-1}{2} = 3y = \frac{2z+3}{4}$. (Average)

2. The Cartesian equation of a line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$. Write its Vector form. (Easy)

3. Find the direction cosines of the line which makes equal angles with coordinate axis. (Easy)

4. Find the direction cosines of the line passing through two points (-2, 4, -5) and (1, 2, 3). (Easy)

5. Find the equation of the line which passes through the point (1,2,3) and parallel to the vector $3\vec{\imath} + 2\vec{\jmath} - 2\vec{k}$,both are in vector and Cartesian form. (Easy)

6. Find the angle between the lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$ and $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$. (Easy)

7. Show that the line passes through the points (4,7,8) , (2,3,4) is parallel to the line passing through the points (-1,2,1) and (1,2,5). (Easy)
8. Show that the line through the points (1,-1,2) ,(3,4,-2) is perpendicular to the line through the points (0,3,2) and (3,5,6). (Easy)
9. Show that the points (2,3,4) ,(-1,-2,1) and (5,8,7) are collinear. (Easy)
10. Show that the points A (2, 3, – 4), B (1, – 2, 3) and C (3, 8, – 11) are collinear. (Easy)
11. Find the Cartesian equation of the line through the point (5, 2, -4) and which is parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 8\hat{k}$. (Easy)
12. Find the equation of the line in vector form that passes through the point with position vector $2\vec{i} - \vec{j} + 4\vec{k}$ and is in the direction $\vec{i} + 2\vec{j} - \vec{k}$. (Easy)
13. Find the angle between the pair of lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{1}$ and $\frac{x+1}{1} = \frac{y-4}{-1} = \frac{z-5}{2}$ (Easy)
14. Find the angle between the pair of lines $\vec{r} = 3\vec{\imath} + 2\vec{\jmath} - 4\vec{k} + \lambda(\vec{\imath} + 2\vec{\jmath} + 2\vec{k}.)$ and $\vec{r} = 5\vec{\imath} - 2\vec{\jmath} + \mu(3\vec{\imath} + 2\vec{\jmath} + 6\vec{k})$ (Easy)
15. Find the angle between the pair of lines $\vec{r} = 3\vec{i} + \vec{j} - 2\vec{k} + \lambda(\vec{i} - \vec{j} - 2\vec{k})$ and $\vec{r} = 2\vec{i} - \vec{j} - 56\vec{k} + \mu(3\vec{i} - 5\vec{j} - 4\vec{k})$ (Easy)
16. Find the angle between the pair of lines $\vec{r} = 2\hat{\imath} - 5\hat{\jmath} + \hat{k} + \lambda(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$ and $\vec{r} = 7\hat{\imath} - 6\hat{\jmath} + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ (Easy)
17. Find the value of p, so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles. (Average)
18. Find the value of k, so that the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ are at right angles. (Easy)

THREE MARKS QUESTIONS:

1. Find the shortest between the lines l_1 and l_2 whose vector equations are $\vec{r} = i + j + \lambda(2i - j + k)$ and $\vec{r} = 2i + j - k + \mu(3i - 5j + 2k)$. (Easy)
2. Find distance between the lines l_1 and l_2 given by $\vec{r} = i + 2j - 4k + \lambda(2i + 3j + 6k)$ and $\vec{r} = 3i + 3j - 5k + \mu(2i + 3j + 6k)$ (Easy)
3. Find shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$. (Average)
4. Derive the equation of the line in space passing through the point and parallel to the vector in the vector form. (Easy)
5. Derive the equation of the line in space passing through the point and parallel to the vector both in the Cartesian form. (Easy)
6. Derive the angle between two lines in vector and Cartesian form. (Average)
7. Derive the shortest distance between skew lines both in vector form. (Difficult)
8. Derive the distance between the parallel lines $\vec{r} = \vec{a1} + \lambda(\vec{b})$ and $\vec{r} = \vec{a2} + \mu(\vec{b})$. (Difficult)
9. Find the vector equation of the line passing through the point (1, 2, – 4) and perpendicular to the two lines : $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$. (Difficult)
10. Find the distance between the lines l_1& l_2 whose vector equations are $\vec{r} = \hat{\imath} + \hat{\jmath} + \lambda(2\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} + \hat{\jmath} - \hat{k} + \mu(3\hat{\imath} - 5\hat{\jmath} + 2\hat{k})$. (Average)
11. Find the shortest distance between the lines whose vector equations are $\vec{r} = (1-t)\hat{\imath} + (t-2)\hat{\jmath} + (3-2t)\hat{k}$ and $\vec{r} = (s+1)\hat{\imath} + (2s-1)\hat{\jmath} - (2s+1)\hat{k}$ (Difficult)
12. Find the shortest distance between the lines whose vector equations are $\vec{r} = (1-t)\hat{\imath} + (t-2)\hat{\jmath} + (3-2t)\hat{k}$ and $\vec{r} = (s+1)\hat{\imath} + (2s-1)\hat{\jmath} - (2s+1)\hat{k}$ (Difficult)
13. Find the distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(\widehat{2\imath} + 3\hat{\jmath} + \hat{k})$ (Average)
14. Find the distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and $\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ (Average)
15. Find the distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k} + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ And $\vec{r} = 4\hat{\imath} + 5\hat{\jmath} + 6\hat{k} + \mu(\widehat{2\imath} + 3\hat{\jmath} + \hat{k})$ (Average)

CHAPTER -12
LINEAR PROGRAMMING

MCQ /FB questions.(not included in the model papers of KSEB)

1. A general class of problems which seek to be maximize or, minimize is called. (Easy)
   (A) The objective functions (B) Linear programming problem
   (C) Optimization problems (D Feasible solution
2. Z = ax + by, where *a*, *b* are constants is a linear objective function. Variables x and y are called (Easy)
   (A) Decision variables (B) Dependent variables
   (C) Independent variables (D) None of these
3. Every point of feasible region is called (Easy)
   (A) Infeasible region (B) Optimal solution
   (C) Feasible solution (D) None of these
4. Feasible region is the set of points which satisfy (Easy)
   (A) The objective functions (B) Some the given constraints
   (C) All of the given constraints (D) Non negative constraints.
5. Objective function of a linear programming problem is (Easy)
   (A) a constraint (B) function to be optimized
   (C) A relation between the variables (D) Corner Points.
6. A set of values of decision variables which satisfies the linear constraints and non-negativity conditions of a L.P.P is called its (Easy)
   (A) Unbounded solution (B) Optimum solution
   (C) Feasible solution (D) Feasible region
7. The optimal value of the objective function is attained at the (Easy)
   (A) points on X-axis (B) points on Y-axis
   (C) corner points of the feasible region (D) none of these
8. In a LPP, the objective function is always (Easy)
   (A) cubic function (B) quadratic function
   (C) Linear function (D) constant.
9. The number of feasible solution of a L.P.P is (Easy)
   (A) one (B) two (C) finite (D) infinite.
10. Let R be the feasible region for a linear programming problem, and let Z = ax + by be the objective function. If R is bounded, then Z has (Easy)
    (A) only a maximum value on R (B) only a minimum value on R
    (C) both a maximum and a minimum value on R (D) no minimum value on R
11. Maximum or a minimum may not exist for a linear programming problem if (Easy)
    (A) The feasible region is bounded (B) If the constraints are non linear
    (C) if the objective function is continuous (D) The feasible region is unbounded
12. In a LPP, which of the following is correct (Average)
    (A) A corner point of a feasible region is a point in the region which is the intersection of two boundary lines.
    (B) A feasible region is bounded if it can be enclosed within a circle
    (C) A feasible region is unbounded that the feasible region does extend indefinitely in any direction.
    (D) If two corner points produce the same maximum (or minimum) value of the objective function, then every point on the line segment joining these points will not give the same maximum (or minimum) value.
13. The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 50), (30, 0), (20, 30). The objective function is Z = 4x + y , then maximum value of Z is (Easy)
    (A) 210 (B) 150 (C) 110 (D) 120.

14. The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5), (15, 15), (0, 20). Let Z = px + qy, where p, q > 0. Condition on p and q so that the maximum of Z occurs at both the points (15, 15) and (0, 20) , then (Average)
(A) p = q (B) p = 2q (C) q = 2p (D) q = 3p.

15. Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let Z = px + qy, where p, q > 0. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is (Average)
(A) p = 2q (B) p = q/2 (C) p = 3q (D) p = q

16. Corner points of the feasible region for an LPP are (0, 5), (4, 3), (0, 6) .
Let Z = 200 x + 500y be the objective function. The Minimum value of Z occurs at (Easy)
(A) (0, 5) (B) (4,3) (C) (0, 6)
(D) line segment joining the points (0, 5) and (4, 3).

17. Corner points of the feasible region for an LPP are (0,10), (5,5), (0, 20), (15,15).
Let Z = 3x + 9y be the objective function. The maximum value of Z occurs at (Easy)
(A) (0, 20) (B) (15,15)
(C) line segment joining the points (15, 15) and (0, 20)
(D) line segment joining the points (5, 5) and (15, 15).

18. The corner points of the feasible region determined by the system of linear constraints are (2, 72), (15, 20) and (40, 15). The objective function is Z = 6 x + 3 y,
then maximum value of Z is (Easy)
(A) 228 (B) 150 (C) 285 (D) 320.

19. **Assertion (A):** The maximum value of Z = 5x + 3y, satisfying the conditions $x \geq 0$, $y \geq 0$ and $5x + 2y \leq 10$, is 15.
Reason (R): The optimal value of the objective function is attained at the corner points of the feasible region. (Average)
A) A is false but R is true B) A is false and R is false
C) Both A and R are true and R is the correct explanation of A.
D) Both A and R are true and R is not the correct explanation of A.

20. **Assertion (A):** The minimum value of the objective Z = x + 3y. satisfying the conditions $2x + y \leq 20$, $x \geq 0, y \geq 0$ is 0.
Reason (R): In a LPP, the minimum value of the objective function Z =ax + by is always 0, if origin is one of the corner point of the feasible region. (Average)
A) A is false and R is true B) A is false and R is false
C) Both A and R are true and R is the correct explanation of A.
D) Both A and R are true and R is not the correct explanation of A.

Six mark questions

Solve the following linear programming problems graphically

1. Maximize Z=4x+y subject to constraints $x+y \leq 50, 3x+y \leq 90, x \geq 0, y \geq 0$ (Easy)

2. Maximize Z= 3x+4y subject to $x + y \leq 4, x \geq 0, y \geq 0$ (Easy)

3. Minimize Z = 200x + 500y, subject to the constraints $x + 2y \geq 10$, $3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$. (Easy)

4. Maximize $Z = 3x + 2y$ subject to constraints $x + 2y \leq 10, 3x + y \leq 15, x, y \geq 0$ (Average)

5. Minimize Z = – 3x + 4y, subject to constraints $x + 2y \leq 8$, $3x + 2y \geq 12$, $x \geq 0$, $y \geq 0$. (Average)

6. Maximize and minimize : $z = 5x + 10y$ subject to constraints
$x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0, x, y \geq 0.$ (Difficult)

7. Maximize and minimize : $z = x + 2y$ subject to constraints
$x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0.$ (Difficult)

8. Minimize and Maximize Z = 3x + 9y
subject to the constraints: $x + 3y \leq 60$, $x + y \geq 10$ and $x \leq y$ and $x \geq 0$, $y \geq 0$. (Difficult)

9. Maximize Z = 5x + 3y, subject to constraints
$3x + 5y \leq 15$, $5x + 2y \leq 10$, $x \geq 0$, $y \geq 0$. (Difficult)

Additional Questions

10. Maximize z= x+y subject to constraints $x+2y\leq 40, 2x+y\leq 50, x\geq 0, y\geq 0$ (Easy)

11. Maximize z= x+y subject to constraints $x+2y\leq 28, 3x+y\leq 24, x\geq 0, y\geq 0$ (Easy)

12. Maximize $z=17.5x+7y$ subject to constraints $x+3y\leq 12, 3x+y\leq 12, x\geq 0, y\geq 0$ (Average)

13. Maximize $z=7x+10y$ subject to constraints $2x+3y\leq 120, 2x+y\leq 80, x\geq 0, y\geq 0$ (Easy)

14. Maximize $z=5x+6y$ subject to constraints $25+8y\leq 200, 10x+8y\leq 240, x\geq 0, y\geq 0$ (Easy)

15. Minimize and Maximize Z = 4x + y, subject to constraints
$x + y \geq 50$, $3x + y \leq 90$, x, y ≥ 0. (Easy)

16. Maximize Z = $250x + 75y$, subject to the constraints $5x + y \geq 100$, $x + y \leq 60$, x ≥ 0, y ≥ 0. (Average)

CHAPTER-13
PROBABILITY

MCQ /FB questions.

1) If E & F are any events then witch of the following is incorrect (Easy)
A) $P(F|F) = 1$ B) $P(S|F) < 1$
C) $P(E'|F) = 1 - P(E|F)$ D) $P((E \cup F)|G) = P(E|G) + P(F|G) - P((E \cap F)|G)$

2) If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$ then $P(A|B)$ is (Easy)
A) $\frac{4}{13}$ B)$\frac{4}{9}$ C)$\frac{9}{13}$ D)$\frac{4}{7}$.

3) If $P(E) = \frac{1}{4}, P(F) = \frac{3}{4}$ and $P(E \cap F) = \frac{1}{4}$ then $P(E|F)$ is (Easy)
A) $\frac{1}{4}$ B) 1 C) $\frac{1}{3}$ D) $\frac{2}{3}$.

4) If $P(B) = 0.5$ and $P(A \cap B) = 0.32$ then $P(A|B)$ (Easy)
A) $\frac{8}{25}$ B)$\frac{1}{2}$ C)$\frac{4}{25}$ D)$\frac{16}{25}$.

5) If $P(A) = \frac{1}{2}$ and $P(B) = 0$ then find $P(A|B)$ is (Easy)
A) $\frac{1}{2}$ B)1 C)0 D)$not\ exists$.

6) If $P(A) = \frac{1}{2}$ and $P(B) = 0$ then find $P(B|A)$ is (Easy)
A) $\frac{1}{2}$ B)1 C)0 D)$not\ exists$.

7) If $P(E) = 0.6, P(F) = 0.3$ and $P(E \cap F) = 0.2$ then $P(E|F)$ is (Easy)
A) $\frac{1}{3}$ B) $\frac{2}{3}$ C)0 D) $\frac{3}{2}$.

8) If $P(E) = 0.6, P(F) = 0.3$ and $P(E \cap F) = 0.2$ then $P(F|E)$ is (Easy)
A) $\frac{1}{3}$ B) $\frac{2}{3}$ C)0 D) $\frac{3}{2}$.

9) If A is a subset of B and P(A) $\neq$ 0, then $(B|A)$ is (Easy)
A) 1 B)0 C)$\frac{1}{2}$ D)$not\ exists$.

10) If $A \cap B = \phi$ and P(A) $\neq 0$, $then$ $P(B|A)$ is (Easy)
A) $\frac{1}{2}$ B)1 C)0 D)$not\ exists$.

11) If $2P(A) = P(B) = \frac{5}{13}$ and $P(A|B) = \frac{2}{5}$, then $P(A \cap B)$ is (Average)
A) $\frac{5}{26}$ B)$\frac{15}{26}$ C)$\frac{19}{26}$ D) $\frac{2}{13}$.

12) If $2P(A) = P(B) = \frac{5}{13}$ and $P(A|B) = \frac{2}{5}$ then $P(A \cup B)$ is (Average
A) $\frac{5}{26}$ B)$\frac{15}{26}$ C)$\frac{11}{26}$ D) $\frac{2}{13}$.

13) If $P(A) = \frac{6}{11}, P(B) = \frac{5}{11}$ and $P(A \cup B) = \frac{7}{11}$ then $P(A/B)$ is (Average)
A) $\frac{5}{7}$ B) $\frac{6}{7}$ C)$\frac{4}{5}$ D) $\frac{4}{6}$.

14) If $P(A) = \frac{6}{11}, P(B) = \frac{5}{11}$ and $P(A \cup B) = \frac{7}{11}$ then $P(B/A)$ is (Average)
A) $\frac{5}{7}$ B)$\frac{6}{7}$ C)$\frac{4}{5}$ D)$\frac{4}{6}$.

15) If $P(A) = \frac{6}{11}, P(B) = \frac{5}{11}$ and $P(A \cup B) = \frac{7}{11}$ then $P(A \cap B)$ is (Average)
A) $\frac{2}{11}$ B)$\frac{4}{11}$ C)$\frac{4}{5}$ D)$\frac{4}{6}$.

16) If $P(A) = 0.8, P(B) = 0.5, P(B|A) = 0.4$ then $P(A \cap B)$ is (Average)
A) 0.32 B)0.2 C)0.4 D)0.3

17) If $P(A) = 0.8, P(B) = 0.5, P(B|A) = 0.4$ then $P(A|B)$ is (Average)
A) $\frac{16}{25}$ B)$\frac{4}{5}$ C)$\frac{1}{2}$ D)$\frac{4}{25}$

18) If $P(A) = 0.8, P(B) = 0.5, P(B|A) = 0.4$ then $P(A \cup B)$ is (Average)
A) 0.32 B) 0.98 C) 0.9 D) 0.72

19) If A and B are any two events such that P(A) + P(B) – P(A and B) =P(A), then P(B/A) = (Average)

A) 1 B)0 C)$\frac{P(B)}{P(A)}$ D)$not\ exists.$

20) If A and B are two event such that P(A)≠ 0 and P(B ∣ A) = 1, then (Easy)

(A) A ⊂B (B) B ⊂A (C) B = ∅ (D) A = ∅.

21) If A and B are events such that P(A|B) = P(B|A), then (Average)

(A) A ⊂B but A ≠B (B) A = B (C) A ∩B = ∅ (D) P(A) = P(B).

22) If P(A|B) > P(A), then which of the following is correct : (Average)

(A) P(B|A) < P(B) (B) P(A ∩ B) < P(A).P(B) (C) P(B|A) > P(B) (D) P(B|A) = P(B)

23) If A and B are two events such that A ⊂B and P(B) ≠0, then which of the following is correct? (Average)

(A) $P(B/A) = \frac{P(B)}{P(A)}$ (B) P(A∩B) < P(A) (C) P(A|B) = P(A) (D) $P(B/A) = 1$

24) A die is rolled, consider an events $E = \{1,3,5\},\ F = \{2,3\}$, then $P(E|F)$is (Average)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C)$\frac{1}{5}$ D)$\frac{2}{3}$

25) A die is rolled, consider an events $E = \{1,3,5\},\ F = \{2,3\}$, then$P(F|E)$is (Average)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C)$\frac{1}{5}$ D)$\frac{2}{3}$

26) A die is rolled, consider an events $E = \{1,3,5\},\ G = \{2,3,4,5\}$, then$P(G|E)$is (Average)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C)$\frac{1}{5}$ D)$\frac{2}{3}$

27) A is rolled, consider an events $E = \{1,3,5\},\ G = \{2,3,4,5\}$, then$P(E|G)$is (Average)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C)$\frac{1}{5}$ D)$\frac{2}{3}$

28) A die is rolled, consider an events $E = \{1,3,5\}, F = \{2,3\}$and G = {2,3,4,5} then $P(E \cup F|G)$is (Average)

A) 1 B)$\frac{1}{2}$ C)$\frac{1}{4}$ D)$\frac{3}{4}$

29) If $P(A) = 0.4\ P(B) = 0.5\ \ and\ P(A \cap B) = 0.25$ then $P(A'|B)\ is$ (Average)

A) $\frac{5}{8}$ B)$\frac{1}{2}$ C)$\frac{1}{4}$ D)$\frac{3}{4}$.

30) In a hostel, 60% of the students read Hindi newspaper, 40% read English newspaper and 20% read both Hindi and English newspapers. A student is selected at random. If she reads Hindi newspaper, find the probability that she reads English newspaper. (Difficult)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{1}{4}$.

31) In a hostel, 60% of the students read Hindi newspaper, 40% read English newspaper and 20% read both Hindi and English newspapers. A student is selected at random. If she reads English newspaper, find the probability that she reads Hindi newspaper. (Difficult)

A) $\frac{1}{3}$ B)$\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{1}{4}$.

32) Two cards are drawn random without replacement from a pack of 52 playing cards. Find the probability that both are black cards. (Average)

A) $\frac{1}{26}$ B)$\frac{1}{4}$ C)$\frac{25}{102}$ D)$\frac{25}{104}$.

