KENDRIYA VIDYALAYA SANGATHAN

HYDERABAD REGION

तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

STUDY MATERIAL (MCQ)

CLASS XII MATHEMATICS

केंद्रीयविद्यालयसंगठन/KENDRIYA VIDYALAYA SANGATHAN

हैदराबादसंभाग/HYDERABAD REGION

QUESTION BANK OF MULTIPLE-CHOICE QUESTIONS 2023-24

CLASS XII (MATHEMATICS)

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RELATIONS AND FUNCTIONS

Multiple choice questions -

1 If $A = \{a, b, c, d\}$ *then a relation* $R = \{(a, b), (b, a), (a, a)\}$ *on* A *is*

(a) Symmetric only
(b) Transitive only
(c) Reflexive and transitive
(d) Symmetric and transitive only

2 If $A = \{5,6,7\}$ and let R $= \{(5,5), (6,6), (7,7), (5,6), (6,5), (6,7), (7,6)\}$. Then R is

(a) Reflexive, symmetric but not Transitive
(b) Symmetric, transitive but not reflexive
(c) Reflexive, Transitive but not symmetric
(d) an equivalence relation

3 Let R be a relation defined on Z as follows: $(a, b) \in R \Leftrightarrow a^2 + b^2 = 25.$ *Then Domain of* R *is*

(a) {3,4,5}
(b) {0,3,4,5}
(c) {0,±3,±4,±5}
(c) None of these

4 The maximum number of equivalence relations on the set A= {1 , 2 , 3} is

(a) 1
(b) 2
(c) 3
(d) 5

5 Consider the set A= {1, 2}. The relation on A which is symmetric but neither transitive nor reflexive is

(a) {(1,1) (2,2) }
(b) { }
(c) {(1,2)}
(d) { (1,2) (2,1) }

6 If $A = \{d, \text{e}, \text{f}\}$ and let R $= \{(\text{d}, \text{d}), (\text{d}, \text{e}), (\text{e}, \text{d}), (e, e)\}$. Then R is

(a) Reflexive, symmetric but not Transitive
(b) Symmetric, transitive but not reflexive
(c) Reflexive, Transitive but not symmetric
(d) an equivalence relation

7 Let R be a reflexive relation on a finite set A having n elements and let there be m ordered pairs in R,then

(a) m < n
(b) m > n
(c) m = n
(d) none of these

8 The number of elements in set A is 3.The number of possible relations fthat can be defined on A is

(a) 8 (b) 4

(c) 64 (d) 512

9 The number of elements in Set A is 3.The number of possible reflexive relations that can be defined in A is

(a) 64 (b) 8

(c) 512 (d) 4

10 The number of elements in set P is 4.The number of possible symmetric relations that can be defined on P is

(a) 16 (b) 32

(c) 512 (d) 1024

11 N is the set of all natural numbers and R is a relation on N x N defined by

(a, b) R (c, d) if and only if a + d = b + c ,then R is

(a) only Reflexive (b) only symmetric

(c) only transitive (d) equivalence relation

12 The relation R defined on the set $A = \{1,2,3,4,5\}, by\ R = \{(a, b): |a^2 - b^2| > 16\}$ is given by

(a) $\{(1,1), (2,1), (3,1), (4,1), (2,3)\}$ (b) $\{(2,2), (3,2), (4,2), (2,4)\}$

(c) $\{(3,3), (4,3), (5,4), (3,4)\}$ (d) none of these

13 Let A={p,q,r}.The relation which is not an equivalence relation on A is

(a) {(p,p),(q,q),(r,r)} (b) {(p,p),(q,q),(r,r),(p,q),(q, p)}

(c) {(p,p),(q,q), (r,r),(r,q),(q , r)} (d) none of these

14 Let R be a relation on the set N of natural numbers defined by aRb if and only if a divides b.Then R is

(a) Reflexive and Symmetric (b) Transitive and Symmetric

(c) Equivalence (d) Reflexive and Transitive but not symmetric

15 Consider the set A={4,5}.The smallest equivalence relation

(i.e. the relation with the least number of elements), is

(a) { } (b) {(4,5)}

(c) {(4,4),(5,5)} (d){(4,5),(5,4)}

16 Let P = {a,b,c}.Then the number of Equivalence relations containing (a,b) is

(a) 1 (b) 2

(c) 3 (d) 4

17 Let A and B be finite sets containing m and n elements. Then the number of relations that can be defined from A to B is

(a) 2^{mn} (b) 2^{m+n}

(c) mn (d) 0

18 Let $A = \{1,2,3\}, then\ the\ number\ of\ relations\ containing\ (1,2) and\ (1,3)$

that are reflexive and symmetric but not transitive is

(a) 1 (b) 2

(c) 3 (d) 4

19 For real numbers x and y ,x-y+$\sqrt{2}$ is an irrational number ,then the relation R is

(a) Reflexive (b) Symmetric

(c) Transitive (d) None of these

20 Set A has 3 elements and set B has 4 elements. Then the number of injective mappings from A to B is

(a) 144 (b) 12

(c) 24 (d) 64

21 Set A has 4 elements and set B has 5 elements. Then the number of bijective mappings from A to B is

(a) 120 (b) 20

(c) 0 (d) 625

22 Let $f: R \to R\ be\ defined\ by$

$$f(x) = x^2 + 1. Then\ preimages\ of\ 17\ and - 3\ respectively\ are$$

(a) $\emptyset, \{4, -4\}$ (b) $\{3, -3\}, \emptyset$

(c) $\{4, -4\}, \emptyset$ (d) $\{4, -4\}, \{2, -2\}$

23 Let $f: [2, \infty) \to R\ be\ defined\ by\ f(x) = x^2 - 4x + 5. Then\ range\ of\ f\ is$

(a) R (b) $[1, \infty)$

(c) $[4, \infty)$ (d) $[5, \infty)$

24 Let $f: R \to R\ be\ defined\ by\ f(x) = \frac{1}{x}\ \forall\ x \in R. Then\ f\ is$

(a) One-one (b) Onto

(c) Bijective (d) f is not defined

25 Let $A = \{-1,0,1\}, B = \{0,2\}$ then the $function\ f: A \rightarrow B defined\ by\ f(x) = 2x^4\ is$

(a) One-one onto
(b) One –one into
(c) Many –one onto
(d) Many-one into

26 Let $f: R \rightarrow R\ be\ defined\ by\ f(x) = x^3 + 4$,then f is

(a) Injective
(b) Surjective
(c) Bijective
(d) None of these

27 A={1,2,3,. . .,n},B={a,b}.Then the number of onto functions that can be defined from A to B is

(a) 2^n
(b) 2^n-2
(c) 2^n-1
(d) None of these

28 Let $A = \{x: -1 \leq x \leq 1\}\ and\ f: A \rightarrow A\ is\ defined\ by\ f(x) = x|x|$, Then $f\ is$

(a) a Bijection
(b) injection but not surjection
(c) surjection but not injection
(d) neither injection nor surjection