33) A Urn contains 10 black and 5 white balls, 2 balls are drawn one after the other without replacement. What is the probability that both drawn balls are black. (Average)

A) $\frac{3}{7}$ B)$\frac{4}{9}$ C)$\frac{1}{9}$ D)$\frac{2}{21}$

34) Three cards drawn successively without replacement from a pack of 52 well shuffled cards. What is the probability that 1st two cards are king and 3rd card drawn is ace. (Difficult)

A) $\frac{2}{13\times 13\times 13}$ B)$\frac{1}{13\times 13\times 13}$ C)$\frac{2}{13\times 17\times 25}$ D)$\frac{1}{13\times 17\times 25}$.

35) If A and B are independent events then (Easy)

A) A and B' are dependent B) A' and B are dependent

C) A' and B' are dependent D) $P\ (A \cup B) = 1 - P(A')P(B')$.

36) Two events A and B are said to be independent, if, (Easy)

(A) A and B are mutually exclusive (B) P(A′∩B′) = [1 – P(A)] [1 – P(B)]

(C) P(A/B) = P(B) (D) P(B/A) = P(A).

37) If A and B are two independent events then the probability of occurrence of at least one of A and B is (Average)
A) $1+P(A')P(B')$ B) $1-P(A)-P(B)$ C) $1-P(A')P(B')$ D) $1-\left(P(A)+P(B)\right)$

38) Two events E and F are independent events, which of the following is not true (Easy)
A) P(F|E) = P (F) B) P (E|F) = P (E)
C) P(E ∪ F) = P (E) + P (F) D)P(E ∩ F) = P(E) . P (F).

39) If A & B *are independent events* and $P(A)=\frac{3}{5}, P(B)=\frac{1}{5}$,then $P(A\cap B)$ is (Easy)
A) $\frac{1}{3}$ B)$\frac{3}{25}$ C)$\frac{22}{25}$ D)$\frac{2}{3}$

40) Let E and F be two events such that $P(E)=\frac{3}{5}, P(F)=\frac{3}{10}$ and $P(E\cap F)=\frac{1}{5}$.
then E and F are (Easy)
A) dependent events B) independent events
C) mutually exclusive events D) *exhaustive events*.

41) If A and B are two independent events such that $P(A)=\frac{1}{4}$ and $P(B)=\frac{1}{2}$ then P(not A and not B) (Average)
A) $\frac{1}{3}$ B)$\frac{3}{8}$ C)$\frac{7}{8}$ D)$\frac{1}{2}$

42) If A and B are independent events with $P(A)=0.3, P(B)=0.4$ then $P(B|A)$ is (Easy)
A) $\frac{3}{10}$ B)$\frac{2}{5}$ C)$\frac{3}{25}$ D)$\frac{7}{10}$

43) If A and B are independent events with $P(A)=0.3, P(B)=0.4$ then $P(A|B)$ (Easy)
A) $\frac{3}{10}$ B)$\frac{2}{5}$ C)$\frac{3}{25}$ D)$\frac{7}{10}$

44) If A and B are independent events with $P(A)=0.3, P(B)=0.4$ then $P(A\ and\ B)$ (Easy)
A) 0.3 B) 0.4 C)0.12 D)0.7

45) If A and B are independent events with $P(A)=0.3, P(B)=0.4$ then $P(A\ or\ B)$ (Easy)
A) 0.3 B) 0.42 C)0.12 D) 0.58.

46) If A and B are independent events with $P(A)=0.3, P(B)=0.4$ then P(neither A nor B) (Easy)
A) 0.3 B) 0.42 C)0.12 D) 0.58

47) If A and B are two events such that P (A) = $\frac{1}{2}$, P (B) = $\frac{1}{4}$ and P($A\cap B$) = $\frac{1}{8}$,
then P (not A and not B) (Average)
A) $\frac{1}{3}$ B)$\frac{3}{8}$ C)$\frac{7}{8}$ D)$\frac{1}{2}$

48) If $P(A)=\frac{1}{2}, P(B)=\frac{7}{12}$ *and* $P(not\ A\ or\ not\ B)=\frac{1}{4}$ then A and B are. (Average)
A) dependent events B) independent events
C) mutually exclusive events D) *exhaustive events*.

49) If A and B are independent events such that $P(A)=0.3$ *and* $P(B)=0.6$,
then P(A and not B) is (Average)
A) 0.12 B)0.18 C)0.28 D)0.42

50) If A and B are independent events such that $P(A)=0.3$ *and* $P(B)=0.6$,
then P (neither A nor B) is (Average)
A) 0.12 B)0.18 C)0.28 D)0.42

51) A and B are events such that $P(A)=\frac{1}{2}, P(A\cup B)=\frac{3}{5}, P(B)=q$, then the value of q if A and B are mutually exclusive (Average)
A) $\frac{3}{10}$ B)$\frac{1}{10}$ C)$\frac{1}{5}$ D)$\frac{7}{10}$

52) A and B are events such that $P(A)=\frac{1}{2}, P(A\cup B)=\frac{3}{5}, P(B)=q$, then the value of q if A and B are independent (Average)
A) $\frac{3}{10}$ B)$\frac{1}{10}$ C)$\frac{1}{5}$ D)$\frac{7}{10}$

53) An electronic assembly consists of two subsystems say A and B. From previous testing procedures, the following probabilities are assumed to be known, P(A fails) = 0.2, P(B fails alone) = 0.15 and P(A and B fail) = 0.15, then P(A fails alone) (Difficult)
A) 0.15 B) 0.5 C) 0.05 D) 0.75

54) An electronic assembly consists of two subsystems, say, A and B. From previous testing procedures, the following probabilities are assumed to be known, P(A fails) = 0.2, P(B fails alone) = 0.15 and P(A and B fail) = 0.15, then P(A fails |B has failed) is (Difficult)
A) 0.15 B) 0.5 C) 0.05 D) 0.75.

55) The probability of obtaining an even prime number on each die, when a pair of dice is rolled is (Average)
A) $\frac{1}{36}$ B) $\frac{1}{6}$ C) $\frac{1}{18}$ D) $\frac{1}{4}$.

56) A die is tossed thrice. Find the probability of getting an odd number at least once. (Average
A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{3}{4}$ D) $\frac{7}{8}$.

57) Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem then the probability that the problem is solved (Average)
A) $\frac{1}{6}$ B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) $\frac{5}{6}$

58) Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem then the probability that exactly one of them solves the problem is (Average)
A) $\frac{1}{6}$ B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$

59) Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls, then the probability that both are red is (Average)
A) $\frac{25}{81}$ B) $\frac{16}{81}$ C) $\frac{20}{81}$ D) $\frac{28}{153}$

60) Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls find the probability that 1st ball is black and second is red (Average)
A) $\frac{25}{81}$ B) $\frac{16}{81}$ C) $\frac{20}{81}$ D) $\frac{28}{153}$

61) Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls find the probability that One of them is black and other is red (Average)
A) $\frac{40}{81}$ B) $\frac{20}{81}$ C) $\frac{16}{81}$ D) $\frac{56}{153}$

62) **Statement 1:** Given that E and F are events such that P(E) = 0.6, P(F) = 0.3 and P(E ∩ F) = 0.2, then P(E|F) = 2/3 (Average)

Statement 2: Let E and F be two events with a random experiment, then P(E|F) = $\frac{P(\mathrm{E} \cap \mathrm{F})}{\mathrm{P(E)}}$

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is false.

63) **Statement 1:** If P(A) = 0 and P(B) ≠ 0, then find P(A $/B$) = 0 (Easy)
Statement 2: If P(A) = 0, then P(A∩B) = 0
A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1
D) Statement 1 is false and Statement 2 is true.

64) For any two independent events A and B. P(A)= x and P(B)= y (Difficult)
Assertion (A): The probability that at least one of the events A and B occurs is x + y -2 xy.
Reason (R):$P(\mathrm{E} \cap \mathrm{F}^{/}) = P(\mathrm{E})P(\mathrm{F}^{/})$.
A) A is false and R is true B) A is false and R is false
C) Both A and R are true and R is the correct explanation of A.
D) Both A and R are true and R is not the correct explanation of A.

65) **Assertion (A):** In rolling a die, event A= {1, 3, 5} and event B = {3, 6} are mutually independent events. (Easy)

Reason (R): If A and B are two independent events then $P(E \cap F) = P(E)P(F)$.

A) A is false and R is true
B) A is false and R is false
C) Both A and R are true
D) A is true and R is false

66) **Assertion (A) :** Let A and B be two events such that P (A) $= \frac{1}{5}$, P (B) $= \frac{1}{2}$ and P(A/B)$= \frac{1}{5}$, then A and B are independent events. (Easy)

Reason (R) : If A and B are two independent events then P (B/A) = P(B) .

A) A is false and R is true
B) Both A and R are true and R is the correct explanation of A.
C) Both A and R are true and R is not the correct explanation of A.
D) A is false and R is false

67) If $P(B) = \frac{5}{12}$, $P(A \cap B) = \frac{4}{12}$ and $P(A|B) = \frac{k}{5}$, then k= ----------- (Average)

68) If $P(F) = 0.6$ and $P(E \cap F) = 0.2$ then find $P(E'|F) = \frac{k}{3}$, then k= ------------- (Average)

69) If $P(A) = \frac{1}{3}$ and $P(B|A) = 0$ then $P(B) = - - - -$ (Easy)

70) If P(A) = 0 and P(B) $= \frac{1}{4}$, then P(A /B) =--------- (Easy)

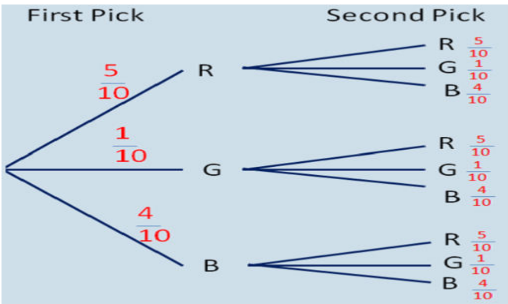
71) If A and B are two events such that A is a sub set of B and P(A) $\neq$ 0, then P(B/A) =- (Easy)

72) If A$\neq \emptyset$ is a subset of B then $P(B|A) = - - - - -$ (Easy)

73) If P $(A) \neq 0$, then $P(A|A) = - - - - -$ (Easy)

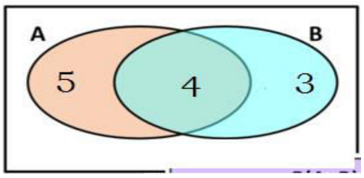
74) If $P(A) = \frac{3}{5}, P(B) = \frac{1}{3}$ and A and B are independent events then $P(A \cap B) = \frac{3}{k}$, then k= (Easy)

75) For the figure given below the P(Second Pick R) is (Average)



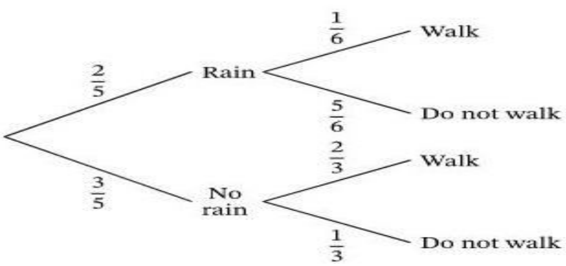
A) $\frac{1}{2}$
B) $\frac{1}{4}$
C) $\frac{3}{10}$
D) $\frac{1}{5}$.

76) For the figure given below P (B/A)= (Easy)



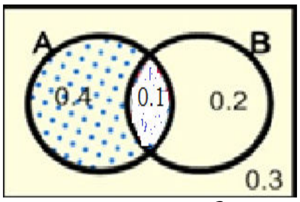
A) $\frac{4}{7}$
B) $\frac{4}{12}$
C) $\frac{4}{9}$
D) $\frac{5}{12}$.

77) For the figure given below the P(Walk) is (Average)



A) $\frac{11}{15}$
B) $\frac{8}{15}$
C) $\frac{1}{15}$
D) $\frac{7}{18}$.

78) For the figure given below the P(B$^{/}$/A) is (Average)



A) $\frac{1}{5}$ B)$\frac{4}{5}$ C)$\frac{2}{3}$ D) $\frac{3}{4}$.

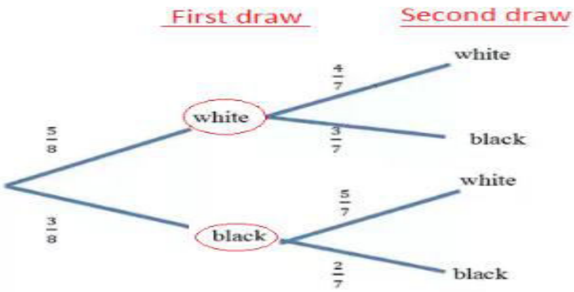
79. A coin is flipped and a dice is rolled. (Average)

Statement 1: The probability of getting a 'tail' and a 6' is $\frac{1}{12}$

Statement 2: The probability of getting a 'tail' and a not 6' is $\frac{5}{12}$.

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is true and Statement 2 is true.
C) Statement 1 is false and Statement 2 is true.
D) Statement 1 is false and Statement 2 is false.

80. For the figure given below (Average)



Statement 1: P(both are white)=$\frac{20}{56}$

Statement 2: P(at least one white) =$\frac{30}{56}$

Statement 3: P(both are black) =$\frac{6}{56}$

Which of the above statements are correct?

(A) 1 and 3 only (B) 2 and 3 only (C) 1 and 3 only (D) All 1, 2 and 3.

Two mark questions.

1. If A and B are independent events with $P(A) = 0.3, P(B) = 0.4$ then find $P(\text{not A and not B})$. (Average)
2. If A and B are independent events such that $P(A) = 0.3\ and P(B) = 0.6$, find P(A and B). (Average)
3. If A and B are independent events such that $P(A) = 0.3\ and P(B) = 0.6$, find P(A and not B). (Average)
4. If $2P(A) = P(B) = \frac{5}{13}\ and\ P(A|B) = \frac{2}{5}$ then find $P(A \cup B)$. (Average)
5. Prove that $P(A^{l}|B) = 1 - P(A|B)$. (Average)
6. If A and B are independent events with $P(A) = 0.3, P(B) = 0.4$ then find $P(A \cup B)$. (Average)
7. If $P(A) = \frac{6}{11},\ P(B) = \frac{5}{11} and P(A \cup B) = \frac{7}{11}$ then find $P(B|A)$. (Average)
8. A and B are an events such that $P(A) = \frac{1}{2} P(A \cup B) = \frac{3}{5}, P(B) = q$,then find q if A and B are Independent. (Average)
9. Let A and B are two events such that $P(A) = \frac{1}{4}, P(A|B) = \frac{1}{2} and\ P(B|A) = \frac{2}{3}$ then find$P(B)$. (Average)
10. A fair die is rolled consider an events $E = \{2,4,6\}\ and\ F = \{1,2\}$ then find $P(E|F)$. (Easy)
11. A fair die is rolled consider an events E = {1,3,5} and F = {2,3,5}, then find P(F/E). (Easy)

12. A couple has two children. Find the probability that both children are males if it is known that at least one of the children is male. (Average)

13. Mother, Father and son line up at random for a family picture , Find P(E/F).
If E: son on one end, F: father in middle. (Average)

14. Consider an experiment of tossing two fair coins simultaneously. Find the probability that both are heads. Given that at least one of them is head. (Average)

15. A couple has 2 children find the probability that both are female if it is known that elder child is female. (Average)

16. Given that the 2 number appear in on throwing two dices are different.
Find the probability of an event the sum of the number is 4. (Average)

17. Find the conditional probability of obtaining the sum 8 given that the red die resulted is a number less than 4. (Average)

18. In a hostel 60% of students read Hindi newspaper, 40% of students read English newspaper and 20% read both Hindi and English newspapers. A student is selected at random then,
If she reads Hindi newspaper find the probability that she also reads English newspapers. (Difficult)

19. A coin is tossed 3 times then find $P(E|F)$, where E : Head on third toss and
F : Head on first two tosses . (Average)

20. A coin is tossed 3 times then find $P(E|F)$,where E :at least two heads and
F : at most two heads. (Average)

21. A black and red dice are rolled. Find the conditional probability of obtaining the sum greater than 9. Given that black die resulted as 5. (Average)

22. If A and B are independent events, then prove that A and B' are also independent. (Average)

23. If A and B are independent events, then prove that A' and B are also independent. (Average)

24. If A and B are independent events, then prove that A' and B' are also independent. (Average)

25. If A and B are two independent events then prove that the probability of occurrence of at least one of A and B is given by $1 - P(A').P(B')$. (Average)

26. If $P(A) = \frac{1}{2}, P(B) = \frac{7}{12}\, and\, P(notA\ or\ notB) = \frac{1}{4}$ then state whereas A or B are independent (Average)

27. If A and B are two events such that $P(A) = \frac{1}{4}\ and\ P(B) = \frac{1}{2}$. Then $P(A \cap B) = \frac{1}{8}$ then
Find P(not A and not B) . (Average)

28. Find the probability of getting even prime number on each die, when a pair of dice is rolled. (Average)

29. Two cards are drawn random without replacement from a pack of 52 playing cards.
Find the probability that both are black cards. (Average)

30. Two cards are drawn successfully with replacement from a pack 52 cards
Find the probability distribution of number of ace cards. (Average)

31. An Urn contains 10 black and 5 white balls, 2 balls are drawn one after the other without replacement. What is the probability that both drawn balls are black. (Average)

32. Three cards drawn successively without replacement from a pack of 52 well shuffled cards.
What is the probability that 1^{st} two cards are king and 3^{rd} card drawn is ace. (Average)

33. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls find the probability that both are red. (Average)

34. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls find the probability that 1^{st} ball is black and second is red. (Average)

35. A die is tossed thrice. Find the probability of getting an odd number at least once. (Average)

36. Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively.
If both try to solve the problem independently. Find the probability that the problem is solved. (Average)

37. If P(E_1) = ½ , P(E_2)= ½ and P(A/E_1)= ½, P(A/E_2)= ¼ . Find P(E_1/A). (Average)

Three mark questions.

1. A die is thrown twice and sum of the numbers appeared is observed to be six.
   What is the conditional probability that the number 4 has appeared at least once. (Average)
2. A die is thrown 3 times. Events A and B are defined as follows.
   Event A :4 on first throw and Event B : 6 and 5 on second and third throw.
   Find the probability of 'A' given that 'B' has already occurred. (Average)
3. A pair of die are thrown, an event A and B are as follows, A : the sum of 2 numbers on the die is 8 and B : there is an even number on the first die.
   Find the conditional probability $P(B|A)$. (Average)
4. 10 cards numbered from 1 to 10 are placed in a box mix up thoroughly and 1 card is drawn random, if it is known that the number on the drawn card is more than 3.
   What is the probability that it is an even number. (Average)
5. An instructor has question bank consisting of 300 easy true/false questions, 200 difficult true/false questions, 500 easy multiple choice questions and use 400 difficult MCQ's. If a question is selected at random from the question bank. What is the probability that it will be a easy question given that it's a MCQ. (Difficult)
6. One card is drawn at random from a well shuffled deck of 52 cards. Find where events E and F are independent. E : the card drawn is a spade and F: the card drawn is an ace. (Difficult)
7. A die is marked 1,2,3 in red and 4,5,6 in green is tossed. Let 'A' be an event that 'the number is even' and B be an event that 'the number is red. Are A and B independent. (Difficult)
8. An unbiased dies is thrown twice, let A be an event 'odd number on the first thrown' let 'B' be an event odd number on the 2nd thrown check the independence of the events A and B.(Difficult)
9. A die is thrown, if E be an event, the number appearing is a multiple of 3 and F be an event the number appearing is even, then find whether E and F are independent. (Difficult)
10. A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls.
    One of the two bags is selected at random and a ball is drawn from the bag.
    What is the probability that the ball is red. (Difficult)
11. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red ? (Difficult)
12. Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls.
    One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II . The ball so drawn is found to be red in colour. Find the probability that the transferred ball is black.(Difficult)
13. A bag contains 3 red and 4 black balls, another bag contains 5 red and 6 black balls.
    One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag. (Difficult)
14. There are three coins, one is a two headed coin, another is a biased coin that comes up head 75% $of the time and third is$an unbiased coin. One of the three coins is chosen at random and tossed it shows head. What is the probability that it was the two headed coin. (Difficult)
15. Given three identical boxes I, II and III, each containing two coins. In box I, both coins are gold coins, in box II, both are silver coins and in the box III, there is one gold and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold? (Difficult)
16. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probabilities of an accident are 0.01, 0.03 and 0.15 respectively. One of the insured person meets with an accident. What is the probability that he is a scooter driver**?** (Difficult)
17. A manufacturer has three machine operators A, B and C. The first operator A produces 1% defective items, where as the other two operators B and C produce 5% and 7% defective items respectively. A is on the job for 50% of the time, B is on the job for 30% of the time and C is on the job for 20% of the time. A defective item is produced, what is the probability that it was produced by A? (Difficult)

18. A doctor is to visit a patient from the past experience it is known that the probabilities that he will come by train, bus scooter or by other means of transportation are $\frac{3}{10}, \frac{1}{5}, \frac{1}{10}$ $and\ \frac{2}{5}$ respectively. The probability that he will be late are $\frac{1}{4}, \frac{1}{3} \& \frac{1}{12}$. If he comes by train, bus scooter respectively. But he comes by the means of transport he will not be late. When he arrive, is late. What is the probability be will come by trains. (Difficult)

19. Of the students in a college it is known that 60% reside in hotel and 40% are day scholar (not residing in hostel) previous year results report that 30% of the student who reside in hostel attain 'A' grade and 20% of day scholars attain 'A' grade in their annual examination. At the end of the year one student is chosen at random from college and he has 'A' grade. What is the probability that the student is a hosteller? (Difficult)

20. In a factory which manufactures bolts, machines A, B and C manufacture respectively 25%, 35% and 40% of the bolts. Of their outputs, 5, 4 & 2 percent are respectively defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by the machine B? (Difficult)

21. In answering a question on a multiple choice test a student either knows the answer or guesses. Let 3/4 be the probability that he knows the answer and 1/4 be the probability that he guesses. Assuming that a student who guesses the answer will be correct with probability 1/4 . What is the probability that a student knows the answer given that he answered it correctly. (Difficult)

22. A man is know to speak truth 3 out of 4 times. He throws a die and reports that it is six. Find the probability that it is actually six. (Difficult)

23. Probability that a person speaks truth is $\frac{4}{5}$, A coin is tossed a person reports that head appears. Find the probability that it is actually head. (Difficult)

24. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find the probability of the lost card being a diamond. (Difficult)

25. A factory has two machines A and B. Past record shows that machine A produced 60% of the items of output and machine B produced 40% of the items. Further, 2% of the items produced by machine A and 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B? (Difficult)

26. Suppose that the reliability of a HIV test is specified as follows: Of people having HIV, 90% of the test detect the disease but 10% go undetected. Of people free of HIV, 99% of the test are judged HIV–ve but 1% are diagnosed as showing HIV+ve. From a large population of which only 0.1% have HIV, one person is selected at random, given the HIV test, and the pathologist reports him/her as HIV+ve. What is the probability that the person actually has HIV? (Difficult)

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GOVERNMENT OF KARNATAKA

DEPARTMENT OF SCHOOL EXAMINATION AND ASSESSMENT BOARD

II PUC MATHEMATICS (35) EXAMINATION – 1, 2025

Duration: 3hrs Max Marks: 80

Instructions:

1) The question paper has five Parts namely **A, B, C, D** and **E**. Answer all the Parts.
2) Part - A has **15** multiple choice questions, 5 fill in the blank questions.
3) For Part-A questions, only the first written answers will be considered for evaluation.
4) Use the graph sheet for question on Linear Programming Problem in Part-E.

PART-A

I. Answer all the Multiple-choice questions: $(\mathbf{15 \times 1 = 15})$

1. A relation R in a set A is called reflexive relation if
   a) $(a,a) \in R$ For all $a \in A$
   b) $(a,a) \in R$ For at least one $a \in A$
   c) $(a,b) \in R$ Implies $(b,a) \in R$
   d) $(a,b) \in R$ and $(b,c) \in R$ Implies $(a,c) \in R$

2. The principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is
   a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

3. Match list -I With list -II.

List -I	List -II
A) Domain of $\sin^{-1} X$	i) $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$
B) Range of $\tan^{-1} X$	ii) $[0, \pi]$
C) Range of $\cos^{-1} X$	iii) $[-1,1]$

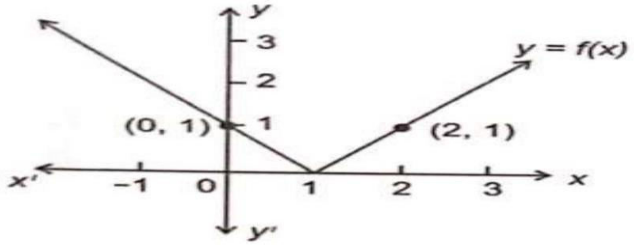
   Choose the correct answer from the options given below:
   a) $A - i, B - ii, C - iii$
   b) $A - iii, B - ii, C - i$
   c) $A - ii, B - i, C - iii$
   d) $A - iii, B - i, C - ii$

4. For a 2×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = 2i - j$ is equal to
   a) $\begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

5. Let A be a non-singular matrix of order 3×3, then $|adjA|$ is equal to
   a) $|A|$ b) $3|A|$ c) $|A|^3$ d) $|A|^2$

6. If $f(x) = \cos 2x$, then $f'(\frac{\pi}{4})$ is
   a) 2 b) -2 c) $\sqrt{2}$ d) $-\sqrt{2}$

7. For the given figure consider the following statements 1 and 2 :



   Statement 1: Left hand derivative of $y = f(x)$ at $x = 1$ is -1 .
   Statement 2: The function $y = f(x)$ is differentiable at $x = 1$.
   Then which of the following are true?
   a) Statement 1 is true, statement 2 is false
   b) Statement 1 is false, statement 2 is true
   c)Both statements 1 and 2 are true
   d) both statements 1 and 2 are false

8. The absolute maximum value of the function f given by $f(x) = x^3, x \in [-2,2]$ is
   a) 2 b) 0 c) -2 d) 8

9. $\int e^x(\sin x - \cos x)dx$ Is
   a) $-e^x\cos x$ b) $e^x\cos x$ c) $e^x\sin x$ d) $e^x\sin^2 x$
10. The degree of differential equation $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + e^{\frac{dy}{dx}} = 0$ is
   a) 1 b) 3 c) 2 d) not defined
11. The direction cosines of the vector $\vec{a} = \hat{\imath} - \hat{\jmath} + 2\hat{k}$ are
   a) $\frac{1}{\sqrt{5}}, \frac{-1}{\sqrt{5}}, \frac{2}{\sqrt{5}}$ b) $\frac{1}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{2}{\sqrt{6}}$ c) $\frac{1}{6}, \frac{-1}{6}, \frac{2}{6}$ d) $\frac{-1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}$
12. The angle between two vectors $\vec{a}$ and $\vec{b}$ with $|\vec{a}| = \sqrt{3}, |\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{6}$ is
   a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$
13. The equation of y-axis in space is
   a) $x = 0, y = o$ b) $x = 0, z = 0$ c) $y = 0, z = 0$ d) $y = 0$
14. If $P(A) = \frac{1}{2} P(B \mid A) = \frac{2}{3}$ then $P(A \cap B)$ is
   a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) 1 d) $\frac{3}{5}$
15. **Assertion [A]:** For two events E and F if $P(E) = \frac{1}{5}, P(F) = \frac{1}{2}$ and $P(E \mid F) = \frac{1}{5}$. Then E and F are independent events
   Reason [R]: If E and F are two independent events then $P(F \mid E) = P(F)$
   Then which of the following are true?
   a) $[A]$ is true but $[R]$ is false b) Both $[A]$ and $[R]$ are false
   c) Both $[A]$ and $[R]$ are true d) [A] is false but [R] is true

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket $\left[0, 2, 1, \frac{5}{9}, -1, 6\right]$ $(5 \times 1 = 5)$

16. The value of $\cos\left(\sec^{-1}(2) - \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)$ is
17. If $y = \sin^{-1}(\cos x)$ then $\frac{dy}{dx} =$ ___
18. The value of $\int_7^{13} 1 dx =$ ___
19. The projection of vector $\hat{\imath} + \hat{\jmath}$ along the vector $\hat{\imath} - \hat{\jmath}$ is ___
20. If $P(A \cap B) = \frac{4}{13}$ and $P(B) = \frac{9}{13}$ then $P(A' \mid B) =$ ___

PART -B

III. Answer any six of the following questions: $(6 \times 2 = 12)$

21. Find the equation of the line through the points (1,2) and (3,6) using determinants.
22. If $\sqrt{x} + \sqrt{y} = \sqrt{10}$ then show that $\frac{dy}{dx} + \sqrt{\frac{y}{x}} = 0$
23. A balloon which is always remains spherical has a variable radius find the rate at which its volume is increasing with radius when the radius is 10 cm .
24. Find the interval in which the function given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is decreasing
25. Find $\int \cot x \cdot \log(\sin x)dx$.
26. Verify that the function $y = a\sin x + b\cos x$ is a solution of differential equation $\frac{d^2y}{dx^2} + y = 0$.
27. If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \hat{b} = 2\hat{\imath} - \hat{\jmath} + 3\hat{k}$, and $\vec{c} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$ then find unit vector parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$
28. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-2}$ are perpendicular to each other, then find the value of k
29. An urn contains 10 black and 5 white balls, two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls black?

PART -C

IV. Answer any six of the following questions: **($6 \times 3 = 18$)**

30. Check whether the relation R in R defined by $R = \{(a,b): a \leq b^3\}$ is reflexive, symmetric and transitive.
31. Prove than $\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right)$
32. Express $\begin{bmatrix} 1 & 5 \\ -1 & 2 \end{bmatrix}$ as the sum of symmetric and a skew - symmetric matrix.
33. Find $\frac{dy}{dx}$ if $x = a\left(\cos\, t + \log\left(\tan\frac{t}{2}\right)\right)$ and $y = a\sin\, t$.
34. Find the two positive numbers x and y such that $x + y = 60$ and xy^3 is maximum
35. Evaluate $\int \frac{2x}{x^2+3x+2} dx$.
36. Find the area of triangle ABC where positions vectors A, B, C are $\hat{\imath} - \hat{\jmath} + 2\hat{k}, 2\hat{\jmath} + \hat{k}, \hat{\jmath} + 3\hat{k}$ respectively
37. Derive the equation of a line in space through given point and parallel to a given vector $\vec{b}$ in the vector form
38. In two identical boxes, box I contains 2 gold coins, while box II contains one gold and one silver coin, A person chooses a box at random and takes out a coin, if the coin is of gold, what is the probability that the other coin in the box is also a gold?

PART-D

V. Answer any four of the following questions: **($4 \times 5 = 20$)**

39. IF $A = R - (3)$ and $B = R - \{1\}$ and $f: A \to B$ is a function defined by $f(x) = \left(\frac{x-2}{x-3}\right)$ is f one-one and onto? Justify your answer
40. If $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}$ and $B = [-1 \quad 2 \quad 1,]$ verify that $(AB)' = B'A'$.
41. Solve the following system of linear equations by matrix method. $4x + 3y + 2z = 60, 2x + 4y + 6z = 90, 6x + 2y + 3z = 70$.
42. If $y = (\tan^{-1} x)^2$ then show that $(x^2+1)^2 y_2 + 2x(x^2+1)y_1 = 2$
43. Find the integral of $\frac{1}{x^2+a^2}$ with respect to x and hence find $\int \frac{1}{x^2-6x+13} dx$.
44. Find the area of circle $x^2 + y^2 = a^2$ by method of integration
45. Solve the differential equation $\cos^2 x \frac{dy}{dx} + y = \tan\, x \left(0 \leq x < \frac{\pi}{2}\right)$

PART -E

VI. Answer the following questions:

46. Prove that $\int_0^a f(x)dx = \int_0^a (a-x)dx$ and hence evaluate $\int_0^{\frac{\pi}{4}} \log(1 + \tan\, x)dx$. **6**

OR

Solve the following linear programming problem graphically:
Minimize and maximize $Z = 5x + 10y$, Subject to $x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0$ and $x \geq 0. y \geq 0$ **6**

47. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ show that $A^2 - 5A + 7l = 0$ and hence find A^{-1} **4**

OR

Determine the value of k if $f(x) = \begin{cases} \frac{k\cos\, x}{\pi - 2x}, & x \neq \frac{\pi}{2} \\ 3, & x = \frac{\pi}{2} \end{cases}$ is continues at $x = \frac{\pi}{2}$ **4**

GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

II PUC MATHEMATICS (35) EXAMINATION – 2, 2025

Duration: 3hrs Max Marks: 80

Instructions:

1) The question paper has five Parts namely **A**, **B**, **C**, **D** and **E**. Answer all the Parts.
2) Part - A has **15** multiple choice questions, 5 fill in the blank questions.
3) For Part-A questions, only the first written answers will be considered for evaluation.
4) Use the graph sheet for question on Linear Programming Problem in Part-E.

PART-A

I. Answer all the Multiple-choice questions: $(\mathbf{15 \times 1 = 15})$

1. The relation R in the set [1,2,3] given by $R = \{(2,3)\}$ is
   a) Reflexive b) Symmetric c) Transitive d) Equivalence
2. The principal value branch of $\cot^{-1} x$ is
   a) $[0, \pi]$ b) $(0, \pi)$ c) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ d) $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$
3. **Statement 1:** If $\frac{-\pi}{2} \le x \le \frac{\pi}{2}$ then $\sin^{-1}(\sin x) = x$
   Statement 2: If $0 \le x \le \pi$ then $\cos(\cos^{-1} x) = x$
   a) Statement 1 and statement 2 are true
   b) Statement 1 and statement 2 are false
   c) Statement 1 is true but statement 2 is false
   d) Statement 2 is true but statement 1 is false
4. If a matrix has 8 elements, then the total number of possible matrices of different order here
   a) 4 b) 6 c) 2 d) 8
5. If A is a square Matrix with $|A| = 8$, then the value of $|AA'| =$
   a) 8 b) 64 c) 16 d) $\frac{1}{8}$
6. If $y = \log(\log x)$, then $\frac{dy}{dx} =$
   a) $\frac{\log x}{x}$ b) $\frac{1}{x}$ c) $\frac{1}{\log x}$ d) $\frac{1}{x\log x}$
7. If $y = \sin^{-1} x + \sin^{-1} \sqrt{1-x^2}$, then $\frac{dy}{dx} =$
   a) $\frac{1}{\sqrt{1-x^2}}$ b) -1 c) 0 d) 1
8. The total revenue in rupees received from the sale x units of a product is given $R(x) = 3x^2 + 36x + 5$ the marginal revenue when $x = 15$ is
   a) 90 b) 96 c) 116 d) 126
9. $\int e^x \left(\frac{1}{x} - \frac{1}{x^2}\right) dx =$
   a) $\frac{e^x}{x} + C$ b) $\frac{e^x}{x^2} + C$ c) $e^x + C$ d) $\frac{-e^x}{x^2} + C$
10. $\int_1^{\sqrt{3}} \frac{dx}{1+x^2}$
    a) $\frac{\pi}{12}$ b) $\frac{-\pi}{12}$ c) $\frac{\pi}{3}$ d) $\frac{-\pi}{4}$
11. The position vector of a point which divides the join of points with position vectors $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ externally in the ratio $2:1$ is
    a) $4\vec{a} - \vec{b}$ b) $4\vec{b} - \vec{a}$ c) $2\vec{a} + \vec{b}$ d) $\frac{5\vec{a}}{3}$
12. The value of x for which $x(\hat{\imath} + \hat{\jmath} + \hat{k})$ is a unit vector is
    a) $\pm\sqrt{3}$ b) 3 c) $\pm\frac{1}{\sqrt{3}}$ d) 1
13. The direction cosines of negative Z - axis are
    a) 0,0,1 b) $0,0,-1$ c) $-1,-1,0$ d) 0,1,0
14. If A and B are two events such that $P(A \mid B) = P(B \mid A)$, then
    a) $P(A) = P(B)$ b) $A = B$ c) $A \cap B = \emptyset$ d) $A \subset B$ but $A \neq B$

15. If A and B are independent events such that $P(A) = 0.3$ and $P(B) = 0.4$ then $P(A \cap B)$ is
   a) 0.7 b) 0.4 c) 0.3 d) 0.12

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket $(-2, -1, 0, 1, 2, 3)$ **$(5 \times 1 = 5)$**

16. The valve of $\cos\left(\frac{\pi}{6} + \tan^{-1}\sqrt{3}\right) =$ ___
17. Left hand derivative of $|x|$ at $x = 0$ is ___
18. The order of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 + 2\frac{dy}{dx} = \log x$ is ___
19. The projection of vector $i + 2j - 2k$ on z -axis is ___
20. If $A \subset B$, then $P(B/A) =$ ___

PART -B

III. Answer any six of the following questions: **$(6 \times 2 = 12)$**

21. Find the equation of the line through the points (1,3) and (0,0) using determinants.
22. Find $\frac{dy}{dx}$, if $\mathrm{y} + \sin \mathrm{y} = \cos \mathrm{x}$
23. Find the absolute maximum value of the function $\mathrm{f(x)} = \mathrm{x}^3$ in the given interval $[-2,2]$.
24. Find the interval in which the function given by $f(x) = x^2 - 4x + 6$ is increasing
25. Find $\int \frac{x^3-x^2+x-1}{x-1}\mathrm{dx}$.
26. Find the general solution of the differential equation $\frac{dy}{dx} = -4xy^2$.
27. Find the area of the triangle whose adjacent sides are given by the vectors $\vec{a} = 3\hat{\imath} + \hat{\jmath} + 4\hat{\kappa}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{\kappa}$
28. Find the angle between pair of lines $\frac{x}{2} = \frac{y}{2} = \frac{z}{1}$ and $\frac{x-5}{4} = \frac{y-2}{1} = \frac{z-3}{8}$
29. Two cards are drawn at random and without replacement from a pack of 52 playing cards. Find the probability that both the cards are black.

PART -C

IV. Answer any six of the following questions: **$(6 \times 3 = 18)$**

30. Show that the relation R in the set Z of integer given by $R = \{(a, b): 2 \text{ divides } a - b\}$ is an equivalence relation.
31. Prove that $\cos^{-1}\left(\frac{4}{5}\right) - \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{63}{65}\right)$
32. If A and B are symmetric matrices, prove that $AB - BA$ is skew symmetric matrix.
33. Find $\frac{dy}{dx}$, if $\mathrm{x} = \mathrm{a}(\theta - \sin\theta); \mathrm{y} = \mathrm{a}(1 + \cos\theta)$
34. A man height 2 meters walks at a uniform speed of 5 km/hr away from a lamp post which is 6 meter high. Find the rate at which the length of his shadow increases.
35. Evaluate $\int \frac{3x-2}{(x+3)(x+1)^2}dx$.
36. Three vectors $\vec{a}$, $\vec{b}$ & $\vec{c}$ satisfy the condition $\vec{a} + \vec{b} + \vec{c} = 0$. Evaluate the quantity $\mu = \vec{a}\cdot\vec{b}\cdot + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$. Given $|\vec{a}| = 3, |\vec{b}| = 4$ & $|\vec{c}| = 5$.
37. Find the shortest distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(2\hat{\imath} + \hat{\jmath} + 2\hat{k})$
38. Given three identical boxes I , II and III with each containing two coins. in box I, both coins are gold coins, in box II, both are silver coins and in box III, there is one gold and one silver. A person chooses a box at random and takes out the coin .If the coin is of gold, what is the probability that the other coin in the box is also of gold.

PART-D

V. Answer any four of the following questions: **$(4 \times 5 = 20)$**

39. State whether the function $f: R \to R$ defined by $f(x) = 3 - 4x$ is one-one, onto or bijective. Justify your answer.

40. If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$, calculate AC, BC and $(A + B)C$. Also verify that $(A + B)C = AC + BC$

41. Solve the following system of linear equations by matrix method. $4x + 3y + 2z = 60, 2x + 4y + 6z = 90, 6x + 2y + 3z = 70.$

42. If $y = (\tan^{-1} x)^2$ then show that $(x^2 + 1)^2 y_2 + 2x(x^2 + 1)y_1 = 2$

43. Find the integral of $\frac{1}{x^2 - a^2}$ with respect to x and hence find $\int \frac{1}{4x^2 - 9} dx$.

44. Find the are of the region bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = -1$ and $x = 1$ by the method of integration.

45. Find the general solution of differential equation $x \frac{dy}{dx} + 2y = x^2 \log x, x \neq 0$

PART -E

VI. Answer the following questions:

46. Solve the following linear programming problem graphically: Minimize and maximize $Z = 5x + 10y$ Subject to $x + 2y \leq 120,\ x + y \geq 60$ and $x - 2y \geq 0,\ x \geq 0,\ y \geq 0.$ **6**

OR

Prove that $\int_0^a f(x)dx = \int_0^a (a + b - x)dx$ and hence evaluate $\int_2^3 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{5 - x}} dx$ **6**

47. If $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ $A = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$ Verify that $(AB)^{-1} = B^{-1}A^{-1}$ **4**

OR

Find the value of K so that the function $f(x) = \begin{cases} kx^2 & \text{if } x \leq 2 \\ 3. & \text{if } x > 2 \end{cases}$ is continues at x = 2. **4**

GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

II PUC MATHEMATICS (35) EXAMINATION – 3, 2025

Duration: 3hrs Max Marks: 80

Instructions:

1) The question paper has five Parts namely **A, B, C, D** and **E**. Answer all the Parts.
2) Part - A has **15** multiple choice questions, 5 fill in the blank questions.
3) For Part-A questions, only the first written answers will be considered for evaluation.
4) Use the graph sheet for question on Linear Programming Problem in Part-E.