29 A={1,2,3} and a relation R on A is R={(1,2),(2,1)}, then R is

(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

30 The function f:[π,2π]→R defined by $f(x)$=$cosx$ is

(a) one – one but not onto
(b) onto but not one–one
(c) many – one function
(d) bijective function

Answers for MCQ's

1	d	**2**	a	**3**	c	**4**	d	**5**	d
6	b	**7**	c	**8**	d	**9**	a	**10**	d
11	d	**12**	d	**13**	d	**14**	d	**15**	c
16	b	**17**	a	**18**	a	**19**	a	**20**	c
21	c	**22**	c	**23**	b	**24**	d	**25**	c
26	c	**27**	b	**28**	b	**29**	c	**30**	d

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1 **Assertion (A):** If n (A) =p and n (B) =then the number of relations from A to B is 2^{pq}.
Reason(R): A relation from A to B is a subset of A x B.

2 **Assertion (A):** If n (A) =m, then the number of reflexive relations on A is m.
Reason(R): A relation R on the set A is reflexive if (a, a) $\in R$, ∀a∈ A.

3 **Assertion(A):** Domain and Range of a relation
$R = \{(x, y): x - 2y = 0\}$ $defined\ on\ the\ set$
$A = \{1,2,3,4\}$ $are\ respectively$ $\{1,2,3,4\}$$and$ $\{2,4,6,8\}$
.
Reason(R): Domain and Range of a relation R are respectively the sets
$\{a: a \in A\ and\ (a, b) \in R.\}\ and\ \{b: b \in A\ and\ (a, b) \in R\}$

4 **Assertion(A):** A relation R ={ (1,1),(1,2),(2,2),(2,3)(3,3)}defined on the set A={1,2,3} is reflexive.
Reason(R): A relation R on the set A is reflexive if (a,a) $\in R$, ∀ a ∈ A

5 **Assertion(A):** A relation R ={ (1,1),(1,2),(2,2),(2,3)(3,3)}defined on the set A={1,2,3} is symmetric
Reason(R): A relation R on the set A is symmetric if (a,b) $\in R \Longrightarrow (b, a) \in R$

6 **Assertion(A):** A relation R ={ (1,1),(1,3),(1.5),(3,1)(3,3),(3,5)}defined on the set A={1,3,5} is transitive.
Reason(R): A relation R on the set A symmetric if
$(a, b)\ \in Rand\ (a, c) \in R \Longrightarrow (a, c) \in R)$

7 **Assertion(A):** A relation R ={ (1,1),(1,3),(3,1)(3,3),(3,5)}defined on the set A={1,3,5} is reflexive.
Reason(R): A relation R on the set A is transitive if
$(a, b)\ \in R\ and\ (b, c) \in R \Longrightarrow (a, c) \in R)$

8 A={1,2,3},B={4,5,6,7} ,f={(1,4),(2,5),(3,6)} is a function from A to B.
Assertion(A): f is one-one
Reason(R): A function f is one –one if distinct elements of A have distinct images in B.

9 Consider the function f:R⇢ R defined by f(x)= $\frac{x}{x^2+1}$.
Assertion(A): f is one-one
Reason(R): f(4)=4/17 f(1/4)=4/17.

10 Consider the function f: R⇢ R defined by f(x) =[x].
Assertion(A): f is one-one
Reason(R): A function f is one –one if f(x_1)=f(x_2) then x_1=x_2

11 Consider the function f: R⇢ R defined by f(x) =x^3.
Assertion(A): f is one-one
Reason(R): A function f is one –one if every element of co-domain has at least one pre-image in the domain.

12 For the set A=R-{5} and B=R-{1},the function f: A⇢ B,is defined by

$$f(x) = \frac{x-4}{x-5}$$

Assertion(A): f is bijective
Reason(R): the function f is onto, if for all y ∈ B,there exists x∈ A such that f(x)=y

13 **Assertion (A):** A function f: A⇢ B, cannot be an onto function if n (A) <n (B).
Reason(R): A function f is one –one if every element of co-domain has at least one pre-image in the domain.

14 A, B are two sets such that n(A)=p and n(B)=q
Assertion (A): The number of functions from A onto B is q^p.
Reason(R): Every function is a relation

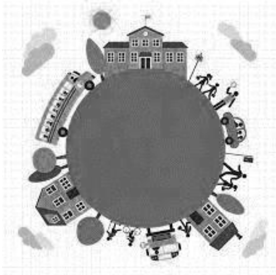
15 A, B are two sets such that n(A)=m and n(B)=n
Assertion (A): The number of one-one functions from A onto B is n_{p_m} ,if n≥ m
Reason(R): A function f is one –one if distinct elements of A have distinct images in B.