PART-A

I. Answer all the Multiple-choice questions: $(\mathbf{15 \times 1 = 15})$

1. If $f: R \to R$ and $g: R \to R$ are given by $f(x) = \sin x$ and $g(x) = x^2$, then the fog is
   a) $x^2 \sin x$ b) $(\sin x)^2$ c) $\sin(x^2)$ d) $\frac{\sin x}{x^2}$
2. **Statement 1:** Matrix $\begin{bmatrix} 3 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ is scalar matrix.
   Statement 2: Every scalar matrix is a diagonal matrix.
   Choose the correct answer from the options given below
   a) Statement 1 is false and Statement 2 is true
   b) Statement 1 is true and Statement 2 is false
   c) Statement 1 is false and Statement 2 is false
   d) Statement 1 is true and Statement 2 is true
3. If A is a matrix of order 3×4 and B is a matrix, such that $A'B$ and BA' are both defined, then the order of matrix B is
   a) 4×3 b) 3×4 c) 3×3 d) 4×4
4. Let A be a non-singular matrix of order 3×3 and $|A| = 5$, then $|A(\text{adj}A)|$ is
   a) 216 b)5 c) 0 d) 125
5. If $y = \cos^{-1}(\sin x)$, then $\frac{dy}{dx}$ is
   a) -1 b) 1 c) 25 d) $\frac{\pi}{2}$
6. If $y = \log_5 x$, then $\frac{dy}{dx}$ is
   a) $\frac{1}{x}$ b) $\log_x 5$ c) $\frac{1}{x\log_e 5}$ d) $\frac{\log_e 5}{x}$
7. The function f given by $f(x) = x^2 - 4x + 6$ is increasing in the interval
   a) $(-\infty, 2)$ b) $(2, \infty)$ c) $[2, \infty)$ d) $\{-\infty, \infty)$
8. A particle moving in a straight line covers a distance 5 cm in time t sec. is given by $S = t^3 + 3t^2 + 6t - 18$, the initial velocity of a particle is
   a) 3 cm/sec. b) 18 cm/sec c) 8 cm/sec. d) 6 cm/sec.
9. $\int e^x(1 + \tan x + \tan^2 x)dx =$
   a) $\tan x + C$ b) $e^x \tan x + C$ c) $e^x \sec x + C$ d) $\sec x + C$
10. The degree of the differential equation $\left(1 + \frac{dy}{dx}\right)^3 = \left(\frac{d^2y}{dx^2}\right)^2$ is
    a) 2 b) 3 c) 4 d) 1
11. The position vector of the point which divides the join of two points with position vectors $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ in the ratio 2:1 internally is
    a) $\frac{3\vec{a}}{5}$ b) $4\vec{b} - \vec{a}$ c) $\frac{5\vec{a}}{3}$ d) $\vec{a} + 4\vec{b}$
12. For the given triangle ABC . Which of the following is not true?
    a) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$ b) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$
    c) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \vec{0}$ d) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \vec{0}$
13. If a line makes angles α, β, γ with the positive direction of the co-ordinate axes. Then the value of $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ is
    a) 2 b) 1 c) 3 d) -1

14. Two cards are drawn at random and without replacement from a pack of 52 playing cards. The probability that both the cards are red is
    a) $\frac{23}{102}$ b) $\frac{25}{102}$ c) $\frac{25}{104}$ d) $\frac{1}{4}$
15. If P(A/B) > P(A), Then which of the following is correct?
    a) $P(A\cap B) < P|A|\cdot P|B|$ b) $P(B/A) < P(B)$
    c) $P(B/A) > P(B)$ d) $P(B \mid A) = P(A)$

II. Fill in the blanks by choosing the appropriate answer given in the bracket for all of the following

[0,4,11,3,5,1] **($5\times 1 = 5$)**

16. The value of $\tan^3(\sec^{-1} 2) + \cot^2(\operatorname{cosec}^{-1}3)$ ___ .
17. If $f(x) = |x-5|$, Then f is continuous but not differentiable at x = ___
18. $\int_{-\pi/4}^{\pi/4} \frac{1}{1+\cos 2x} dx =$ ___ .
19. If $|\vec{a}x\vec{b}|^2 + |\vec{a},\vec{b}|^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}|$ ___ .
20. If $P(B) = \frac{5}{12}.P(A\cap B) = \frac{1}{3}$ and $P(A \mid B) = \frac{k}{5}$, then $k =$ ___ .

PART - B

III. Answer any six of the following questions **($6\times 2 = 12$)**

21. Prove that $3\cos^{-1}(x) = \cos^{-1}(4x^3-3x), x\in\left[\frac{1}{2},1\right]$
22. If $A = \begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}, I = \begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ and $A + A' = I$, Find the value of α.
23. Find the area of the triangle whose vertices are (−2, −3), (3,2) and (−1, −8) using determinants.
24. Find $\frac{dy}{dx}$, if $\sin^2 x + \cos^2 y = 1$ with respect to x .
25. Evaluate $\int \frac{x^3(\tan^{-1} x^4)}{1+x^8} dx$
26. Find the integrating factor of the differential equation $x\log x\frac{dy}{dx} + y = \frac{2}{x}\log x$.
27. Find the area of the parallelogram whose adjacent sides are represented by the vectors $\vec{a} = i - j + 3k\,\vec{b} = 2i - 7j + k$.
28. Find the angle between the pair of lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$
29. An unbiased die is thrown twice. Let the event A be 'odd number on the first throw' and B the event 'odd number on the second throw'. Check the independence of the events A and B.

PART - C

IV. Answer any six of the following questions **($6\times 3 = 18$)**

30. Determine whether the Relation R in the set N of natural numbers defined as $R = \{(x,y): y = x+5 \text{ and } x < 4\}$, reflexive, symmetric and transitive.
31. Prove that $\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right)$
32. Find $\frac{dy}{dx}$, if $y^x = x^y$.
33. The volume of a cube is increasing at the rate of 9 cm^3/sec. How fast is the surface area increasing when length of an edge is 10 cm ?
34. Find the absolute maximum value of $2x^3 - 24x + 107$ in the interval [1,3].
35. Find $\int \frac{\cos x}{(1-\sin x)(2-\sin x)} dx$
36. If $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $|\vec{a}| = 3, |\vec{b}| = 4, |\vec{c}| = 5$ and each one of them being perpendicular to the sum of the other two, find $|\vec{a}+\vec{b}+\vec{c}|$
37. Find the shortest distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(2\hat{\imath} + \hat{\jmath} + 2\hat{k})$

38. In answering a question on a multiple-choice test, a student either knows the answer or guesses. Let $\frac{3}{4}$ be the probability that he knows the answer and $\frac{1}{4}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability $\frac{1}{4}$. What is the probability that the student knows the answer given that he answered it correctly?

PART - D

V. Answer any four of the following questions: **$(4 \times 5 = 20)$**

39. Let $A = R - \{3\}$ and $B = R - \{1\}$ consider the function $f: A \to B$ defined by $f(x) = \left(\frac{x-2}{x-3}\right)$ then show that f is one-one and onto. Also find f^{-1}.

40. If $\mathrm{A} = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $\mathrm{B} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$ and $\mathrm{C} = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$, calculate AC, BC and $(\mathrm{A} - \mathrm{B})\mathrm{C}$. Also verify that $(\mathrm{A} - \mathrm{B})\mathrm{C} = \mathrm{AC} - \mathrm{BC}$.

41. Solve the system of equation $x - y + 2z = 7$, $3x + 4y - 5z = -5$ and $2x - y + 3z = 12$

42. Find $\frac{dy}{dx}$, if $\mathrm{x} = \mathrm{a}(\cos\theta + \theta\sin\theta)$, $\mathrm{y} = \mathrm{a}(\sin\theta - \theta\cos\theta)$ Then show that $\frac{d^2y}{dx^2} = \frac{1}{a\theta}\sec^3\theta$.

43. Find the integral of $\frac{1}{a^2-x^2}$ with respect to x and hence evaluate $\int \frac{dx}{3-x^2+2x}$.

44. Find the area bounded by the curve $\mathrm{y} = \cos \mathrm{x}$ between $\mathrm{x} = 0$ & $\mathrm{x} = 2\pi$.

45. Find the equation of a curve passing through the point (0,0) and whose differential equation is $\frac{dy}{dx} = e^x \sin x$

PART - E

VI. Answer the following questions:

46. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^1 x(1-x)^n dx$ **6**

OR

Solve the following linear programming problem graphically.
Maximise $Z = 3\mathrm{x} + 2\mathrm{y}$, subject to the constraints, $2x + y \le 50$, $x + 2y \le 40$ and $x \ge 0, y \ge 0$. **6**

47. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, show that $A^2 - A + 2I = 0$. Using the equation, find A^{-1}. **4**

OR

Find the value of k so that function $f(x) = \begin{cases} \frac{k\cos x}{\pi - 2x} & \text{if } x \ne \frac{\pi}{2} \\ 3 & \text{if } x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$ **4**

GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

WEIGHTAGE FRAMEWORK FOR MQP 1: II PUC MATHEMATICS(35):2024-25

Chapter	CONTENT	Number of Teaching hours	PART A 1 mark		PART B 2 mark	PART C 3 mark	PART D 5 mark	PART E		Total
			MCQ	FB				6 mark	4 mark	
1	RELATIONS AND FUNCTIONS	9	1			1	1			9
2	INVERSE TRIGONOMETRIC FUNCTIONS	6	1		1	1				6
3	MATRICES	9	1			1	1			9
4	DETERMINANTS	12	1		1		1		1	12
5	CONTINUITY AND DIFFERENTIABILITY	20	2	1	1	1	1		1	17
6	APPLICATION OF DERIVATIVES	10	2	1	1	1				8
7	INTEGRALS	22	2		1	1	1	1		18
8	APPLICATION OF INTEGRALS	5					1			5
9	DIFFERENTIAL EQUATIONS	10		1	1		1			8
10	VECTOR ALGEBRA	11	2	1	1	1				8
11	THREE D GEOMETRY	8	1		1	1				6
12	LINEAR PROGRAMMING	7						1		6
13	PROBABILITY	11	2	1	1	1				8
	TOTAL	**140**	**15**	**5**	**9**	**9**	**7**	**2**	**2**	120

Department of School Education (Pre University) and Karnataka School Examination and Assessment Board

GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

Model Question Paper -1

II P.U.C : MATHEMATICS (35): 2024-25

Time : 3 hours **Max. Marks : 80**

Instructions :

1) *The question paper has five parts namely A, B, C, D and E. Answer all the parts.*
2) *PART A has 15 MCQ's ,5 Fill in the blanks of 1 mark each.*
3) *Use the graph sheet for question on linear programming in PART E.*
4) *For questions having figure/graph, alternate questions are given at the end of question paper in separate section for visually challenged students.*

PART A

I. Answer ALL the Multiple Choice Questions **15×1 = 15**

1. Let the relation R in the set A = { x ∈ Z: $0 \le x \le 12$}, given by R={(a, b):|a-b| is multiple of 4}, then [3], the equivalence class containing 3 is

A) {1,5,9} B) ϕ C) A D) {3, 7,11}

2. If $\cot^{-1} x = y$, then

A) $0 \le y \le \pi$ B) $0 < y < \pi$ C) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$ D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$.

3. If $A = [a_{ij}]$ is a symmetric matrix of order $m \times n$ then

A) m=n and a_{ij}=0 for i=j B) m=n and $a_{ij}=a_{ji}$ for all i,j

C) $a_{ij}=a_{ji}$ for all i,j D) m=n and $a_{ij}=-a_{ji}$ for all i,j

4. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ then the value of x is equal to

A) 2 B) 4 C) 8 D) $\pm 2\sqrt{2}$.

5. Statement 1: Left hand derivative of $f(x) = |x|$ at x = 0 is -1.

Statement 2: Left hand derivative of f(x) at x = a is $\lim_{h \to 0} f(a-h)$

A) Statement 1 is true, and Statement 2 is false.

B) Statement 1 is true, and Statement 2 is true, Statement 2 is correct Explanation for Statement 1

C) Statement 1 is true, and Statement 2 is true, Statement 2 is not a correct Explanation for Statement 1

D) Statement 1 is false, and Statement 2 is false.

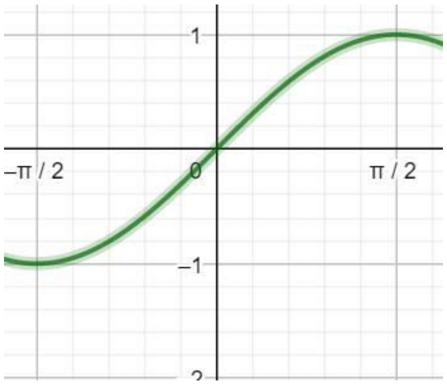
6. The derivative of log(secx+tanx) with respect to x is

A)secx B) tanx C) secx.tanx D) $\frac{1}{secx+tanx}$

7. The absolute maximum value of the function f given by $f(x) = x^3$, $x \in [-2, 2]$ *is*

A)-2 B)2 C)0 D)8

8. The point of inflection for the following graph is



A) $-\frac{\pi}{2}$ B) $\frac{\pi}{2}$ C) 0 D) point of inflection does not exist

9. $\int e^x\left(\frac{1}{x}-\frac{1}{x^2}\right)dx =$

A) $e^x + c$ B) $\frac{e^x}{x^2} + c$ C) $\frac{e^x}{x} + c$ D) $\frac{-e^x}{x} + c$

10. $\int x\sin x dx$ =

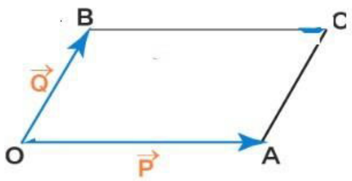
A) $-xcosx - sinx + c$ B) $xcosx + sinx + c$

C) $-xcosx + sinx + c$ D) $-cosx - sinx + c$

11. The projection vector of the vector $\overrightarrow{AB}$ on the directed line l, if angle $\theta = \frac{\pi}{2}$ will be.

A) $Zero$ vector. B) $\overrightarrow{AB}$ C) $\overrightarrow{BA}$ D) $Unit$ vector.

12. For the given figure, $\vec{P} - \vec{Q}$ is



A) $\overrightarrow{OC}$ B) $\overrightarrow{CO}$ C) $\overrightarrow{BA}$ D) $\overrightarrow{AB}$

13. The direction cosines of negative *z*-axis.

A) -1 , -1 , 0 B) 0 , 0 , −1 C) 0 , 0 , 1 D) 1 , 1 , 0

14. If P(A) = $\frac{1}{2}$, P (B) = 0, then P (A|B) is

A) 0 B) $\frac{1}{2}$ C) 1 D) not defined

15. An urn contains 10 black and 5 white balls, 2 balls are drawn one after the other without replacement, then the probability that both drawn balls are black is

A) $\frac{3}{7}$ B) $\frac{4}{9}$ C) $\frac{2}{3}$ D) $\frac{2}{9}$

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket (0, 1, 2, 3, 4, 5) **5 × 1 = 5**

16. The number of points in R for which the function f(x) = |x|+ |x + 1| is not differentiable, is_________

17. The value of $\hat{\imath}.\left(\hat{\jmath} \times \hat{k}\right) - \hat{\jmath}.\left(\hat{k} \times \hat{\imath}\right) - \hat{k}.\left(\hat{\jmath} \times \hat{\imath}\right)$ is_________

18. The sum of the order and degree of the differential equation $2x^2\left(\frac{d^2y}{dx^2}\right) - 3\left(\frac{dy}{dx}\right) + y$ is_____

19.The total revenue in rupees received from the sale of x unit of a product is given by R(x)=$2x^2 - 4x + 5$,The marginal revenue when x=2 is________

20. If P(A) = $\frac{3}{k}$, P(A∩ B) = $\frac{2}{5}$ and P(B|A) = $\frac{2}{3}$, then k is _________

PART B

Answer any SIX questions: **$6 \times 2 = 12$**

21. Show that $\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\sin^{-1}(x),\ -\frac{1}{\sqrt{2}} \le x \le \frac{1}{\sqrt{2}}$.

22. Show that points A (a, b + c), B (b, c + a), C (c, a + b) are collinear using determinants.

23. Find $\frac{dy}{dx}$, if $2x+3y=\sin x$.

24. Find the local maximum value of the function $g(x)=x^3-3x\cdot$

25. Evaluate $\int \sin 3x \cos 4x \; dx\cdot$

26. Find the general solution of the differential equation $\frac{ydx-xdy}{y}=0$.

27. Find $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a})=15$.

28. Find the equation of the line in vector form that passes through the point with position vector $2\,\hat{\imath}-\hat{\jmath}\ +4\,\hat{k}$ and is in the direction $\hat{\imath}+2\,\hat{\jmath}-\hat{k}$.

29. Prove that if E and F are independent events, then so are the events E and F'.

PART C

Answer any SIX questions: **$6\times3 = 18.$**

30. Show that the relation R in the set of real numbers **R** defined as $R=\{(a,b)\ :a\le b\}$,is reflexive and transitive but not symmetric.

31. Prove that $\cos^{-1}\frac{4}{5}\ +\cos^{-1}\frac{12}{13}=\cos^{-1}\frac{33}{65}$.

32. Express $\begin{bmatrix}3 & 5\\1 & -1\end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix.

33. Find $\frac{dy}{dx}$ if $x=a(\cos\theta+\theta\sin\theta)$ and $y=a(\sin\theta-\theta\cos\theta)$.

34. Find the intervals in which the function $f(x)=(x-2)^3(x+4)^3$ is a) increasing b) decreasing.

35. Find $\int \frac{x}{(x+1)\,(x+2)}dx\cdot$

36. If $\vec{a},\vec{b}\ \&\ \vec{c}$ are three vectors such that $|\vec{a}|=3$, $|\vec{b}|=4$, $|\vec{c}|=5$ and each vector is orthogonal to sum of the other two vectors then find $|\vec{a}+\vec{b}+\vec{c}|$.

37. Find the distance between the lines $\vec{r} = 6\hat{\imath} + 2\,\hat{\jmath} + 2\,\hat{k} + \lambda\,(\hat{\imath} - 2\,\hat{\jmath} + 2\,\hat{k})$ and $\vec{r} = -4\hat{\imath} - \hat{k} + \mu\,(3\hat{\imath} - 2\,\hat{\jmath} - 2\,\hat{k})$.

38. Bag I contains 4 Red and 4 Black balls, Bag II contains 2 Red and 6 Black balls . One bag is selected at random and a ball is drawn is found to be Red. What is the probability that bag I is selected?

PART D

Answer any FOUR questions: **$5\times 4 = 20.$**

39. State whether the function f: **R** →**R** defined by $f(x) = 3 - 4x$ is one-one, onto or bijective. Justify your answer.

40. If $A=\begin{bmatrix}1 & 0 & 2\\0 & 2 & 1\\2 & 0 & 3\end{bmatrix}$, prove that $A^3-6A^2+7A+2I=O$.

41. Solve the following system of equations by matrix method: $2x + y - z = 1$; $x + y = z$ and $2x + 3y + z = 11$

42. If $y=3\cos(logx)+4\sin(logx)$, prove that $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=0$.

43. Find the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and evaluate $\int \frac{dx}{\sqrt{7-x^2}}$.

44. Solve the differential equation $\frac{dy}{dx}$ + y secx = tanx $(0 \le x \le \pi/2)$.

45. Find the area of the circle $x^2+y^2=a^2$ by the method of integration.

PART E

Answer the following questions:

46. Maximize and Minimise ; $z=3x+9y$ subject to constraints

$x+3y \le 60,\ x+y \ge 10,\ x \le y,\ x \ge 0,\ y \ge 0$ by graphical method.

OR

Prove that $\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$ and hence evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1+\sqrt{\tan x}}\,dx$. **6**

47. Find the value of k so that the function $f(x)=\begin{cases} kx+1, & if \;\; x \le 5 \\ 3x-5, & if \;\; x>5 \end{cases}$, at $x=5$ is a continuous function.