Answers :

1	B	2	C	3	D	4	A	5	D
6	C	7	D	8	A	9	D	10	D
11	C	12	B	13	B	14	B	15	B

CASE STUDY TYPE QUESTIONS

CS 1 Manikanta and Sharmila are studying in the same KendriyaVidyalaya in Visakhapatnam. The distance from Manikanta's house to the school is same as distance from Sharmila's house to the school. If the houses are taken as a set of points and KV is taken as origin, **then answer the below questions based on the given information**; (M for Manikanta's house and S for Sharmila's house)



Answer the following questions:

1 The relation R is given by $R = \{\ (M, S)$:Distance of point M from origin is same as distance of point S from origin } is

(a) Reflexive, Symmetric and Transitive

(b)Reflexive, Symmetric & not Transitive

(c) Neither Reflexive nor Symmetric

(d) Not an equivalence relation

2 Suppose Dheeraj's house is also at the same distance from KV then

(a) OM ≠ OS

(b) OM ≠ OD

(c) OS ≠ OD

(d) OM = OS= OD

3 If the distance from Manikanta, Sharmila and Dheeraj houses from KV are same, then the points form a

(a) Rectangle

(b) Square

(c) Circle

(d) Triangle

4 Let $R = \{(0,3), (0,0), (3,0)\}$, then the point which does not lie on the circle is

(a) (0,3)

(b) (0,0)

(c) (3,0)

(d) None of these

CS 2 Priya and Surya are playing monopoly in their house during COVID. While rolling the dice their mother Chandrika noted the possible outcomes of the throw every time belongs to the set $\{1, 2, 3, 4, 5, 6\}$. Let A denote the set of players and B be the set of all possible outcomes. Then $A = \{P, S\}$ $B = \{1, 2, 3, 4, 5, 6\}$.**Then answer the below questions based on the given information**

Answer the following questions:

1 Let $R: B \rightarrow B$ be defined by $R = \{(a, b)\ both\ a\ and\ b\ are\ either\ odd\ or\ even\}$, then R is

(a) Equivalence relation

(b) Not Reflexive but symmetric, transitive

(c) Reflexive, Symmetric and not transitive

(d) Reflexive, transitive but not symmetric

2 Chandrika wants to know the number of **functions**for$A$to B. How many number of **functions** are possible?

(a) 6^2

(b) 2^6

(c) 6!

(d) 2^{12}

3 Let R be a relation on B defined by $R = \{(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)\}$. Then R is

(a) Symmetric

(b) Reflexive

(c) Transitive

(d) None of these

4 Let $R: B \rightarrow B$ be defined by $R = \{(1, 1), (1, 2), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$ then R is

(a) Symmetric

(b) Reflexive and Transitive

(c) Transitive and Symmetric

(d) Equivalence Relation

5 Chandrika wants to know the number of **relations**for$A$to B. How many number of **relations** are possible?

(a) 6^2

(b) 2^6

(c) 6!

(d) 2^{12}

CS 3 In two different societies, there are some school going students – including girls as well as boys. Satish forms two sets with these students, as his college project.

Let $A = \{a_1, a_2, a_3, a_4, a_5\}$ and $B = \{b_1, b_2, b_3, b_4\}$ where $a_i's, b_i's$ are the school going students of first and second society respectively.

Using the information given above,

Answer the following questions:

1 Satish wishes to know the number of reflexive relations defined on set A. How many such relations are possible?

(a) 0 (b) 2^5

(c) 2^{10} (d) 2^{20}

2 Let $R: A \to A, R = \{(x, y): x \text{ and } y \text{ are students of same sex}\}$. Then relation R is

(a) Reflexive only (b)Reflexive and symmetric but not transitive

(c) Reflexive and transitive but not symmetric (d) An equivalence relation

3 Satish and his friend Rajat are interested to know the number of symmetric relations defined on both the sets A and B, separately. Satish decides to find the symmetric relation on set A, while Rajat decides to find symmetric relation on set B. What is difference between their results?

(a)1024 (b) $2^{10}(15)$

(c) $2^{10}(31)$ (d) $2^{10}(63)$

4 Let $R: A \to B, R = \{(a_1, b_1), (a_1, b_2), (a_2, b_1), (a_3, b_3), (a_4, b_2), (a_5, b_2)\}$, then R is

(a) Neither one-one nor onto (b) One-one but not onto

(c) Only onto but not one-one (d) One-one and onto both

5 To help Satish in his project, Rajat decides to form onto function from set A to itself. How many such functions are possible?

(a) 342 (b) 243

(c) 729 (d) 120

CASE STUDY

CS-1	1) a	2) d	3) c	4) b	
CS-2	1) a	2) a	3) d	4) b	5) d
CS-3	1) d	2) d	3) c	4) a	5) d

INVERSE TRIGONOMETRIC FUNCTIONS

Multiple choice questions -

1 The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

(a) $-\boldsymbol{\frac{\pi}{3}}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

2 The principal value of $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

(a) $-\frac{4\pi}{3}$ (b) $\frac{5\pi}{3}$

(c) $\boldsymbol{\frac{5\pi}{6}}$ (d) π

3 The principal value of $\sec^{-1}(-2)$

(a) $-\frac{4\pi}{3}$ (b) $\boldsymbol{\frac{2\pi}{3}}$

(c) $\frac{5\pi}{6}$ (d) π

4 What is the value of the function $\sin^{-1}\left(\sin\frac{4\pi}{5}\right)$

(a) $-\frac{\pi}{3}$ (b) $\frac{\pi}{3}$

(c) $\boldsymbol{\frac{\pi}{5}}$ (d) π

5 What is the value of the function $\tan^{-1}\left(\tan\frac{5\pi}{4}\right)$

(a) $-\frac{\pi}{3}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{5}$ (d) $\boldsymbol{\frac{\pi}{4}}$

6 Write the principal value of $\text{cosec}^{-1}(\sqrt{2})$

(a) $-\frac{4\pi}{3}$ (b) $\frac{2\pi}{3}$

(c) $\boldsymbol{\frac{\pi}{4}}$ (d) π

7 Write the principal value of $\sec^{-1}(\sqrt{2})$

(a) $-\frac{4\pi}{3}$ (b) $\frac{2\pi}{3}$

(c) $\boldsymbol{\frac{\pi}{4}}$ (d) π

8 What is the value of the function $\tan^{-1}(1) - \cot^{-1}(-1)$

(a) $-\boldsymbol{\frac{\pi}{2}}$ (b) $\frac{5\pi}{3}$

(c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{2}$

9 What is the value of the function $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right) - \sec^{-1}\left(\frac{2}{\sqrt{3}}\right)$

(a) $-\frac{\pi}{2}$ (b) 0

(c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{2}$

10 What is the value of the function $\text{cosec}^{-1}(\sqrt{2}) + \sec^{-1}(-\sqrt{2})$

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{8}$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{2}$

Answers for MCQ's

1	a	2	c	3	b	4	c	5	d
6	c	7	c	8	a	9	b	10	a

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.

B) Both A and R are true but R is NOT the correct explanation of A.

C) A is true but R is false.

D) A is false but R is true.

E) Both A and R are false

1. **Assertion (A)**: the domain of $tan^{-1}x$ is R

Reason(R): the derivative ofsin^{-1} x is $\frac{1}{1+x^2}$

2. **Assertion (A):** the domain of $tan^{-1}x$+$cos^{-1}x$ *is (0,*$\frac{\pi}{2}$*)*

Reason(R): Let f: A→R and g:B→R be live functions *the* domain of f+g is A∩B

3. **Assertion (A):** Let f: A→R and g:B→R be to functions *the* domain of f+g is A∩B

Reason(R): The Range of $cos^{-1}x$ is [0,π].

4. **Assertion (A):** If $tan^{-1}x = \frac{\pi}{10}$, x∈R then $cot^{-1}x$=$\frac{2\pi}{5}$

Reason(R): graphs of $tan^{-1}x$ and $cot^{-1}x$ intersect at $(1,\frac{\pi}{4})$.

5.

Assertion (A): $cos^{-1}x$>$sin^{-1}x$ for all x€[-1,1].

Reason(R): both$cos^{-1}x$ and $sin^{-1}x$are continuous functions.

6.

Assertion (A): $tan^{-1}(\frac{1}{2})$+$tan^{-1}(\frac{2}{11})$=$tan^{-1}\frac{3}{4}$

Reason(R): $tan^{-1}x$+ $tan^{-1}y$=$tan^{-1}(\frac{x+y}{1-xy})$

7. **Assertion (A):** a and b are the roots of quadratic equation $2x^2 - 3x + 1 = 0$

Reason(R): $tan^{-1}a$+$tan^{-1}b = tan^{-1}(2(a + b))$

8. **Assertion (A):** to define inverse of the function f(x)= tan x any of the intervals $(-\frac{3x}{2},-\frac{\pi}{2}),(-\frac{\pi}{2},\frac{\pi}{2}),(\frac{\pi}{2},\frac{3\pi}{2})$,etc. can be choosen.

Reason(R): the branch having range $(-\frac{\pi}{2},\frac{\pi}{2})$ is called principal value branch of the function g(x)=tan $^{-1}$x.

9. **Assertion (A):** tan[$cos^{-1}\frac{4}{5}$+$tan^{-1}\frac{2}{3}$]=$\frac{17}{6}$

Reason(R): tan(A+B)=$\frac{\tan A+tanB}{1-tanAtanB}$

10. **Assertion (A):** $sin^{-1}x = cos^{-1}x$

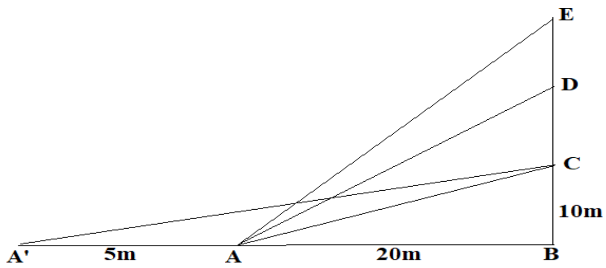
Reason(R): both the functions are having same domain [-1,1] and interesting at $\frac{\pi}{4}$.

Answers :

1	C	2	D	3	B	4	B	5	D
6	A	7	A	8	B	9	A	10	A

CASE STUDY TYPE QUESTIONS

CS 1



The Government of India is planning to fix a hoarding board at the face of a building on the road of a busy market for awareness on COVID-19 protocol. Ram, Robert and Rahim are the three engineers who are working on this project."A" is considered to be a person viewing the hoarding board 20 metres away from the building, standing at the edge of a pathway nearby. Ram, Robert and Rahim suggested to the firm top lace the hoarding board at three different locations namely C,D and E."C" is at the height of 10 metres from the Ground level. For the viewer A,the angle of elevation of "D" is double the angle of elevation of "C" The angle of elevation of "E" is triple the angle of elevation of "C" for the same viewer. Look at the figure given and based on the above information answer the following:

1 Measure of $\angle CAB$=

(a) $\tan^{-1}(2)$ (b) $\tan^{-1}(\frac{1}{2})$

(c) $\tan^{-1}(1)$ (d) $\tan^{-1}(3)$

2 $Measure\ of \angle DAB$=

(a) $\tan^{-1}(\frac{3}{4})$ (b) $\tan^{-1}(3)$

(c) $\tan^{-1}(\frac{4}{3})$ (d) $\tan^{-1}(4)$

3 $Measureof \angle EAB$=

(a) $\tan^{-1}(11)$ (b) $\tan^{-1}(3)$

(c) $\tan^{-1}(\frac{2}{11})$ (d) $\tan^{-1}(\frac{11}{2})$

4 $A^{|}$ Is another viewer standing on the same line of observation across the road. If the width of the road is 5meters, then the difference between $\angle CAB$ and $\angle CA'B$ Is

(a) $\tan^{-1}(\frac{1}{2})$ (b) $\tan^{-1}(\frac{1}{8})$

(c) $\tan^{-1}(\frac{2}{5})$ (d) $\tan^{-1}(\frac{11}{21})$

5 Domain and Range of $\tan^{-1}x$ =

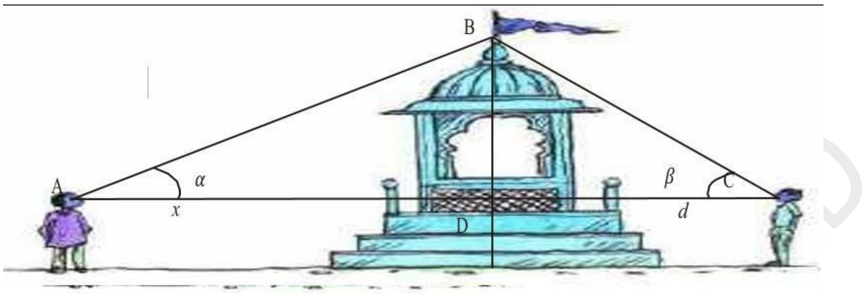
(b) $R^-, (\frac{-\pi}{2}, \frac{\pi}{2})$