OR

If A $=\begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and B $=\begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$ then verify that $(AB)^{-1}=B^{-1}A^{-1}$. **4**

PART F

(For Visually Challenged Students only)

8. The point of inflection of the function f(x)=sinx in the interval $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ is

A)$-\frac{\pi}{2}$ B) $\frac{\pi}{2}$ C) 0 D) point of inflection does not exist

12. In a parallelogram OACB, $\overrightarrow{OA}=\vec{P}$ and $\overrightarrow{OB}=\vec{Q}$, then $\vec{P}-\vec{Q}$ is

A) $\overrightarrow{OC}$ B) $\overrightarrow{CO}$ C) $\overrightarrow{BA}$ D) $\overrightarrow{AB}$

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WEIGHTAGE FRAMEWORK FOR MQP 2: II PUC MATHEMATICS(35):2024-25

Chapter	CONTENT	Number of Teaching hours	PART A 1 mark		PART B 2 mark	PART C 3 mark	PART D 5 mark	PART E		Total
			MCQ	FB				6 mark	4 mark	
1	RELATIONS AND FUNCTIONS	9	1			1	1			9
2	INVERSE TRIGONOMETRIC FUNCTIONS	6	2	1		1				6
3	MATRICES	9	1			1	1			9
4	DETERMINANTS	12	1		1		1		1	12
5	CONTINUITY AND DIFFERENTIABILITY	20	2	1	1	1	1		1	17
6	APPLICATION OF DERIVATIVES	10	1		2	1				8
7	INTEGRALS	22	1	1	1	1	1	1		18
8	APPLICATION OF INTEGRALS	5					1			5
9	DIFFERENTIAL EQUATIONS	10	1		1		1			8
10	VECTOR ALGEBRA	11	2	1	1	1				8
11	THREE D GEOMETRY	8	1		1	1				6
12	LINEAR PROGRAMMING	7						1		6
13	PROBABILITY	11	2	1	1	1				8
	TOTAL	**140**	**15**	**5**	**9**	**9**	**7**	**2**	**2**	120

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Model Question Paper -2

II P.U.C MATHEMATICS (35):2024-25

Time : 3 hours **Max. Marks : 80**

Instructions :

1) *The question paper has five parts namely A, B, C, D and E. Answer all the parts.*
2) *PART A has 15 MCQ's ,5 Fill in the blanks of 1 mark each.*
3) *Use the graph sheet for question on linear programming in PART E.*
4) *For questions having figure/graph, alternate questions are given at the end of question paper in separate section for visually challenged students.*

PART A

I. Answer ALL the Multiple Choice Questions **15×1 = 15**

1. If a relation R on the set {1, 2, 3} is defined by R = {(1, 1)}, then R is

A) symmetric but not transitive B) transitive but not symmetric

C) symmetric and transitive. D) neither symmetric nor transitive.

2. $\sin(\tan^{-1}x)$, $|x| < 1$ is equal to

A) $\frac{\sqrt{1-x^2}}{x}$ B) $\frac{x}{\sqrt{1-x^2}}$ C) $\frac{1}{1+x^2}$ D) $\frac{x}{\sqrt{1+x^2}}$.

3. Match List I with List II

List I	List II
a) Domain of $\sin^{-1} x$	i) $(-\infty, \infty)$
b) Domain of $tan^{-1} x$	ii) $[o, \pi]$
c) Range of $cos^{-1} x$	iii) [-1, 1]

Choose the correct answer from the options given below:

A) a-i , b-ii, c-iii B) a-iii, b-ii, c-I C) a-ii, b-i, c-iii D) a-iii, b-i, c-ii

4. Statement 1: If A is a symmetric as well as a skew symmetric matrix, then A is a null matrix

Statement 2: A is a symmetric matrix if $A^T = A$ and A is a skew symmetric matrix if $A^T = -A$.

A) Statement 1 is true and Statement 2 is false.

B) Statement 1 is false and Statement 2 is false.

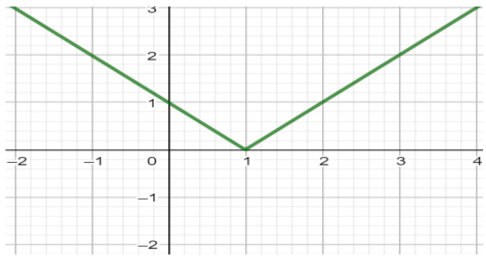
C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

D) Statement 1 is true and Statement 2 is true, Statement 2 is a correct explanation for Statement 1

5. If A is a square matrix of order 3 and |A| = 3, then $|A^{-1}|$ =

A) 3 B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) 12

6. For the figure given below, consider the following statements 1 and 2



Statement 1: The given function is differentiable at x = 1

Statement 2: The given function is continuous at x = 0

A) Statement 1 is true and Statement 2 is false

B) Statement 1 is false and Statement 2 is true

C) Both Statement 1 and 2 are true

D) Both Statement 1 and 2 are false

7. If $y = e^{logx}$, then $\frac{dy}{dx} =$

(A) $\frac{1}{x}$ B) e^{logx} C) -1 D) 1.

8. The function f given by $f(x) = \log(\sin x)$ is increasing on

(A) $(0, \pi)$ B) $\left(\pi, \frac{3\pi}{2}\right)$ C) $\left(\frac{\pi}{2}, \pi\right)$ D) $\left(\frac{3\pi}{2}, 2\pi\right)$.

9. $\int \frac{1}{x\sqrt{x^2-1}}\,dx =$

A) $\sec x$ +C B) $cosec^{-1}x$ +C C) $\sec^{-1} x + C$ D) $cosecx + C$

10. A differential equation of the form $\frac{dy}{dx}$= F (x, y) is said to be *homogenous* if F(x, y) is a homogenous function of degree

A) 1 B) 2 C) n D) 0.

11. The projection of the vector $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ on y-axis is

A) $\frac{3}{\sqrt{17}}$ B) 3 C) $\frac{8}{\sqrt{17}}$ D) $\frac{2}{\sqrt{17}}$.

12. Unit vector in the direction of the vector $\vec{a} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ is

A) $\frac{\hat{\imath}+\hat{\jmath}+2\hat{k}}{\sqrt{6}}$ B) $\frac{\hat{\imath}+\hat{\jmath}+2\hat{k}}{6}$ C) $\frac{\hat{\imath}+\hat{\jmath}+2\hat{k}}{4}$ D) $\frac{\hat{\imath}+\hat{\jmath}+2\hat{k}}{2}$

13. The equation of a line parallel to x-axis and passing through the origin is

A) $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$ B) $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$

C) $\frac{x+5}{0} = \frac{y-2}{1} = \frac{z+3}{0}$ D) $\frac{x-5}{0} = \frac{y+2}{0} = \frac{z-3}{1}$.

14. If $P(A) = 0.4\ P(B) = 0.5\ \ and\ P(A \cap B) = 0.25$ then $P(A'|B)\ is$

A) $\frac{1}{2}$ B) $\frac{5}{8}$ C) $\frac{1}{4}$ D) $\frac{3}{4}$.

15. If A and B are independent events with $P(A) = 0.3, P(B) = 0.4$ then $P(A\,|B)$

A) 0.3 B) 0.4 C) 0.12 D) 0.7

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket

(-1, 0, 1, 2, 3, 5,) **5×1 = 5**

16. The value of $\cos\left(\frac{\pi}{3} + sin^{-1}\left(\frac{1}{2}\right)\right)$ =______________

17. The number of points at which f(x)=[x], where [x] is greatest integer function is discontinuous in the interval (-2, 2) is ___________

18. $\int_0^{\frac{\pi}{2}}\left(sin^2\frac{x}{2} - cos^2\frac{x}{2}\right)\,dx =$

19. If $(2\vec{a} - 3\vec{b}) \times (3\vec{a} - 2\vec{b}) = \lambda(\vec{a} \times \vec{b})$, then the value of λ is _____

20. Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem then the probability that the problem is solved is $\frac{k}{3}$, then the value of k is _________

PART B

Answer any SIX questions: **$6 \times 2 = 12$**

21. Find 'k' if area of the triangle with vertices (2,-6) , (5,4) and (k,4) is 35 square units.

22. If $x = 4t$, $y = \frac{4}{t}$, then find $\frac{dy}{dx}$.

23. The radius of an air bubble is increasing at the rate of 0.5 cm/s. At what rate is the volume of the bubble is increasing when the radius is 1 cm ?

24. Find the two numbers whose sum is 24 and product is as large as possible.

25. Evaluate: $\int \frac{x^3 - x^2 + x - 1}{x - 1} dx$.

26. Find the general solution of the differential equation $\frac{dy}{dx} = \sqrt{1 - x^2 + y^2 - x^2y^2}$.

27. Find the area of the parallelogram whose adjacent sides are the vectors $3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ and $\hat{\imath} - \hat{\jmath} + \hat{k}$.

28. Find the angle between the pair of lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$ and $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$.

29. A couple has two children. Find the probability that both children are males, if it is known that at least one of the children is male.

PART C

Answer any SIX questions: **$6 \times 3 = 18$**

30. Let L be the set of all lines in a plane and R be the relation in L defined as R = $\{(L_1, L_2) : L_1$ is perpendicular to $L_2\}$. Show that R is symmetric but neither reflexive nor transitive.

31. Solve: $2\tan^{-1}(cosx) = \tan^{-1}(2cosecx)$.

32. Find 'x', if $[x \quad -5 \quad -1]\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}\begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = O.$

33. If $y = 3e^{2x} + 2e^{3x}$, prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0.$

34. Find the intervals in which the function f is given by f(x) = $x^3 + \frac{1}{x^3}$ is a) decreasing b) increasing.

35. Evaluate: $\int \frac{3x-2}{(x+1)^2(x+3)} dx$.

36. Show that the position vector of the point R, which divides the line joining the points P and Q having the position vectors $\vec{a}$ and $\vec{b}$ internally in the ratio $m{:}\,n$ is $\frac{m\vec{b}+n\vec{a}}{m+n}$.

37. Derive the equation of the line in space passing through a given point and parallel to a given vector in the vector form.

38. A man is known to speak truth 3 out of 5 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

PART D

Answer any FOUR questions: **$4 \times 5=20$**

39. Consider the function f: A → B defined by $f(x) = \left(\frac{x-2}{x-3}\right)$. Is f one-one and onto? Justify your answer.

40. If $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 & 1 \end{bmatrix}$, verify that $(AB)' = B'A'$.

41. Use the product $\begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{pmatrix}\begin{pmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{pmatrix}$ to solve the system of equations

$x - y + 2z = 1,\ 2y - 3z = 1,\ 3x - 2y + 4z = 9.$

42. Find the values of a and b such that $f(x) = \begin{cases} 5 & if \ \ x \le 2 \\ ax+b & if \ \ 2 < x < 10 \\ 21 & if \ \ x \ge 10 \end{cases}$ is continuous function

43. Find the integral of $\frac{1}{\sqrt{x^2+a^2}}$ w.r.t x and hence evaluate $\int \frac{1}{\sqrt{x^2+121}}dx$.

44. Find the area of the region bounded by the ellipse $\frac{x^2}{16}+\frac{y^2}{9} = 1$ by integration method.

45. Solve the differential equation $ydx - (x+2y^2)dy = 0$.

PART E

Answer the following questions:

46.Prove that $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ and hence evaluate $\int_{-1}^2 |x^3 - x|\, dx$.

OR

Solve the following problem graphically: Maximize and minimize

$Z = 3x + 2y$, Subject to the constraints, $x + 2y \le 10, 3x + y \le 15, x, y \ge 0.$ **6**

47. Show that the matrix $A = \begin{bmatrix} 5 & 6 \\ 4 & 3 \end{bmatrix}$ satisfies the equation A^2 – 8A -9I = O, where I is 2 × 2 identity matrix and O is 2 × 2 zero matrix. Using this equation, find A^{-1}.

OR

Differentiate $(sinx)^x + \sin^{-1} x$ w.r.t. x. **4**

PART F

(For Visually Challenged Students only)

6. For the function f(x)=|x-1|, consider the following statements 1 and 2

Statement 1: The given function is differentiable at x=1

Statement 2: The given function is continuous at x=0

A) Statement 1 is true and Statement 2 is false

B) Statement 1 is false and Statement 2 is true

C) Both Statement 1 and 2 are true

D) Both Statement 1 and 2 are false

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WEIGHTAGE FRAMEWORK FOR MQP 3: II PU MATHEMATICS (35):2024-25

Chapter	CONTENT	Number of Teaching hours	PART A 1 mark		PART B 2 mark	PART C 3 mark	PART D 5 mark	PART E		Total
			MCQ	FB				6 mark	4 mark	
1	RELATIONS AND FUNCTIONS	9	1			1	1			9
2	INVERSE TRIGONOMETRIC FUNCTIONS	6	2		2					6
3	MATRICES	9	1	1	1		1			9
4	DETERMINANTS	12	1		1		1		1	12
5	CONTINUITY AND DIFFERENTIABILITY	20	2	1	1	1	1		1	17
6	APPLICATION OF DERIVATIVES	10	2	1	1	1				8
7	INTEGRALS	22	1	1	1	1	1	1		18
8	APPLICATION OF INTEGRALS	5					1			5
9	DIFFERENTIAL EQUATIONS	10	1		1		1			8
10	VECTOR ALGEBRA	11	2			2				8
11	THREE D GEOMETRY	8	1		1	1				6
12	LINEAR PROGRAMMING	7						1		6
13	PROBABILITY	11	1	1		2				8
	TOTAL	**140**	**15**	**5**	**9**	**9**	**7**	**2**	**2**	**120**

Department of School Education (Pre University) and Karnataka School Examination and Assessment Board

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Model Question Paper -3

II P.U.C MATHEMATICS (35):2024-25

Time : 3 hours **Max. Marks : 80**

Instructions :

1) *The question paper has five parts namely A, B, C, D and E. Answer all the parts.*
2) *PART A has 15 MCQ's ,5 Fill in the blanks of 1 mark each.*
3) *Use the graph sheet for question on linear programming in PART E.*

PART A

I. Answer ALL the Multiple Choice Questions **15×1 = 15**

1. The element needed to be added to the relation R={(1,1), (1,3), (2,2),(3,3) } on A = {1, 2, 3} so that the relation is neither symmetric nor transitive

A) (2, 3) B) (3, 1) C) (1, 2) D) (3, 2)

2. The graph of the function $y = \cos^{-1} x$ is the mirror image of the graph of the function y = cosx along the line

A) x = 0 B) y = x C) y = 1 D) y = 0

3. The value of $\tan^{-1}(\sqrt{3}) + \sec^{-1}(-2)$ is equal to

A) π B) $\frac{2\pi}{3}$ C) $-\frac{\pi}{3}$ D) $\frac{\pi}{3}$

4. If A and B are matrices of order 3 × 2 and 2 × 2 respectively, then which of the following are defined

A) AB B) BA C) A^2 D) A + B

5. A square matrix *A* is invertible if *A* is

A) Null matrix B) Singular matrix

C) skew symmetric matrix of order 3 D) Non-Singular matrix

6. If $y = \sin^{-1}(x\sqrt{x})$, then $\frac{dy}{dx}$ =

A) $\frac{1}{\sqrt{1-x^3}}$ B) $\frac{2\sqrt{x}}{3\sqrt{1-x^3}}$ C) $\frac{3\sqrt{x}}{2\sqrt{1-x^3}}$ D) $\frac{-3\sqrt{x}}{2\sqrt{1-x^3}}$.

7. If $y = x^a + a^x + a^a$ for some fixed *a* > 0 and *x* > 0, then $\frac{dy}{dx} =$

A) $ax^{a-1} + a^x \log a + aa^{a-1}$ B) $ax^{a-1} + a^x \log a$

C) $ax^{a-1} + xa^{x-1} + aa^{a-1}$ D) $ax^{a-1} + a^x \log a + a^a$.

8. Consider the following statements for the given function y=f(x) defined on an interval I and c∈ I, at x = c

I. $f'(c) = 0$ and $f''(c) < 0 \Rightarrow$ f attains local maxima

II. $f'(c) = 0$ and $f''(c) > 0 \Rightarrow$ f attains local minima

III. $f'(c) = 0$ and $f''(c) = 0 \Rightarrow$ f attains both maxima and minima

A) I and II are true B) I and III are true

C) II and III are true D) all are false

9. If each side of a cube is x units, then the rate of change of its surface area with respect to side is

A) 12x B) 6x C) $6x^2$ D) $3x^2$

10. Statement 1: The anti-derivative of $\left(\frac{1}{\sqrt{1+x^2}}\right)$ with respect to x is

$$\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\log\left|x+\sqrt{1+x^2}\right|+C.$$

Statement 2: The derivative of $\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\log\left|x+\sqrt{1+x^2}\right|+C$ with respect to x is $\frac{1}{\sqrt{1+x^2}}$.

A) Statement 1 is true, and Statement 2 is false.

B) Statement 1 is true, and Statement 2 is true, Statement 2 is correct explanation for Statement 1

C) Statement 1 is true, and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

D) Both statements are false.

11. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3+\left(\frac{dy}{dx}\right)^2+\sin\left(\frac{dy}{dx}\right)+1 = 0$ is

A) 2 B) 3 C) 5 D) not defined

12. The position vector of a point which divides the join of points with position vectors $3\vec{a}-2\vec{b}$ and $\vec{a}+\vec{b}$ externally in the ratio 2 : 1 is

A) $\frac{5\vec{a}}{3}$ B) $4\vec{a}-\vec{b}$ C) $4\vec{b}-\vec{a}$ D) $2\vec{a}+\vec{b}$

13. If a vector $\vec{a}$ makes angles with $\frac{\pi}{3}$ with $\hat{\imath}$ *and* $\frac{\pi}{4}$ with $\hat{\jmath}$ and an acute angle θ with $\hat{k}$, then θ is

A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$

14. Find the angle between the lines whose direction ratios are a, b, c and $b-c$, $c-a$, $a-b$ is

A) 45^0 B) 30^0 C) 60^0 D) 90^0

15. If A and B are two independent events such that $P(A)=\frac{1}{4}$ and $P(B)=\frac{1}{2}$ then P(neither A nor B)

A) $\frac{1}{3}$ B) $\frac{3}{8}$ C) $\frac{7}{8}$ D) $\frac{1}{2}$.

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket (-2, $\frac{5}{2}$, 0, 1, 2, $\frac{3}{2}$) **5×1 = 5**

16. The number of all possible orders of matrices with 13 elements is ____

17. If $y = 5\cos x - 3\sin x$, then $\frac{d^2y}{dx^2}+y=$_____

18. If the function f given by $f(x) = x^2 + ax + 1$ is increasing on [1, 2], then the value of 'a' is greater than __

19. $\int_1^2 |x|\,dx=$_________

20. If A and B are any two events such that P(A) + P(B) – P(A and B) =P(A), then P(A|B) is________

PART B

Answer any SIX questions **6 × 2=12**

21. Write the simplest form of $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right),\ 0<x<\pi.$

22. Prove that $2\sin^{-1}\frac{3}{5}=\tan^{-1}\frac{24}{7}$.

23. If F(x)= $\begin{bmatrix}\cos x & -\sin x & 0\\ \sin x & \cos x & 0\\ 0 & 0 & 1\end{bmatrix}$, then show that F($x$) F($y$) = F($x+y$).

24. Find the equation of line joining (1, 2) and (3, 6) using determinants.

25. Differentiate $x^{\sin x}, x > 0$ with respect to x.

26. Find the intervals in which the function f given by $f(x) = x^2 e^{-x}$ is increasing.

27. Find $\int (x^2+1)\log x\, dx$.

28. Verify the function y =mx is the solution of $\frac{dy}{dx} - y = 0$, x ≠ 0.

29. Find the distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and $\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$.

PART C

Answer any SIX questions **6 × 3= 18**

30. Let f : X →Y be a function. Define a relation R in X given by R = $\{(a, b): f(a) = f(b)\}$. Examine whether R is an equivalence relation or not.

31. If $x^3 + x^2y + xy^2 + y^3 = 81$, then find $\frac{dy}{dx}$.

32. The length x of a rectangle is decreasing at the rate of 3 cm/min and the width y is increasing at the rate of 2 cm/min. When $x = 10$ cm and $y = 6$ cm, find the rate of change of the perimeter of the rectangle.

33. Find the integral of $\frac{1}{a^2 + x^2}$ with respect to x .

34. If the vertices A, B and C of a triangle are $(1, 2, 3)$, $(-1, 0, 0)$ and $(0, 1, 2)$ respectively, then find the angle $\angle ABC$.

35. Find the area of the rectangle, whose vertices are $A\left(-\hat{i}+\frac{1}{2}\hat{j}+4k\right)$, $B\left(\hat{i}+\frac{1}{2}j+4k\right)$, $C\left(\hat{i}-\frac{1}{2}j+4k\right)$ and $D\left(-\hat{i}-\frac{1}{2}j+4k\right)$.