(a) $R^+, (\frac{-\pi}{2}, \frac{\pi}{2})$

(c) $R, (\frac{-\pi}{2}, \frac{\pi}{2})$

(d) $R, (0, \frac{\pi}{2})$

CS 2 Two men on either side of a temple of 30 meters high observe its top at the angles of elevation α and β respectively.(as shown in the figure above).The distance between the two men is $40\sqrt{3}$ meters and the distance between the first person A and the temple is $30\sqrt{3}$ meters. Based on the above information answer the following:



1 $\angle CAB = \alpha =$

(a) $\sin^{-1}(\frac{2}{\sqrt{3}})$

(b) $\sin^{-1}(\frac{1}{2})$

(c) $\sin^{-1}(2)$

(d) $\sin^{-1}(\frac{\sqrt{3}}{2})$

2 $\angle CAB = \alpha =$

(a) $\cos^{-1}(\frac{1}{5})$

(b) $\cos^{-1}(\frac{2}{5})$

(c) $\cos^{-1}(\frac{\sqrt{3}}{2})$

(d) $\cos^{-1}(\frac{4}{5})$

3 $\angle BCA = \beta =$

(a) $\tan^{-1}(\frac{1}{2})$

(b) $\tan^{-1}(2)$

(c) $\tan^{-1}(\frac{1}{\sqrt{3}})$

(d) $\tan^{-1}(\sqrt{3})$

4 $\angle ABC =$

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{2}$

(d) $\frac{\pi}{3}$

5 DomainandRangeof$\cos^{-1}x$=

(a) $(-1,1), (0, \pi)$

(b) $[-1,1], (0, \pi)$

(c) $[-1,1], [0, \pi]$

(d) $(-1,1), [-\frac{\pi}{2}, \frac{\pi}{2}]$

CASE STUDY

CS-1	1) b	2) c	3) d	4) b	5) c
CS-2	1) b	2) c	3) d	4) c	5) c

Multiple choice questions -

1 1. If a matrix $A = [1 \quad 2 \quad 3]$, then the matrix AA' (where A' is the transpose of A) is

(a) 14

(b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$

(d) $[14]$

2 If A is a square matrix and $A^2 = A$, then $(I + A)^2 - 3A$ is equal to

(a) I

(b) A

(c) 2 A

(d) 3I

3 The product $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ is equal to

(a) $\begin{bmatrix} a^2 + b^2 & 0 \\ 0 & a^2 + b^2 \end{bmatrix}$

(b) $\begin{bmatrix} (a+b)^2 & 0 \\ (a+b)^2 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} a^2 + b^2 & 0 \\ a^2 + b^2 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$

4 If $x\begin{bmatrix} 1 \\ 2 \end{bmatrix} + y\begin{bmatrix} 2 \\ 5 \end{bmatrix} = \begin{bmatrix} 4 \\ 9 \end{bmatrix}$, then

(a) $x = 1, y = 2$

(b) $x = 2, y = 1$

(c) $x = 1, y = -1$

(d) $x = 3, y = 2$

5 If for a square matrix A, $A^2 - 3A + I = 0$ and $A^{-1} = xA + yI$, then the value of $x + y$ is :

(a) -2

(b) 2

(c) 3

(d) -3

6 If $A = \begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix}$ and $2A + B$ is a null matrix, then B is equal to

(a) $\begin{bmatrix} 6 & 8 \\ 10 & 4 \end{bmatrix}$

(b) $\begin{bmatrix} -6 & -8 \\ -10 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 8 \\ 10 & 3 \end{bmatrix}$

(d) $\begin{bmatrix} -5 & -8 \\ -10 & -3 \end{bmatrix}$

7 If $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $(3I + 4A)(3I - 4A) = x^2 I$, then the value(s) x is/are:

(a) $\pm\sqrt{7}$

(b) 0

(c) 5

(d) 25

8 If $A = \begin{bmatrix} 1 & 4 & x \\ z & 2 & y \\ -3 & -1 & 3 \end{bmatrix}$ is a symmetric matrix, then the value of $x + y + z$ is

(a) 10 (b) 6

(c) 8 (d) 0

9 If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then A^{2023} is equal to:

(a) $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 2023 \\ 0 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 2023 & 0 \\ 0 & 2023 \end{bmatrix}$

10 A and B are skew-symmetric matrices of same order. AB is symmetric, if

(a) $\mathrm{AB} = 0$ (b) $\mathrm{AB} = -\mathrm{BA}$

(c) $\mathrm{AB} = \mathrm{BA}$ (d) $\mathrm{BA} = 0$

11 For what value of $\mathrm{x} \in \left[0, \frac{\pi}{2}\right]$, is $\mathrm{A} + \mathrm{A}' = \sqrt{3}\mathrm{I}$, where $\mathrm{A} = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$?

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$

(c) 0 (d) $\frac{\pi}{2}$

12 If $\mathrm{A} = \begin{bmatrix} 2 & 0 \\ 5 & 4 \end{bmatrix} = \mathrm{P} + \mathrm{Q}$, where P is symmetric and Q is a skew symmetric matrix, then Q is equal to:

(a) $\begin{bmatrix} 2 & 5/2 \\ 5/2 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & -5/2 \\ 5/2 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 5/2 \\ -5/2 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -5/2 \\ 5/2 & 4 \end{bmatrix}$

13 If $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$, then the value of $(2x + y - z)$ is

(a) 1 (b) 2

(c) 3 (d) 5

14 If $\mathrm{A} = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $\mathrm{B} = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $\mathrm{A} = \mathrm{B}^2$, then x equals

(a) 1 (b) -1

(c) 1 (d) 2

Answers for MCQ's

1	d	2	a	3	a	4	b	5	b
6	b	7	c	8	d	9	c	10	c
11	b	12	b	13	d	14	c		

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A)** If $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 4 \\ 0 & 5 \end{pmatrix}$.$(A + B)^2 = A^2 + 2AB + B^2$

   Reason(R) $AB \neq BA$

2. **Assertion (A)** If $A = \begin{pmatrix} 1 & 2 & -1 \\ 2 & 0 & 3 \\ -1 & 3 & 4 \end{pmatrix}$, then $A^{-1}$is symmetric matrix.

   Reason(R) If A is symmetric matrix then A^{-1} is symmetric matrix

3. **Assertion (A)** if $A = \begin{pmatrix} 0 & 2 & -1 \\ -2 & 0 & 3 \\ 1 & -3 & 0 \end{pmatrix}$ then, $A^{-1}$is skew symmetric matrix.

   Reason(R) If A is skew symmetric matrix then A^{-1} is skew symmetric matrix.

4. **Assertion (A)** Let A and B are 2x2 matrices. $AB = I_2 \Rightarrow A = B^{-1}$.

   Reason(R) $AB = O \implies A = O$ or $B = O$.

5. **Assertion (A)** Matrix $A = \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$, satisfies the equation $X^2 - 2X + 5I = \mathbf{O}$, then A is invertible.

   Reason(R) If a square matrix satisfies the equation $a_n X^n + a_{n-1} X^{n-1} + \cdots + a_1 X + a_n I_2 = \mathbf{O}$ and $a_n \neq 0$, Then A is invertible

6. **Assertion (A)** If $A = \begin{pmatrix} 3 & -2 & 10 \\ -2 & 4 & 5 \\ 10 & 5 & 6 \end{pmatrix}$ and $X = \begin{pmatrix} 1 & 5 & 6 \\ -2 & 0 & 1 \\ 4 & 3 & 2 \end{pmatrix}$ $X'AX$ is symmetric matrix.

   Reason(R) $X'AX$ is symmetric or skew symmetric as A is symmetric or skew symmetric

7. **Assertion (A)** If $A = \begin{pmatrix} -3 & 2 \\ -5 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & -2 \\ 5 & -3 \end{pmatrix}$.then$A^{100}B = BA^{100}$.

Reason(R) If $AB = BA \Rightarrow A^nB = BA^n$ for all positive integers n

8. **Assertion (A)** : If $A = \begin{pmatrix} 0 & -2 & 3 \\ 2 & 0 & 6 \\ -3 & -6 & 0 \end{pmatrix}$, then A^{-1} does not exist.

Reason(R) : If A is a skew symmetric matrix of odd order, then A is singular

9. **Assertion (A)** If A is a square matrix such that $A^2 = I$, then $(I + A)^2 - 3A = I$.

Reason(R) $AI = IA = A$, wehre I is Idetity matrix

10. **Assertion (A)** $(A + B)^2 \neq A^2 + 2AB + B^2$

Reason(R) Generally AB=BA

11. **Assertion (A)** If the matrix $P = \begin{pmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & 3 \end{pmatrix}$ is a symmetric matrix, then $a = -\frac{2}{3}$ and $b = \frac{3}{2}$

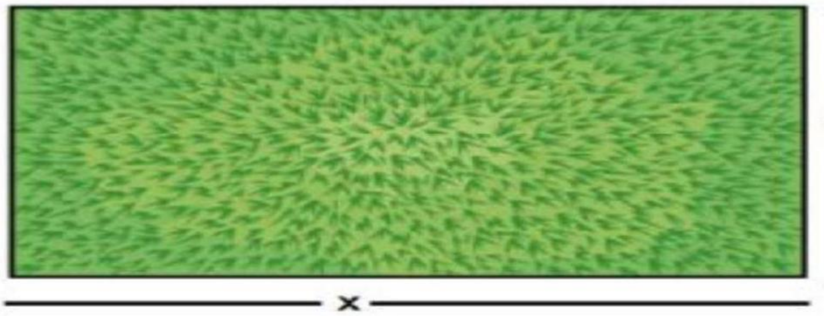
Reason(R) If P is a symmetric matrix, then $P' = P$

Answers :

1	D	2	A	3	A	4	C	5	A
6	A	7	A	8	A	9	D	10	C
11	A								

CASE STUDY TYPE QUESTIONS

CS 1 Manjit wants to donate a rectangular plot of land for a school in his village. When he was asked to give dimensions of the plot, he told that if its length is decreased by 50 m and breadth is increased by 50 m, then its area will remain same, but if length is decreased by 10 m and breadthis decreased by 20 m, then its area will decrease by $5300\ m^2$



Based on the information given above, answer the following questions :

Answer the following questions:

1 The equations in terms of x and y are

(a) $x - y = 50, 2x - y = 550$ (b) $x - y = 50, 2x + y = 550$

(c) $x + y = 50, 2x + y = 550$ (d) $x + y = 50, 2x - y = 550$

2 Which of the following matrix equation represents the information given above?

(a) $\begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 50 \\ 550 \end{pmatrix}$ (b) $\begin{pmatrix} -1 & 1 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 50 \\ 550 \end{pmatrix}$

(c) $\begin{pmatrix} 1 & -1 \\ 2 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 50 \\ 550 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 50 \\ 550 \end{pmatrix}$

3 The value of x (length of rectangular field), is

(a) 150 m (b) 400 m

(c) 200 m (d) 320 m

4 The value of y (breadth of rectangular field), is

(a) 150 m (b) 200 m

(c) 430 m (d) 350 m

5 How much is the area of rectangular field?

(a) 60000 Sq. M (b) 30000 Sq. M

(c) 30000 m (d) 3000 m

CS 2 Three schools NVS, CVC and KVS decided to organize a fair for collecting money for helping the flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs. 25, Rs. 100 and Rs. 50 each respectively. The numbers of articles sold are given as

School /Article	NVS	CVC	KVS
Handmade fans	40	25	35
Mats	50	40	50
Plates	20	30	40

1 What is the total money (in Rupees) collected by the school NVS?

(a) 700 (b) 7000

(c) 6125 (d) 7875

2 What is the total amount of money (in Rs.) collected by schools CVC and KVS?

(a) 14,000 (b) 15,725

(c) 21,000 (d) 13,125

3 What is the total amount of money collected by all three schools NVS, CVC and KVS?

(a) 15,775 (b) 14,000

(c) 21,000 (d) 17,125

4 If the number of handmade fans and plates are interchanged for all the schools, then what is the total money collected by all schools?