36. Find the vector equation of the line passing through the point (1, 2, – 4) and perpendicular to the two lines: $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.

37. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red.

38. Three coins are tossed simultaneously. Consider the Event E ‘three heads or three tails’, F ‘at least two heads and G ‘at most two heads’. Of the pairs (E,F), (E, G) and (F, G), which are independent? Which are dependent?

PART D

Answer any FOUR questions **4 × 5 = 20**

39. Let f : N →Y be a function defined as $f(x) = 4x + 3$, where, Y = $\{y \in N: y = 4x + 3$ for some $x \in N\}$. Show that f is invertible. Find the inverse of f.

40. If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$,

Calculate AC, BC and (A + B) C. Also, verify that (A + B)C = AC + BC.

41. Solve the following system of linear equations by matrix method:

$2x + y + z = 1$, $x - 2y - z = \frac{3}{2}$ and $3y - 5z = 9$.

42. If $x = a(\cos t + t\sin t)$ and $y = a(\sin t - t\cos t)$, find $\frac{d^2y}{dx^2}$.

43. Find $\int \frac{x^4}{(x-1)(x^2+1)}dx$

44. Find the area of the region bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = -1$ and $x = 1$ by integration method.

45. Find the equation of a curve passing through the origin given that the slope of the tangent to the curve at any point (x, y) is equal to the sum of the ordinates of the point.

PART E

Answer the following questions:

46. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx, & \text{if f(x) is even} \\ 0, & \text{if f(x) is odd} \end{cases}$ and evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^7 x\, dx$

OR

Solve the following linear programming problem graphically:
Minimize and maximize $Z = x + 2y$, subject to constraints
$x + 2y \geq 100,\ 2x - y \leq 0,\ 2x + y \leq 200\ \ and\ \ x, y \geq 0.$ **6**

47. If matrix A= $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ satisfying A^3-6A^2+9A-4I=O, then evaluate A^{-1}.

OR

If $f(x) = \begin{cases} \frac{k\cos x}{\pi - 2x}, & If\ x \neq \frac{\pi}{2} \\ 3, & if\ x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, find k . **4**

Department of School Education (Pre University) and Karnataka School Examination and Assessment Board

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6^{TH} CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 1

SUBJECT: MATHEMATICS **MAXIMUM MARKS: 80**

TIME: 03 HOURS **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions $\mathbf{15 \times 1 = 15}$

1. Let R be the relation in the set N given by $R = \{(a,b)/a = b-2,\ b > 6\}$ Choose the correct answer

A) $(2, 4) \in R$ B) $(3, 8) \in R$ C) $(6, 8) \in R$ D) $(8, 7) \in R$

2. The principal value of $cot^{-1}(-1)$ is

A) $-\frac{\pi}{4}$ B) $3\frac{\pi}{4}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{6}$

3. Match Column I with Column II

Column I	Column II
a) Range of $sec^{-1}x$	i) $R-(-1,1)$
b) Range of $cosec^{-1}x$	ii) $[0,\pi]-\left\{\frac{\pi}{2}\right\}$
c) Domain of $cosec^{-1}x$	iii) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$

A) a-i, b-ii, c-iii B) a-iii, b-ii, c-i C) a-iii, b-i, c-ii D) a-ii, b-iii, c-i

4. If A is a matrix of order 4×3 and B is a matrix of order 4×5, then the order of the matrix $(A^T B)^T$ is

A) 5×3 B) 3×5 C) 3×4 D) 4×3

5. If $A = \begin{bmatrix} 1 & 5 \\ 2 & 3 \end{bmatrix}$ then $|A^{-1}|$ is

A) -7 B) $\frac{1}{7}$ C) $-\frac{1}{7}$ D) 7

6. **Statement 1:** The function f(x) = $|x|$ is discontinuous at x = 0.

Statement 2: The function f(x) = $|x|$ is not differentiable at x = 0

Choose the correct among the following

A) Statement 1 is false and Statement 2 is true.

B) Statement 1 is true and Statement 2 is false.

C) Both Statement 1 and Statement 2 are true

D) Both Statement 1 and Statement 2 are false

7. The derivative of $a^{log_a^x}$ w.r.t. x is

A) $\frac{a^{log_a^x}}{x}$ B) a^x C) $\frac{1}{x}$ D) 1

8. The maximum and minimum values of the function sin2x + 5 are

A) 4, 6 B) 6, 4 C) 0, 5 D) -1, 1

9. $\int e^x \sec x\,(1+\tan x)dx =$

A) $e^x cosx + c$ B) $e^x sinx + c$ C) $e^x secx + c$ D) $e^x tanx + c$

10. The order of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \sin\left(\frac{dy}{dx}\right) = 0$ is

A) 4 B) 2 C) 1 D) not defined

11. If for a unit vector $\vec{a}$, $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a}) = 8$, then the value of $|\vec{x}|$ is

A) 3 B) -3 C) -9 D) 9

12. The value of λ for which the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + \lambda\hat{\jmath} - 8\hat{k}$ are collinear is

A) 3 B) -3 C) -6 D) 6

13. The direction ratios of line joining the points (2, 3, −4) and (1, −2, 3) are

A) 3, 1, −1 B) 7, −5, −1 C) −1, −5, 7 D) −1, 1, 3

14. If $P(B) = 0.5$ and $P(A \cap B) = 0.32$, then $P(A|B)$ is

A) $\frac{16}{25}$ B) $\frac{4}{25}$ C) $\frac{1}{2}$ D) $\frac{3}{25}$

15. Two cards are drawn a random without replacement from a pack of 52 playing cards then the probability that the cards are black is

A) $\frac{1}{26}$ B) $\frac{25}{102}$ C) $\frac{1}{4}$ D) $\frac{1}{13}$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket (4, 5, 1, 0, 3, −1) **5 × 1 = 5**

16. $cos\left(\frac{\pi}{6} + sin^{-1}\left(-\frac{1}{2}\right)\right) =$________

17. The left hand derivative of $f(x) = |x-1|$ at $x = -1$ is _______

18. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}(x^3 + x\,cosx + tan^5x)dx =$______

19. For the vectors $\vec{a}$ and $\vec{b}$, $(2\vec{a} - 3\vec{b}) \times (3\vec{a} - 2\vec{b}) = \lambda(\vec{a} \times \vec{b})$ then λ = ______

20. If A and B are independent events such that $P(A) = \frac{1}{2}$, $P(B) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{k}$, then k = ___

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Find the equation of line joining the points (1, 2) and (3, 6) by using determinants.

22. Find $\frac{dy}{dx}$ if $y = \cos^{-1}\left[\frac{1-x^2}{1+x^2}\right], 0 < x < 1.$

23. Find the intervals in which the function f given by $f(x) = 2x^2 - 3x$ is (i) increasing (ii) decreasing.

24. Find the absolute maximum value of the function $f(x) = (x-1)^2 + 3$ on the interval [−3, 1].

25. Find $\int x^3 \log_e x \; dx$.

26. Find the general solution of the differential equation $\frac{dy}{dx} = (1+x^2)(1+y^2)$.

27. Find a unit vector perpendicular to each of the vectors $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$.

28. Find the angle between the pair of lines $\vec{r} = 3\hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ and $\vec{r} = 5\hat{\imath} - 2\hat{k} + \mu(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$

29. A die is thrown. If E is the event 'the number appearing is a multiple of 3' and F is the event 'the number appearing is even', then find whether E and F are independent.

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Show that the relation R in the set of real numbers R defined as $R = \{(a,b): a \leq b\}$ is reflexive and transitive but not symmetric.

31. Write $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ $where\ x \neq 0$ in the simplest form.

32. Express the matrix$\begin{pmatrix} 1 & 5 \\ -1 & 2 \end{pmatrix}$ as the sum of symmetric and skew symmetric matrix.

33. If $x = a(\cos\theta + \theta\sin\theta),\ y = a(\sin\theta - \theta\cos\theta)$ then find $\frac{dy}{dx}$.

34. A balloon, which always remains spherical on inflation, is being inflated by pumping 900 cubic centimeters of gas per second. Find the rate at which the radius of the balloon increases when the radius is 15 cm.

35. Find $\int \frac{x}{(x+1)(x+2)}dx$

36. If $\vec{a}, \vec{b}, \vec{c}$ are unit vector such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then find the value of $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$.

37. Find the distance between the lines given by $\hat{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and $\hat{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$.

38. Bag I contains 3 red & 4 black balls and bag II contains 5 red & 6 black balls. A ball is drawn from one of the bags and it is found to be red. Find the probability that it was drawn from bag II.

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. Consider the function $f: R \to R$ defined by $f(x) = 1 + x^2, \forall x \in R$. Is f is one one and onto? Justify your answer.

40. If $A = \begin{bmatrix} 2 & 1 & 0 \\ -1 & 3 & 1 \\ 1 & 2 & -1 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 & 1 \\ -3 & 4 & 1 \\ 5 & 3 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & -3 & -1 \\ 4 & 2 & 5 \\ 1 & 4 & 6 \end{bmatrix}$ then find (A + B) and (B − C). Also verify that A + (B − C) = (A + B) − C

41. Solve the following system of linear equations using matrix method

$2x + 3y + 3z = 5\ ,\ x - 2y + z = -4\ and\ 3x - y - 2z = 3$

42. If $y = a\cos(\log x) + b\sin(\log x)$ then prove that $x^2y_2 + xy_1 + y = 0$

43. Find the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and hence find $\int \frac{dx}{\sqrt{7-6x-x^2}}$

44. Find the area bounded by the curve $y = sinx$ between $x = 0$ and $x = 2\pi$

45. Find the general solution of the differential equations $(1 + x^2)dy + 2xydx = \cot x\, dx, (x \neq 0)$

PART – E

VI. Answer the following questions

46. Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx & if\quad f(2a-x) = f(x) \\ 0 & if\quad f(2a-x) = -f(x) \end{cases}$ and hence find $\int_0^{2\pi} cos^5x\, dx$. **6**

OR

Solve the following problem graphically. Maximize $Z = 3x + 2y$, Subject to the constraints, $x + 2y \leq 10,\ 3x + y \leq 15,\ x, y \geq 0$ **6**

47. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, Show that $A^2 - 5A + 7I = O$. Using this matrix equation find A^{-1}. **4**

OR

Find the value of k so that the function $f(x) = \begin{cases} kx + 1 & if\ x \leq \pi \\ \cos x & if\ x > \pi \end{cases}$ is continuous at $x = \pi$. **4**

Department of School Education (Pre University) and Karnataka School Examination and Assessment Board

GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

6TH CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 2

SUBJECT: MATHEMATICS **MAXIMUM MARKS: 80**

TIME: 03 HOURS **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions **$15 \times 1 = 15$**

1. If a relation R in the set {1,2,3} defined by $R = \{(1,1),(2,2)\}$, then R is

A) Reflexive and Symmetric B) Symmetric and Transitive

C) Symmetric but not Transitive D) Transitive but not Symmetric

2. The domain of $\sec^{-1} x$ is

A) $(-1,1)$ B) $[-1,1]$ C) $R-[-1,1]$ D) $R-(-1,1)$

3. If a matrix A is both symmetric and skew symmetric, then A is

A) Zero matrix B) Diagonal matrix C) Square matrix D) Unit matrix

4. Let A be a non-singular square matrix of order 3×3 then $|adj\ A|$ is equal to

A) $|A|^2$ B) $|A|^3$ C) $|A|$ D) $3|A|$

5. The derivative of e^{-x} with respect to x is

A) e^{-x} B) $-e^{x}$ C) $-e^{-x}$ D) e^{x}

6. If $y = \log_{10} logx$ then $\frac{dy}{dx} =$

A) $\frac{1}{x\ logx}$ B) $\frac{1}{x\ log10\ logx}$ C) $\frac{1}{log10\ logx}$ D) $\frac{1}{10\ logx}$

7. **Statement 1:** The function $f(x) = 7x - 3$ is strictly increasing in R

Statement 2: For strictly increasing function f in an interval I, $f^{I}(x) > 0$ for all $x \in I$

Choose the correct among the following

A) Statement 1 is true but Statement 2 is false B) Statement 2 is true but Statement 1 is false.

C) Statement 1 and Statement 2 are true D) Statement 1 and Statement 2 are false

8. The point of inflection of the function $f(x) = x^3$ in the interval $[-1,1]$ is

A) -1 B) 0 C) 1 D) does not exit

9. $\int e^{x}\ (\cos x - \sin x)dx =$

A) $e^x cosx + c$ B) $e^x sinx + c$ C) $-e^x cosx + c$ D) $-e^x sinx + c$

10. The order of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is

A) 1 B) 2 C) 3 D) not defined

11. The unit vector in the direction of the vector $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ is

A) $\frac{3\hat{i}-2\hat{j}+\hat{k}}{14}$ B) $\frac{3\hat{i}-2\hat{j}+\hat{k}}{6}$ C) $\frac{3\hat{i}-2\hat{j}+\hat{k}}{\sqrt{6}}$ D) $\frac{3\hat{i}-2\hat{j}+\hat{k}}{\sqrt{14}}$

12. The projection vector of $\overrightarrow{AB}$ on the directed line L, if $\theta = \pi$ will be

A) Zero vector B) $\overrightarrow{BA}$ C) $\overrightarrow{AB}$ D) Unit vector

13. The direction cosines of negative x-axis are

A) 1, 0, 0 B) 0, −1, −1 C) 0, 1, 1 D) −1, 0, 0

14. Let A and B are independent events with $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$ then $P(A \cap B)$ is

A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) $\frac{3}{4}$

15. If A and B are two events such thst $p(A) \neq 0$ and $P(B|A) = 1$ then

A) $B \subset A$ B) $A \subset B$ C) $B = \emptyset$ D) $A = \emptyset$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket (0, 1, 2, 3, 4, 5) **5 × 1 = 5**

16. The greatest integer function $f(x) = [x]$, $4 < x < 6$ is not differentiable at x = ________

17. The absolute maximum value of $f(x) = x^2 - 3$ in the interval $[-1, 2]$ is _______

18. $\int_0^2 |x| dx =$______

19. The value of λ for which the vectors $2\hat{\imath} - \lambda\hat{\jmath} + 4\hat{k}$ and $-4 + 6\hat{\jmath} - 8\hat{k}$ are collinear is ______

20. For any event E of sample space S, $P(E \cap E^I) =$ ______

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Show that $3\sin^{-1} x = \sin^{-1}(3x - 4x^3)$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

22. Find the area of the triangle whose vertices are $(1, 0), (6, 0)$ *and* $(4, 3)$ by using determinants.

23. Find $\frac{dy}{dx}$, if $x^2 + xy + y^2 = 100$

24. Find the local maximum value of the function $f(x) = sinx + cosx$, $0 < x < \frac{\pi}{2}$

25. Find $\int \frac{1}{sin^2x\, cos^2x}\, dx$.

26. Verify that the function $y = Ax$ is a solution of the differential equation $x\frac{dy}{dx} - y = 0, x \neq 0$

27. Find the area of the parallelogram whose adjacent sides are given by the vectors $\vec{a} = \hat{\imath} + \hat{\jmath} - \hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$.

28. Find the angle between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(2\hat{\imath} + \hat{\jmath} + 2\hat{k})$

29. Two cards drawn at random without replacement from a pack of 52 playing cards. Find the probability that both the cards are black.

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Determine whether the relation R in the set A = {1,2,3 …… 13,14} defined as R = {(x, y): 3x − y = 0}, is reflexive, symmetric and transitive.

31. Write $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ *where* $x \neq 0$ in the simplest form.

32. If $F(x) = \begin{bmatrix} cosx & -sinx & 0 \\ sinx & cosx & 0 \\ 0 & 0 & 1 \end{bmatrix}$ then show that $F(x + y) = F(x) \cdot F(y)$

33. If $x = a\cos^3 t$, $y = a\sin^3 t$ then show that $\frac{dy}{dx} = -\sqrt[3]{\frac{y}{x}}$

34. A stone is dropped into a quite lake and waves moves in circles at the speed of 5cm/s. At an instant when the radius of a circular wave is 8cm, how fast is the enclosed area increasing?

35. Integrate $\frac{1}{x(x^n+1)}$ with respect to x.

36. If $\vec{a}, \vec{b}, \vec{c}$ are unit vector such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$.

37. Derive the equation of the line in space, passing through a given point and parallel to a given vector in the vector form.

38. A bag contains 4 red & 4 black balls, another bag contains 2 red & 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that it was drawn from first bag.

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. State whether the function $f: R \to R$ defined by $f(x) = 1 + x^2$ is one-one, onto or bijective? Justify your answer.

40. If $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}, B = \begin{bmatrix} 1 & 3 & -6 \end{bmatrix}$ verify that $(AB)' = B'A'$.

41. Solve the following system of linear equations using matrix method

$x - y + 2z = 1\,, 2y - 3z = 1\ and\ 3x - 2y + 4z = 2$

42. If $y = \cos^{-1} x$ then show that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$

43. Find the integral of $\frac{1}{\sqrt{x^2-a^2}}$ with respect to x and hence find $\int \frac{dx}{\sqrt{x^2-2x-3}}$

44. Find the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by the method of integration.

45. Find the general solution of the differential equations $y\,dx - (x + 2y^2)dy = 0$

PART – E

VI. Answer the following questions

46. Maximize and minimize $Z = 3x + 9y$, Subject to the constraints, $x + 3y \leq 60$, $x + y \geq 10$, $x \leq y$, $x, y \geq 0$ by graphical method. **6**

OR

Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx & if \quad f(2a-x) = f(x) \\ 0 & if \quad f(2a-x) = -f(x) \end{cases}$ and hence find $\int_0^{\pi} cos^5 x\, dx$.

6

47. Show that the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 4A + I = O$. Using this matrix equation find A^{-1}. **4**

OR

Find the relationship between a and b so that the function defined by $f(x) = \begin{cases} ax + 1 & if\ x \leq 3 \\ bx + 3 & if\ x > 3 \end{cases}$ is continuous at $x = 3$. **4**

GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

6TH CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 3

SUBJECT: MATHEMATICS **MAXIMUM MARKS: 80**

TIME: 03 HOURS **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions **15 × 1 = 15**

1. The relation R in the set {1,2,3} given by $R = \{(1,2),(2,1),(1,1)\}$, then R is

A) Reflexive B) Symmetric C) Transitive D) Equivalence

2. If $\sin(\sin^{-1} x) = x$, then

A) $\frac{-\pi}{2} \le x \le \frac{\pi}{2}$ B) $-1 < x < 1$ C) $-1 \le x \le 1$ D) $0 \le x \le 1$

3. If a matrix A contains 3 rows and 4 columns then the number of elements in A is

A) 7 B) 12 C) 3 D) 4

4. If the area of the triangle is 3 sq. units with vertices $(0,0)$, $(k,0)$ and $(1,3)$, then k is

A) -2 B) ± 1 C) 2 D) ± 2

5. If A is a square matrix of order 2 and $|A| = 9$, then $\left|\frac{2}{3}A\right|$ is

A) 4 B) 9 C) 6 D) 3

6. If $y = e^{x^3}$ then $\frac{dy}{dx} =$

A) $x^3 e^{x^3}$ B) e^{3x^2} C) $3x^2 e^{x^3}$ D) e^{x^3}

7. If $y = cos^{-1}(sinx)$, then $\frac{dy}{dx}$ is

A) $\frac{-1}{\sqrt{1-x^2}}$ B) $\frac{1}{\sqrt{1-x^2}}$ C) 1 D) -1

8. The rate of change of area of circle with respect to its radius r at r = 4 is

A) 4π B) 8π C) 10π D) 12π

9. $\int \frac{x^3-1}{x^2}\, dx$ equals

A) $\frac{x^2}{2} - \frac{1}{x} + c$ B) $\frac{x^2}{2} + \frac{1}{x} + c$ C) $\frac{x^2}{2} + \frac{2}{x} + c$ D) $\frac{x^2}{2} - \frac{2}{x} + c$

10. Statement 1: $\int e^x [\, logx + \frac{1}{x}]\, dx. = e^x\, logx + c$

Statement 2: $\int e^x [\, f(x) + f'(x)\,]\, dx. = e^x\, f(x) + c$

A) Statement 1 and Statement 2 are true
B) Statement 1 is true but Statement 2 is false
C) Statement 1 and Statement 2 are false
D) Statement 2 is true but Statement 1 is false

11. The order of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \cos\left(\frac{dy}{dx}\right) = 0$ is

A) 3 B) 1 C) 2 D) not defined

12. The projection vector of $\overrightarrow{AB}$ on the directed line L, if angle $\theta = \frac{3\pi}{2}$ will be

A) $\overrightarrow{AB}$ B) $\overrightarrow{BA}$ C) Unit vector D) Zero vector

13. The angle between the lines whose direction ratios are a, b, c and b−c, c−a, a−b is

A) $\frac{\pi}{2}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{6}$

14. If $P(A) = \frac{1}{2}, P(B) = 0$ then $P(A \mid B)$ is

A) 0 B) $\frac{1}{2}$ C) 1 D) not defined

15. If A and B are two events such thst $P(A) + P(B) - P(A \cap B) = P(A)$, then

A) $P(A|B) = 0$ B) $P(B|A) = 0$ C) $P(A|B) = 1$ D) $P(B|A) = 1$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket (1, 2, 3, 4, 5, 6) **5 × 1 = 5**

16. If A is a invertible matrix of order 3 and $|A^{-1}| = \frac{1}{2}$, then $|A|$ = ________

17. The greatest integer function $f(x) = [x]$, $0 < x < 2$ is not differentiable at x = ________

18. $\int_0^{\frac{\pi}{2}} cos^2x\, dx = \frac{\pi}{4}$ and $\int_0^{\frac{\pi}{2}} sin^2x\, dx = \frac{\pi}{m}$ then m =______

19. If $\vec{a}$ is a non-zero vector and $\frac{1}{3}\vec{a}$ is a unit vector then $|\vec{a}|$ =______

20. If A and B are independent events with $P(A) = \frac{1}{3}, P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{k}$, then k = _____

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Write $\tan^{-1}\sqrt{\frac{1-\cos x}{1+cosx}}$, $0 < x < \pi$ in the simplest form.