(a) 18,000 (b) 6,750

(c) 5,000 (d) 21,250

5 How many articles (in total) are sold by three schools?

(a) 230 (b) 130

(c) 430 (d) 330

CS 3 On her birth day, Seema decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got Rs.10 more. However, if there were 16 children more, everyone would have got Rs. 10 less. Let the number of children be x and the amount distributed by Seema for one child be y (in Rs.).

Based on the information given above, answer the following questions:

1 The equations in terms x and y are

(a) $5x - 4y = 40, 5x - 8y = -80$ (b) $5x - 4y = 40, 5x - 8y = 80$

(c) $5x - 4y = 40, 5x + 8y = -80$ (d) $5x + 4y = 40, 5x - 8y = -80$

2 Which of the following matrix equations represent the information given above?

(a) $\begin{bmatrix} 5 & 4 \\ 5 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ -80 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & -4 \\ 5 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ 80 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & -4 \\ 5 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ -80 \end{bmatrix}$ (d) $\begin{bmatrix} 5 & 4 \\ 5 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ -80 \end{bmatrix}$

3 The number of children who were given some money by Seema, is

(a) 30 (b) 40

(c) 23 (d) 32

4 How much amount is given to each child by Seema?

(a) 32 (b) 30

(c) 62 (d) 26

5 How much amount Seema spends in distributing the money to all the students of the Orphanage?

(a) Rs. 609 (b) Rs. 960

(c) Rs. 906 (d) Rs. 690

CS 4

A manufacture produces three stationery products Pencil, Eraser and Sharpener which he sells in two markets. Annual sales are indicated below

Market	Products (in numbers)		
	Pencil	Eraser	Sharpener
A	10,000	2000	18,000
B	6000	20,000	8,000

If the unit Sale price of Pencil, Eraser and Sharpener are Rs. 2.50, Rs. 1.50 and Rs. 1.00 respectively, and unit cost of the above three commodities are Rs. 2.00, Rs. 1.00 and Rs. 0.50 respectively, then, based on the above information answer the following:

1 Total revenue of market A

(a) Rs. 64,000 (b) Rs. 60,400

(c) Rs. 46,000 (d) Rs. 40600

2 Total revenue of market *B*

(a) . Rs. 35,000 (b) Rs. 53,000

(c) Rs. 50,300 (d) Rs. 30,500

3 Cost incurred in market A

(a) Rs. 13,000 (b) Rs. 30,100

(c) Rs. 10,300 (d) Rs. 31,000

4 Profit in market A and B respectively are

(a) (Rs. 15,000 , Rs. 17,000) (b) (Rs. 17,000, Rs. 15,000)

(c) (Rs. 51,000 , Rs. 71,000) (d) (Rs. 10,000, Rs. 50,000)

5 Gross profit in both market

(a) Rs. 23,000 (b) Rs. 20,300

(c) Rs. 32,000 (d) Rs. 30,200

CASE STUDY ANSWERS:

CS-1	1) b	2) a	3) c	4) a	5) c
CS-2	1) b	2) a	3) c	4) d	5) d
CS-3	1) a	2) c	3) d	4) b	5) b
CS-4	1) c	2) b	3) d	4) a	5) c

DETERMINANTS

Multiple choice questions -

1 If A is a square matrix of order 3x3, then |kA| is equal to

(a) k|A|
(b) k^2|A|
(c) k^3|A|
(d) 3 k |A|

2 If the points A (3, -2), B(k,2) and C (8,8) are collinear, then the value of k is:

(a) 2
(b) 5
(c)-3
(d)-4

3 Find the area of the triangle whose vertices are (3, 8), (– 4, 2) and (5, 2)

(a) 18
(b) 34
(c)61
(d) 27

4 The value of $\begin{vmatrix} \cos 15^0 & \sin 15^0 \\ \sin 15^0 & \cos 15^0 \end{vmatrix}$ is:

(a) 1
(b) $\frac{1}{2}$
(c) $\frac{\sqrt{3}}{2}$
(d) 0

5 If A is a square matrix such that A^2 = I, then A^{-1} is equal to

(a) 2A
(b) O
(c) A
(d) A+I

6 If area of triangle is 35 sq units with vertices (2, – 6), (5, 4) and (k, 4). Then k is

(a) 12
(b) -2
(c) -12,-2
(d) 12,-2

7 A square matrix A is said to be singular if IAI =

(a) 1
(b)-1
(c) 0
(d) None of these

8 If Δ = $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and Aij is Cofactors of aij, then value of Δ is given by:

(a) $a_{11} A_{31} + a_{12} A_{32} + a_{13} A_{33}$
(b) $a_{21} A_{11} + a_{22} A_{12} + a_{23} A_{13}$
(c) $a_{11}A_{11} + a_{12} A_{21} + a_{13} A_{31}$
(d) $a_{11}A_{11} + a_{21}A_{21} + a_{31}A_{31}$

9 Let the determinant of a 3x3 matrix A be 6 and B be a matrix given by B = $5A^2$ .Then |B| =

(a)750
(b) 180
(c) 450
(d)4500

10 Given that A is a square matrix of order 3 and | A | = - 4, then | adj A | is equal to:

(a) 4 (b) -4

(c) 16 (d)-16

11 If $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$, then the possible value(s) of x is/are

(a) 1 (b) $\sqrt{3}$

(c) -$\sqrt{3}$ (d)$\pm\sqrt{3}$

12 Find the minor of the element 7 in the determinant if, $\Delta = \begin{vmatrix} 1 & 4 & 3 \\ 5 & 6 & 7 \\ 8 & 9 & 2 \end{vmatrix}$