22. Find $\frac{dy}{dx}$, if $sin^2x + cos^2y = 1$

23. The total revenue in rupees received from the sale of x units of a product is given by $R(x) = 13x^2 + 26x + 15$. Find the marginal revenue when $x = 7$.

24. Prove that the function given by $f(x) = x^3 - 3x^2 + 3x - 100$ is increasing in R

25. Find $\int \frac{sin^2x - cos^2x}{sin^2x\, cos^2x}\, dx$.

26. Find $\int \frac{2x}{(x+1)(x+2)}\, dx$.

27. Find the general solution of the differential equation $cos\left(\frac{dy}{dx}\right) = a,\ a \in R$.

28. Find the vector and cartesian equations of the line through a point (5, 2, −4) and parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 8\hat{k}$.

29. Events A and B are such that $P(A) = \frac{1}{2}, P(B) = \frac{7}{12}$ and $P(notA\ or\ notB) = \frac{1}{4}$.
State whether A and B are independent?

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Show that the relation R in the set of all integers Z defined by $R = \{(x, y): x - y \text{ is an integer}\}$ is an equivalence relation.

31. Prove that $\cos^{-1}\frac{12}{13} + \cos^{-1}\frac{3}{5} = \cos^{-1}\frac{16}{65}$

32. If A and B are symmetric matrices of same order then show that AB is symmetric if and only if $AB = BA$.

33. If $x = sin\theta,\ y = cos2\theta$ then show that $\frac{dy}{dx} = -4\ sin\theta$.

34. Manufacturer can sell x items at a price of rupees $\left(5 - \frac{x}{100}\right)$ each. The cost price of x items is rupees $\left(\frac{x}{5} + 500\right)$. Find the number of items he should sell to earn maximum profit.

35. Find $|\vec{a} - \vec{b}|$, if two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a} \cdot \vec{b} = 4$

36. Find the area of a triangle having the points $(1, 1, 1), (1, 2, 3)\ and\ (2, 3, 1)$ as its vertices.

37. Find the shortest distance between the lines given by $\hat{r} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k} + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ and $\hat{r} = 4\hat{\imath} + 5\hat{\jmath} + 6\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$.

38. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. Let $f: N \rightarrow Y$ be a function defined by $f(x) = 4x + 3$. Where $Y = \{y \in N\ /y = 4x + 3,\ \forall x \in N\}$ show that f is invertible. Find the inverse of f.

40. If $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}, B = \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}\ and\ C = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$. Calculate $AC, BC\ and\ (A + B)C$. Also verify that $(A + B)C = AC + BC$.

41. Solve the following system of linear equations using matrix method
$2x - 3y + 5z = 11\ , 3x + 2y - 4z = -5\ and\ x + y - 2z = -3.$

42. If $y = A\sin(\log x) + B\cos(\log x)$ then prove that $x^2y_2 + xy_1 + y = 0$.

43. Find the integral of $\frac{1}{\sqrt{x^2+a^2}}$ with respect to x and hence find $\int \frac{x^2}{\sqrt{x^6+a^6}}$.

44. Find the area bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ by the method of integration.

45. Find the general solution of the differential equations $y\ dx + (x - y^2)dy = 0$.

PART – E

VI. Answer the following questions

46. Maximize and minimize $Z = x + 2y,$ subject to the constraints $x + 2y \geq 100,\ 2x - y \leq 0,$ $2x + y \leq 200,\ x, y \geq 0$ by graphical method. **6**

OR

Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx & if \quad f(x)\ is\ even \\ 0 & if \quad f(x)\ is\ odd \end{cases}$ and hence evaluate $\int_{-\pi/2}^{\pi/2} (x^3 + x\ cosx + tan^5x)\ dx.$ **6**

47. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, Show that $A^2 - 5A + 7I = O$, where I is 2×2 identity matrix and O is 2×2 zero matrix. Hence find A^{-1}. **4**

OR

Find the value of $a\ and\ b$ such that the function defined by $f(x) = \begin{cases} 5 & if\ \ x \leq 2 \\ ax + b & if\ \ 2 < x < 10 \\ 21 & if\ \ x \geq 10 \end{cases}$ is continuous function. **4**

GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

6^{TH} CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 4

SUBJECT: MATHEMATICS | **MAXIMUM MARKS: 80**

TIME: 03 HOURS | **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions $\quad$ $15 \times 1 = 15$

1. The relation R in the set {1,2,3} given by $R = \{(1,2),(2,1)\}$, then R is

A) Reflexive $\quad$ B) Symmetric $\quad$ C) Transitive $\quad$ D) Equivalence

2. The principal value of $cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is

A) $\frac{2\pi}{3}$ $\quad$ B) $-\frac{2\pi}{3}$ $\quad$ C) $\frac{\pi}{3}$ $\quad$ D) $\frac{\pi}{6}$

3. Statement 1: Matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix.

Statement 2: Every square matrix is a diagonal matrix.

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true.
C) Both Statement 1 and Statement 2 are true
D) Both Statement 1 and Statement 2 are false

4. If $\begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix} = \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$ then the value of x is

A) 0 $\quad$ B) 1 $\quad$ C) -2 $\quad$ D) 2

5. Statement 1: The function $f(x) = |x|$ is not differentiable at $x = 0$.

Statement 2: The function $f(x) = |x|$ is discontinuous at $x = 0$.

A) Statement 1 is true and Statement 2 is false.
B) Statement 1 is false and Statement 2 is true.
C) Both Statement 1 and Statement 2 are true
D) Both Statement 1 and Statement 2 are false

6. If $y = log(logx),\ x > 0$ then $\frac{dy}{dx} =$

A) $\frac{1}{x}$ $\quad$ B) $\frac{1}{x\ logx}$ $\quad$ C) $\frac{1}{logx}$ $\quad$ D) $\frac{logx}{x}$

7. The rate of change of area of circle per second with respect to its radius r when r = 3cm (in cm^2/s) is

A) π $\quad$ B) 3π $\quad$ C) 6π $\quad$ D) 9π

8. The minimum values of the function $f(x) = x,\ \ x \in [0,1]$ is

A) -1 $\quad$ B) 1 $\quad$ C) 2 $\quad$ D) 0

9. $\int e^x \sec x\,(1 + \tan x)dx =$

A) $e^x secx + c)$ $\quad$ B) $e^x sec^2x + c$ $\quad$ C) $e^x tanx + c$ $\quad$ D) $e^x(1 + tanx) + c$

10. $\int x \cos x \, dx =$

A) $-x \sin x + \cos x + c$ B) $x \cos x - \sin x + c$ C) $x \sin x - \cos x + c$ D) $x \sin x + \cos x + c$

11. The direction ratios of the vector $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ are

A) $1,\ 1, -2$ B) $-1, 1, -2$ C) $1, -1, -2$ D) $-1, -1, 2$

12. One of the values of x for which $x(\hat{\imath} + \hat{\jmath} + \hat{k})$ is a unit vector is

A) 3 B) $\sqrt{3}$ C) $\frac{1}{\sqrt{3}}$ D) 1

13. If α, β and γ are the direction angles of the directed line $\overrightarrow{OP}$, the direction angles of the directed line $\overrightarrow{PO}$ are

A) $-\alpha,\ -\beta,\ -\gamma$ B) $\pi - \alpha,\ \pi - \beta,\ \pi - \gamma$ C) $\alpha,\ \beta,\ \gamma$ D) $\frac{\pi}{2} - \alpha,\ \frac{\pi}{2} - \beta,\ \frac{\pi}{2} - \gamma$

14. An urn contains 10 black and 5 white balls, 2 balls are drawn one after the other without replacements, then the probability that both balls are black is

A) $\frac{2}{3}$ B) $\frac{4}{9}$ C) $\frac{3}{7}$ D) $\frac{2}{9}$

15. A die is rolled. For the events E ={1, 3, 5} and F = {2, 3}, P(F | E) is

A) $\frac{1}{2}$ B) $\frac{1}{5}$ C) $\frac{2}{3}$ D) $\frac{1}{3}$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket (0, 1, 2, 3, 4, 5) **5 × 1 = 5**

16. The number of points at which f(x)=$[x]$, where $[x]$ is the greatest integer function is discontinuous is

17. The total revenue in rupees received from the sale of x units of a product is given by R(x) = x^2+x+5. the marginal revenue when x = 2 is ______

18. The sum of order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right) + 2\left(\frac{d^2y}{dx^2}\right) + \left(\frac{dy}{dx}\right) = 0$ is ______

19. The projection of the vector $\hat{\imath} + \hat{\jmath}$ on the vector $\hat{\imath} - \hat{\jmath}$ is ______

20. If A and B are two events such A is a subset of B and $P(A) \neq 0$, then $P(B|A)$ is _____

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Show that $\sin^{-1}(2x\sqrt{1-x^2}) = \cos^{-1} x,\ \frac{1}{\sqrt{2}} \leq x \leq 1$

22. Find the value of k, if the area of the triangle is 35 sq. units and the vertices are $(2, -6)$ and $(5,4)$ and (k, 4) using determinant method.

23. Find $\frac{dy}{dx}$, if $x^2 + xy + y^2 = 100$.

24. Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is strictly decreasing.

25. Find $\int \sin 2x \cos 3x \, dx$.

26. Find the general solution of the differential equation $\frac{dy}{dx} = (1 + x^2)(1 + y^2)$.

27. Find the area of the parallelogram whose adjacent sides are given by the vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $\vec{b} = 2\hat{\imath} - 7\hat{\jmath} + \hat{k}$

28. Find the angle between the pair of lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ .and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$.

29. Given two independent events A and B such that $P(A) = 0.3$ and $P(B) = 0.6$.
Find i) $P(A \text{ and } B)$ ii) $P(\text{neither } A \text{ nor } B)$

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Let L be the set of all lines in xy plane and R be the relation in L defined as R = {(L_1,L_2) : L_1 is parallel to L_2}. Show that R is an Equivalence relation

31. Find the simplest form of $\tan^{-1}\left(\frac{x}{\sqrt{a^2-x^2}}\right)$, $|x| < a$.

32. Express the matrix$\begin{pmatrix} 1 & 5 \\ -1 & 2 \end{pmatrix}$ as the sum of symmetric and skew symmetric matrix.

33. If $x = a(\cos\theta + \theta\sin\theta), y = a(\sin\theta - \theta\cos\theta)$ then find $\frac{dy}{dx}$

34. Find the two numbers whose sum is 24 and whose product is as large as possible.

35. Find $\int \frac{x}{(x-1)(x-2)} dx$

36. Show that the position vector of the point P which divides the line joining the points A and B having position vectors $\vec{a}\ and\ \vec{b}$ internally in the ratio $m: n$ is $\frac{m\vec{b}+ n\vec{a}}{m+n}$

37. Derive the equation of the line in space, passing through a point and parallel to a given vector in the vector form.

38. A bag contains 4 red & 4 black balls, another bag contains 2 red & 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that it was drawn from first bag.

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. Consider $f: R \rightarrow R$ defined by $f(x) = 10x + 7.$ Show that f is invertible. Find the inverse of f.

40. If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}, and\ C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$. Calculate $AC, BC\ and\ (A+B)C.$ Also, verify that $(A+B)C = AC + BC$

41. Solve the following system of linear equations using matrix method
$x - y + 2z = 7, 3x + 4y - 5z = -5\ and\ 2x - y + 3z = 12$

42. If $y = (\tan^{-1} x)^2$ then prove that $(x^2+1)^2 y_2 + 2x(x^2+1)y_1 = 2$

43. Find the integral of $\frac{1}{x^2-a^2}$ with respect to x and hence find $\int \frac{dx}{x^2-25}$

44. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by the method of integration.

45. Find the general solution of the differential equations $\frac{dy}{dx} + (secx)y = tanx$, $0 \leq x < \frac{\pi}{2}$

PART – E

VI. Answer the following questions

46. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\frac{\pi}{2}} \frac{sin^4 x}{sin^4 x + cos^4 x} dx.$ **6**

OR

Solve the following linear programming problem graphically, Maximize $Z = 3x + 2y,$ Subject to the constraints, $x + 2y \leq 10,\ 3x + y \leq 15,\ \ x, y \geq 0$. **6**

47. Show that the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 4A + I = O$.
Using this matrix equation find A^{-1}. **4**

OR

Find the value of k so that the function $f(x) = \begin{cases} kx + 1 & if\ x \leq \pi \\ \cos x & if\ x > \pi \end{cases}$ is continuous at $x = \pi$. **4**

Department of School Education (Pre University) and Karnataka School Examination and Assessment Board

GOVERNMENT OF KARNATAKA
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6^{TH} CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 5

SUBJECT: MATHEMATICS **MAXIMUM MARKS: 80**

TIME: 03 HOURS **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions $\mathbf{15 \times 1 = 15}$

1. The number of all one-one functions from $A = \{1, 2, 3, 4\}$ on to itself is

A) 8 B) 24 C) 16 D) 256

2. Match Column I with Column II

Column I	Column II
a) Range of $cot^{-1}x$	i) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
b) Range of $tan^{-1}x$	ii) $[-1, 1]$
c) Domain of $sin^{-1}x$	iii) $(0, \pi)$

Choose the correct answer from the options given below.

A) a-i, b-ii, c-iii B) a-iii, b-ii, c-i C) a-ii, b-i, c-iii D) a-iii, b-i, c-ii

3. For a 2×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = \frac{i}{j}$, then A is equal to

A) $\begin{bmatrix} 2 & 3 \\ \frac{1}{2} & \frac{9}{2} \end{bmatrix}$ B) $\begin{bmatrix} \frac{1}{2} & 1 \\ 2 & \frac{1}{2} \end{bmatrix}$ C) $\begin{bmatrix} 1 & \frac{1}{2} \\ 2 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

4. If A is a square matrix of order n, then $|adj\ A|$ is equal to

A) $|A|^{n-1}$ B) $|A|^n$ C) $|A|$ D) n$|A|$

5. **Statement 1:** The function f(x) = $|x|$ is discontinuous at x = 0.

Statement 2: The function f(x) = $|x|$ is not differentiable at x = 0

Which of the following is true?

A) Statement 1 is true and Statement 2 is false. B) Statement 1 is false and Statement 2 is true.

C) Both Statement 1 and Statement 2 are true D) Both Statement 1 and Statement 2 are false

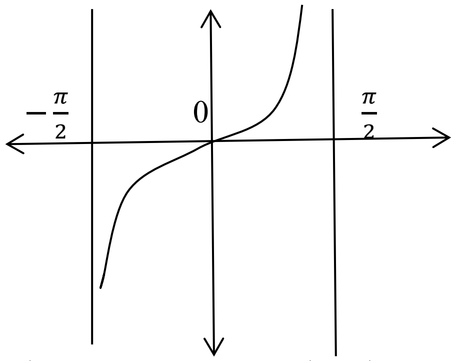
6. If $y = \sin(x^2)$ then $\frac{dy}{dx}$ is

A) 2 $sin2x$ B) 2 $sinx\ cosx$ C) 2 $\cos(x^2)$ D) $2x\cos(x^2)$

7. The rate of change of area of circle with respect to its radius r at r = 6 cm is

A) 10π B) 12π C) 8π D) 11π

8. The point of inflection of the following graph is



A) $\left(\frac{\pi}{2},\ 0\right)$ B) $\left(0,\ \frac{\pi}{2}\right)$ C) $(0,\ 0)$ D) $\left(\frac{\pi}{2},\ \infty\right)$

9. $\int e^x \left(\frac{1}{x} - \frac{1}{x^2}\right) dx$ is equal to

A) $e^x \frac{1}{x} + c$ B) $e^x \frac{1}{x^2} + c$ C) $e^x + c$ D) $e^x \left(-\frac{1}{x^2}\right) + c$

10. The value of $\int_1^{\sqrt{3}} \int \frac{1}{1+x^2}\, dx$ is

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{6}$ D) $\frac{\pi}{12}$

11. If $\vec{a}$ and $\vec{b}$ are adjacent sides of the parallelogram then the area of parallelogram is

A) $\vec{a} \times \vec{b}$ B) $\vec{a} \cdot \vec{b}$ C) $|\vec{a} \times \vec{b}|$ D) $\frac{1}{2}|\vec{a} \times \vec{b}|$

12. The vector components of the vector with initial point (2, 1) and terminal point $(-5, 7)$ are

A) $-7\hat{\imath}\ and\ -6\hat{\jmath}$ B) $-7\hat{\imath}\ and\ 6\hat{\jmath}$ C) $7\hat{\imath}\ and\ -6\hat{\jmath}$ D) $7\hat{\imath}\ and\ 6\hat{\jmath}$

13. If a line makes the angles $90°$,$135°$ and $45°$ with x, y and z axes respectively, then the direction cosines are

A) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ B) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ C) $0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ D) $0, \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$

14. Let A and B are two independent events with $P(A) = 0.3$, $P(B) = 0.4$ then $P(A \cup B)$ is

A) 0.4 B) 0.12 C) 0.58 D) 0.7

15. The probability of obtaining an even prime number on each die, when a pair of dice is rolled is

A) $\frac{1}{36}$ B) $\frac{1}{3}$ C) 0 D) $\frac{1}{12}$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket

$\left(\frac{2}{3}, 1, \frac{3}{7}, \sqrt{2}, 0, 2\right)$ **5 × 1 = 5**

16. If $y = 2\,cosx + 3\,sinx$ then $\frac{d^2y}{dx^2} + y =$________

17. The absolute maximum value of $f(x) = sinx + cosx$, $x \in [0, \pi]$ is _______

18. The order of the differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ is ______

19. The value of $\hat{\imath} \cdot (\hat{\jmath} \times \hat{k}) + \hat{\jmath} \cdot (\hat{\imath} \times \hat{k}) + \hat{k} \cdot (\hat{\imath} \times \hat{\jmath})$ is ______

20. If $P(E) = \frac{10}{15}$, $P(F|E) = \frac{9}{14}$ then the value of $P(E \cap F) =$ _____

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Prove that $3\sin^{-1} x = \sin^{-1}(3x - 4x^3)$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

22. Find the area of the triangle whose vertices are $(2, 7), (1, 1)$ and $(10, 8)$ by using determinant method.

23. Find $\frac{dy}{dx}$, if $y + siny = cosx$

24. Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is increasing.

25. Evaluate $\int \frac{1}{sin^2x\, cos^2x}\, dx$.

26. Find the general solution of the differential equation $\frac{dy}{dx} = \frac{(1+y^2)}{(1+x^2)}$.

27. Find the projection of the vector $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ on the vector $\vec{b} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$

28. Find the angle between the pair of lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$ .and $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$.

29. A family has two children. What is the probability that both the children are boys given that at least one of them is a boy?

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Show that the relation R in the set R of real numbers defined as $R = \{(a, b): a \leq b^2\}$ is neither reflexive nor symmetric nor transitive.

31. Prove that $\cos^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} = \cos^{-1}\frac{33}{65}$

32. Express the matrix $\begin{pmatrix} 3 & 5 \\ 1 & -1 \end{pmatrix}$ as the sum of symmetric and skew symmetric matrix.

33. Find $\frac{dy}{dx}$ if $x = a(\cos\theta + \theta\sin\theta), y = a(\sin\theta - \theta\cos\theta)$.

34. Find the two positive numbers whose sum is 15 and sum of whose squares is minimum.

35. Find $\int \frac{x}{(x+1)(x+2)} dx$

36. Find a unit vector perpendicular to each of the vector $\vec{a} + \vec{b}$ & $\vec{a} - \vec{b}$ where $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ & $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$.

37. Derive the equation of the line in space, passing through a given point and parallel to a given vector in the vector form.

38. An insurance company insured 2000 scooter drivers, 4000 car drivers & 6000 truck drivers. The probabilities of accidents are 0.01, 0.03 & 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver?

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. Verify whether the function $f: R \to R$ defined by $f(x) = 3 - 4x$ is one-one, onto or bijective? Justify your answer.

40. If A = $\begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^2 - 23A - 40I = O$.

41. Solve the following system of linear equations using matrix method

$$x + y + z = 6\, , y + 3z = 11 \text{ and } x - 2y + z = 0$$

42. If $\mathrm{y} = \mathrm{e}^{a\cos^{-1}x}$ then prove that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2y = 0$

43. Find the integral of $\frac{1}{\sqrt{a^2-x^2}}$ with respect to x and hence evaluate $\int \frac{dx}{\sqrt{9-25x^2}}$

44. Find the area of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ by the method of integration.

45. Find the general solution of the differential equations $x\frac{dy}{dx} + 2y = x^2 \log x$

PART – E

VI. Answer the following questions

46. Prove that $\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx & if \quad f(-x) = f(x) \\ 0 & if \quad f(-x) = -f(x) \end{cases}$ and hence find $\int_{-1}^{1} sin^5x\, cos^4x\, dx$.

6

OR

Maximize and minimize $Z = 3x + 9y$, Subject to the constraints,
$x + 3y \le 60,\ x + y \ge 10,\ x \le y,\ x, y \ge 0$ by graphical method. **6**

47. Show that the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 4A + I = O$.
Using this matrix equation find A^{-1}. **4**

OR

Find the relationship between a and b so that the function f defined by $f(x) = \begin{cases} ax + 1 & if\ x \le 3 \\ bx + 3 & if\ x > 3 \end{cases}$ is continuous at $x = 3$. **4**

PART – F

(For visually challenged students only)

8. The point of inflection of the function $y = x^3$ is

A) (2, 8) B) (1, 1) C) (0, 0) D) $(-3,\ -27)$

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6^{TH} CROSS, MALLESHWARAM, BENGALURU – 560 003

2025 -26 II PUC MODEL QUESTION PAPER – 6

SUBJECT: MATHEMATICS **MAXIMUM MARKS: 80**

TIME: 03 HOURS **NUMBER OF QUESTIONS: 47**

Instructions:

1. The question paper has five parts namely A, B, C, D and E. Answer all the parts.
2. Use the graph sheet for the question on linear programming on PART E.

PART – A

I. Answer ALL the Multiple Choice Questions **$15 \times 1 = 15$**

1. Let a relation R on the set {1,2,3} be defined by $R = \{(2,3)\}$, then R is

A) Symmetric but not Transitive B) Transitive but not Symmetric

C) Symmetric and Transitive D) Neither Symmetric nor Transitive

2. Match Column I with Column II

Column I	Column II
a) Range of $cos^{-1}x$	i) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
b) Range of $tan^{-1}x$	ii) $[-1, 1]$
c) Domain of $sin^{-1}x$	iii) $[0, \pi]$

Choose the correct answer from the options given below.

A) a-ii, b-i, c-iii B) a-ii, b-iii, c-i C) a-iii, b-i, c-ii D) a-iii, b-ii, c-i

3. If X is a matrix of order 2×n and Y is a matrix of order 2×p. If n = p, then the order of the matrix $7X + 5Y$ is

A) p×2 B) 2×n C) n×3 D p×n

4. If A is a non singular matrix of order 3× 3 with $|adj\ A| = 16$, then $|A|$ is equal to

A) 0 B) 3 C) 9 D) 4

5. **Statement 1:** $|sinx|$ is continuous for all $x \in R$

Statement 2: sinx and $|x|$ are continuous in R

Which of the following is true?

A) Statement 1 is true and Statement 2 is false.

B) Statement 1 is false and Statement 2 is true.

C) Statement 1 is true and Statement 2 is true, Statement 2 is not the correct explanation of Statement 1

D) Statement 1 is true and Statement 2 is true, Statement 2 is the correct explanation of Statement 1

6. If $y = \cos(1 - x)$ then $\frac{dy}{dx}$ is equal to

A) $sin(1 - x)$ B) $-sin(1 - x)$ C) $sinx$ D) $cosx$

7. The rate of change of area of circle with respect to its radius r at r = 6 cm is

A) 6π B) 11π C) 10π D) 12π

8. The point on the curve $x^2 = 2y$ which is nearest to the point (0, 5) is

A) $(0,\ 0)$ B) $(2\sqrt{2},\ 4)$ C) $(2\sqrt{2},\ 0)$ D) $(2,\ 2)$

9. The anti derivative of $\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)$ is

A) $\frac{1}{3}x^{\frac{1}{3}}+2x^{\frac{1}{2}}+c$ B) $\frac{2}{3}x^{\frac{2}{3}}+\frac{1}{2}x^{2}+c$ C) $\frac{2}{3}x^{\frac{3}{2}}+2x^{\frac{1}{2}}+c$ D) $\frac{3}{2}x^{\frac{3}{2}}+\frac{1}{2}x^{\frac{1}{2}}+c$

10. The value of $\int\frac{cos2x+2\,sin^2x}{cos^2x}\,dx$ is

A) $tanx+c$ B) $cos2x+c$ C) $sin2x+c$ D) $tan2x+c$

11. The value of $\hat{\imath}\cdot(\hat{\jmath}\times\hat{k})+\hat{\jmath}\cdot(\hat{k}\times\hat{\imath})+\hat{k}\cdot(\hat{\imath}\times\hat{\jmath})$ is

A) 2 B) -1 C) 1 D) 3

12. If $\theta=\pi$, then the projection vector of $\overrightarrow{AB}$ will be

A) $\overrightarrow{AB}$ itself B) $\overrightarrow{BA}$ C) $-\overrightarrow{BA}$ D) Zero vector

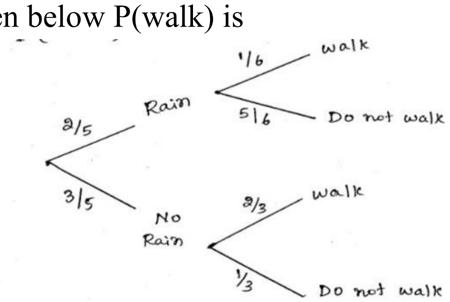
13. The direction cosines of negative y-axis are

A) $0, -1, 0$ B) $1, 0, 1$ C) $0, 0, -1$ D) $-1, 0, -1$

14. If A and B are events such that $P(A|B) = P(B|A)$, then

A) $A\subset B$ but $A\neq B$ B) $A=B$ C) $P(A)=P(B)$ D) $A\cap B=\emptyset$

15. For the figure given below P(walk) is



A) $\frac{8}{15}$ B) $\frac{11}{15}$ C) $\frac{7}{15}$ D) $\frac{1}{15}$

II. Fill in the blanks by choosing appropriate answer from those given in the bracket $(\frac{1}{3}, 2, \frac{1}{2}, 3, 1, \frac{2}{3})$ **5 × 1 = 5**

16. The greatest integer function $f(x)=[x]$, $0<x<2$ is not differentiable at x = ________

17. The maximum value of $f(x)=sinx\cdot\cos x$ is _______

18. The order of the differential equation $2\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3=0$ is ______

19. If $\vec{a}$ is a unit vector and $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a})=8,$ then the value of $|\vec{x}|$ is ______

20. If E and F are the events with $P(E\,|\,F)=\frac{2}{3}$, then $P(E^{I}\,|\,F)=$ _____

PART – B

III. Answer any SIX Questions **6 × 2 = 12**

21. Write the simplest form of $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right), x>1$

22. Using cofactors of the elements of third column, evaluate $\Delta=\begin{vmatrix}1 & x & yz\\ 1 & y & xz\\ 1 & z & xy\end{vmatrix}$

23. If $x=4t,\ y=\frac{4}{t}$ then find $\frac{dy}{dx}$.

24. Prove that logarithmic function is increasing on $(0,\infty)$

25. Evaluate $\int\frac{e^{2x}-1}{e^{2x}+1}\,dx$.

26. Verify that the function $y=\sqrt{1+x^2}$ is the solution of differential equation $\frac{dy}{dx}=\frac{xy}{1+x^2}$.

27. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}| = 3$, $|\vec{b}| = \frac{\sqrt{2}}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector.

28. Find the distance between the lines L_1 and L_2 given by $\hat{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and $\hat{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$.

29. A fair coin and an unbiased die are tossed. Let A be the event 'head appears on the coin' and B be the event '3 on the die'. Check whether A and B are independent events or not.

PART – C

IV. Answer any SIX Questions **6 × 3 = 18**

30. Determine whether the relation R in the set $A = \{1,2,3,4,5,6\}$ as $R = \{(a, b): b = a + 1\}$ is reflexive, symmetric and transitive.

31. Solve $\tan^{-1}\frac{1-x}{1+x} = \frac{1}{2}\tan^{-1} x, x > 0$.

32. If A and B are symmetric matrices of same order then prove that $AB - BA$ is skew-symmetric.

33. Find the value of k so that the function defined by $f(x) = \begin{cases} kx^2 & if\ x \leq 2 \\ 3 & if\ x > 2 \end{cases}$ is continuous at $x = 2$.

34. Manufacturer can sell x items at a price of rupees $\left(5 - \frac{x}{100}\right)$ each. The cost of x items is Rs. $\left(\frac{x}{5} + 500\right)$. Find the number of items he should sell to earn maximum profit.

35. Find $\int \frac{1}{(x+1)(x+2)} dx$

36. If $\vec{a} = 2\hat{\imath} + 2\hat{\jmath} + 3\hat{k}, \vec{b} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ & $\vec{c} = 3\hat{\imath} + \hat{\jmath}$ such that $(\vec{a} + \lambda \vec{b})$ is perpendicular to $\vec{c}$ then find the value of λ.

37. Derive the equation of the line in space, passing through a given point and parallel to a given vector in the vector form.

38. Probability that A speaks truth is $\frac{4}{5}$. A coin in tossed. A reports that a head appears. Find the probability that it is actually head.

PART – D

V. Answer any FOUR Questions **4 × 5 = 20**

39. Show that the function $f: R \to R$ defined by $f(x) = 3 - 4x$ is bijective function. Also find the inverse of f.

40. If $A = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}, B = \begin{pmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{pmatrix}$ and $C = \begin{pmatrix} 2 \\ -2 \\ 3 \end{pmatrix}$, Calculate AC, BC and $(A + B)C$. Also verify that $(A + B)C = AC + BC$,

41. Solve the following system of linear equations using matrix method

$x - y + 2z = 1$, $2y - 3z = 1$ and $3x - 2y + 4z = 2$

42. If $y = 3\cos(\log x) + 4\sin(\log x)$ then prove that $x^2y_2 + xy_1 + y = 0$

43. Integrate $\frac{1}{x^2 + a^2}$ with respect to x and hence find $\int \frac{dx}{x^2 + 2x + 10}$

44. Find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by the method of integration.

45. Find the general solution of the differential equations $\frac{dy}{dx} + 2y = sinx$.

PART – E

VI. Answer the following questions

46. Prove that $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$ and hence evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1+\sqrt{\tan x}}\, dx$. **6**

OR

Minimize $Z = -3x + 4y$, Subject to the constraints, $x + 2y \leq 8,\ 3x + 2y \leq 12,\ x, y \geq 0$ by graphical method. **6**

48. Show that the matrix $A = \begin{bmatrix} 5 & 2 \\ 2 & 1 \end{bmatrix}$ satisfies the equation $A^2 - 6A + I = O$. Using this matrix equation find A^{-1}. **4**

OR

Differentiate $sin^{-1}\left(\frac{2^{x+1}}{1+4^x}\right)$ with respect to x. **4**

PART – E

(For visually challenged students only)

15. If $P(A) = \frac{4}{5}$ and $P(B \mid A) = \frac{2}{5}$, then $P(A \cap B)$ is

A) $\frac{2}{5}$ B) $\frac{6}{5}$ C) $\frac{8}{25}$ D) $\frac{25}{8}$

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and

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2025 – 26 II PUC MATHEMATICS QUESTION BANK DEVELOPMENT COMMITTEE

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KEY ANSWERS TO MULTIPLE CHOICE QUESTIONS

CHAPTER -01: RELATIONS AND FUNCTIONS

1	2	3	4	5	6	7	8	9	10
B	C	A	A	D	B	B	B	C	B
11	12	13	14	15	16	17	18	19	20
B	B	D	B	B	B	A	C	D	C
21	22	23	24	25	26	27	28	29	30
B	D	B	B	D	C	D	B	B	D
31	32	33	34	35	36	37	38	39	40
A	C	B	A	C	B	B	A	A	B
41	42	43	44	45	46	47	48	49	50
D	C	B	B	A	D	A	B	B	B
51	52	53	54	55	56	57	58	59	60
6	24	6	2	0	D	B	C	2	C
61	62	63	64	65					
C	B	A	5	B					

CHAPTER -02: INVERSE TRIGONOMETRIC FUNCTIONS

1	2	3	4	5	6	7	8	9	10
C	D	D	D	A	C	C	B	C	D
11	12	13	14	15	16	17	18	19	20
C	B	A	D	A	B	B	A	A	D
21	22	23	24	25	26	27	28	29	30
D	B	C	C	D	C	B	C	A	B
31	32	33	34	35	36	37	38	39	40
A	D	B	B	A	A	A	B	C	C
41	42	43	44	45	46	47	48	49	50
D	B	A	D	C	C	0	$\frac{3}{2}$	6	$\frac{-1}{2}$
51	52	53	54	55	56	57	58	59	60
1	A	D	B	$\frac{\sqrt{3}}{2}$	A	A	B	$\frac{4}{5}$	$\frac{3}{2}$
61	62	63	64	65	66				
B	A	B	D	D	C				

CHAPTER -03: MATRICES

1	2	3	4	5	6	7	8	9	10
B	C	D	C	B	C	C	B	B	A
11	12	13	14	15	16	17	18	19	20
D	D	A	C	D	D	D	B	B	A
21	22	23	24	25	26	27	28	29	30
C	B	D	C	C	C	C	B	B	C
31	32	33	34	35	36	37	38	39	40
C	D	D	C	D	B	A	B	B	C
41	42	43	44	45	46	47	48	49	50
B	16	3	3	2	5	B	C	D	A
51	52	53	54	55	56	57	58	59	60
B	A	A	B	B	A	D	A	B	A

CHAPTER -4: DETERMINANTS

1	2	3	4	5	6	7	8	9	10
B	A	D	B	C	C	D	C	A	C
11	12	13	14	15	16	17	18	19	20
D	B	B	C	C	A	D	A	C	C
21	22	23	24	25	26	27	28	29	30
D	B	B	D	D	C	D	A	D	C
31	32	33	34	35	36	37	38	39	40
B	A	A	C	B	9	0	1	2	9
41	42	43	44	45	46	47	48	49	50
-4	9	C	B	D	B	A	C	C	D
51	52	53	54	55	56	57	58	59	60
C	B	D	C	A	B	A	B	D	D

CHAPTER-5: CONTINUITY AND DIFFERENTIABILITY

1	2	3	4	5	6	7	8	9	10
B	B	A	D	C	D	D	D	B	A
11	12	13	14	15	16	17	18	19	20
B	D	B	C	D	C	C	D	C	A
21	22	23	24	25	26	27	28	29	30
B	C	D	A	C	B	A	D	C	D
31	32	33	34	35	36	37	38	39	40
A	C	D	B	C	D	C	D	A	B
41	42	43	44	45	46	47	48	49	50
C	C	C	B	A	B	D	D	C	C
51	52	53	54	55	56	57	58	59	60
B	1	0	-1	2	D	C	A	B	D
61	62	63	64	65	66	67	68	69	70
C	C	A	B	A	0	3	3	2	-1

CHAPTER -06: APPLICATION OF DERIVATIVES

1	2	3	4	5	6	7	8	9	10
A	C	C	D	B	C	D	A	D	B
11	12	13	14	15	16	17	18	19	20
A	D	B	A	D	C	C	C	D	A
21	22	23	24	25	26	27	28	29	30
A	C	A	A	B	D	C	B	4	-1
31	32	33	34	35	36	37	38	39	40
$\sqrt{2}$	1	½	25	8	A	B	C	A	B
41	42	43	44	45	46	47	48	49	50
B	C	A	C	A	B	D	B	C	A
51	52	53	54	55	56	57	58	59	60
C	C	D	A	A	B	B	B	C	C

CHAPTER -7: INTEGRALS

1	2	3	4	5	6	7	8	9	10
B	C	A	A	B	C	B	B	C	B
11	12	13	14	15	16	17	18	19	20
C	A	D	D	B	D	A	C	B	A
21	22	23	24	25	26	27	28	29	30
C	B	B	B	C	A	B	B	A	B
31	32	33	34	35	36	37	38	39	40
D	D	B	A	C	A	C	B	D	C
41	42	43	44	45	46	47	48	49	50
D	A	B	A	C	B	A	C	D	B
51	52	53	54	55	56	57	58	59	60
B	A	B	B	C	D	B	D	A	B
61	62	63	64	65	66	67	68	69	70
C	A	B	C	B	B	D	D	A	C
71	72	73	74	75	76	77	78	79	80
D	B	D	D	B	B	B	A	C	C
81	82	83	84	85	86	87	88	89	90
D	C	C	C	C	C	A	D	C	D
91	92	93	94	95	96	97	98	99	100
B	C	B	C	C	6	1	3	D	B
101	102	103	104	105	106				
B	B	1	4	B	C				

CHAPTER -09: DIFFERENTIAL EQUATIONS

1	2	3	4	5	6	7	8	9	10
C	C	D	D	C	B	D	A	B	A
11	12	13	14	15	16	17	18	19	20
C	A	B	D	A	B	A	A	A	A
21	22	23	24	25	26	27	28	29	30
D	C	C	B	C	C	D	D	B	C
31	32	33	34	35	36	37	38	39	40
4	C	1	D	1	-1	2	1	-1/2	B
41	42	43	44	45	46	47	48		
C	C	D	B	B	B	D	C		

CHAPTER-10: VECTOR ALGEBRA

1	2	3	4	5	6	7	8	9	10
D	C	D	A	C	C	C	D	A	D
11	12	13	14	15	16	17	18	19	20
D	C	D	B	D	C	B	A	B	B
21	22	23	24	25	26	27	28	29	30
D	C	A	A	B	C	B	B	C	A
31	32	33	34	35	36	37	38	39	40
C	D	B	C	D	C	C	B	A	B
41	42	43	44	45	46	47	48	49	50
C	A	B	C	A	B	C	B	B	B
51	52	53	54	55	56	57	58	59	60
D	D	D	C	B	A	C	D	A	D
61	62	63	64	65	66	67	68	69	70
C	B	D	5	3	3/2	2	0	0	0
71	72	73	74						
0	5	B	D						

CHAPTER-11: THREE DIMENSIONAL GEOMETRY

1	2	3	4	5	6	7	8	9	10
C	A	B	B	B	B	C	D	A	A
11	12	13	14	15	16	17	18	19	20
B	A	D	B	C	B	B	C	A	D
21	22	23	24	25	26	27	28	29	30
B	C	B	A	C	C	B	D	A	A
31	32	33	34	35	36	37	38	39	40
D	A	A	C	A	D	C	B	C	C
41	42	43	44	45	46	47	48	49	50
C	D	C	C	C	C	C	D	0	-1
51									
1/9									

CHAPTER-13: PROBABILITY

1	2	3	4	5	6	7	8	9	10
B	B	C	D	D	C	B	A	A	C
11	12	13	14	15	16	17	18	19	20
D	C	C	D	B	A	A	B	C	A
21	22	23	24	25	26	27	28	29	30
D	C	D	B	A	D	B	D	B	A
31	32	33	34	35	36	37	38	39	40
B	C	A	C	D	B	C	C	B	A
41	42	43	44	45	46	47	48	49	50
B	B	A	C	D	B	B	A	A	C
51	52	53	54	55	56	57	58	59	60
B	C	C	B	A	D	B	D	B	C
61	62	63	64	65	66	67	68	69	70
A	A	B	A	C	B	4	2	0	0
71	72	73	74	75	76	77	78	79	80
1	1	1	15	A	C	D	B	B	C