(a) 23 (b) -23

(c) 24 (d) 0

13 If A, B and C are angles of a triangle, then the determinant of the matrix $\begin{bmatrix} -1 & cosC & cosB \\ cosC & -1 & cosA \\ cosB & cosA & -1 \end{bmatrix}$ is

(a) 0 (b) -1

(c) 1 (d)2

14 The minor of the element of second row and third column in the following determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$ is

(a) 13 (b) 4

(c) 5 (d) 0

15 If A(3,4), B(-7,2) and C(x,y) are collinear, then:

(a) x+5y+17=0 (b) x+5y+13=0

(c) x-5y+17=0 (d) none of these

16 A=$\begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$,B =$\begin{bmatrix} -2 & -2 \\ 0 & -1 \end{bmatrix}$ then $(A + B)^{-1}$is

(a) $\begin{bmatrix} -1 & 1 \\ 1 & \frac{-1}{2} \end{bmatrix}$ (b) does not exist

(c) is a skew symmetric (d) none of these

18 The area of a triangle with vertices (-3, 0), (3, 0) and (0, k) is 9 sq. units. then k=

(a) 9 (b) 3

(c) -9 (d) 6

19 Compute (AB)$^{-1}$ if A = $\begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 3 & -1 \\ 1 & 0 & 2 \end{bmatrix}$

(a) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 1 \\ 21 & 11 & -7 \\ 10 & -2 & 3 \end{bmatrix}$ (b) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 10 \\ 21 & 11 & -2 \\ 1 & -7 & 3 \end{bmatrix}$

(c) $\frac{1}{19}\begin{bmatrix}16 & 12 & 1\\ -21 & -11 & 7\\ 10 & -2 & 3\end{bmatrix}$ (d) $\frac{1}{19}\begin{bmatrix}16 & -21 & 1\\ 21 & 11 & 7\\ 10 & -2 & 3\end{bmatrix}$

20 Find the adjoint of the matrix A = $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$

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

(c) $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ (d) $\begin{bmatrix}1 & -2\\ -3 & 4\end{bmatrix}$

21 Let A be a non-singular square matrix of order 3 × 3. Then |adj A| is equal to:

(a) | A | (b) $| A |^2$

(c) $| A |^3$ (d) 3|A|

22 If A is an invertible matrix of order 2, then det (A^{-1}) is equal to

(a) det (A) (b) $\frac{1}{\det A}$

(c) 1 (d)0

23 If A is a square matrix of order 4 such that |adj A| = 125, then |A| is ____

(a) 25 (b) 5

(c) 15 (d)625

24 Which of the following is a correct statement?

(a) Determinant is a square matrix

(b) Determinant is a number associated to a matrix

(c) Determinant is a number associated with the order of the matrix

(d) Determinant is a number associated to a square matrix

25 The inverse of the matrix $\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$ is

(a) $\begin{bmatrix}-1 & 4\\ -1 & 3\end{bmatrix}$ (b) $\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$

(c) $\begin{bmatrix}-3 & 4\\ 1 & 1\end{bmatrix}$ (d) $\begin{bmatrix}-3 & -4\\ -1 & -1\end{bmatrix}$

26 If A is a square matrix of order 3x3 such that | A | = -3, then $|-3 A A^T|$ =

(a) 243 (b) -243

(c) -27 (d) -81

27 If for a matrix A= $\begin{bmatrix}t & -2\\ -2 & t\end{bmatrix}$, $| A^3 |$ = 125, then the value of t is

(a) ±3 (b) ±1

(c) -3 (d) 1

28 Let A be a nonsingular square matrix of order 3x3. Then |adj A | is equal to

(a) 3 | A | (b) | A |

(c) $| A |^3$ (d) $| A |^2$

29 If A be any square matrix of order n, then A (adj A) = (adj A) A =

(a) $|A|^2$ (b) | A |

(c) | A | I (d) I

30 There are two values of a which makes determinant $\begin{vmatrix} 1 & -2 & 5 \\ 2 & a & -1 \\ 0 & 4 & 2a \end{vmatrix} = 86$, then the sum of these numbers is

(a) 4 (b) -4

(c) 5 (d) 9

Answers for MCQ's

1	c	2	b	3	d	4	c	5	c
6	d	7	c	8	d	9	d	10	c
11	d	12	b	13	a	14	a	15	c
16	a	17	a	18	b	19	a	20	b
21	b	22	b	23	b	24	d	25	a
26	b	27	a	28	d	29	c	30	b

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A)** The value of x for which $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ is $\pm 2\sqrt{2}$

   Reason(R) The determinant of a matrix A of order 2x2, A= $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is ad – bc

2. **Assertion (A)** The value of x for which $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ is ± 6

   Reason(R) The determinant of a matrix A order 2 x 2 , A= $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is = ab–dc

3. **Assertion (A)** If A= $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$ then $|3A| = 9|A|$

   Reason(R) If A is a square matrix of order n then $|kA| = k^n|A|$

4. **Assertion (A)** If A is a non singular square matrix of order 3x3 and $|A| = 5$ then $|adjA|$ is equal to 125

   Reason(R) $|adjA| = (|A|)^{n-1}$ where n is order of A.

5. **Assertion (A)** Let $A^{-1} = \begin{bmatrix} 5 & -7 \\ -2 & 3 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 7 & 6 \\ 8 & 7 \end{bmatrix}$ then $(AB)^{-1} = \begin{bmatrix} 23 & 31 \\ 26 & 35 \end{bmatrix}$

   Reason(R) $(AB)^{-1} = A^{-1}B^{-1}$

6. **Assertion (A)** Value of x for which the matrix $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \\ -1 & 2 & x \end{bmatrix}$ is singular is 5

   Reason(R) A square matrix is singular if $|A| = 0$

7. **Assertion (A)** The minor of the element 3 in the matrix $\begin{bmatrix} 2 & 3 & 1 \\ 0 & -2 & 4 \\ 2 & 1 & 5 \end{bmatrix}$ is 8.

   Reason(R) : Minor of an element a_{ij} of a matrix is the determinant obtained by deleting its j^{th} row and i^{th} column

8. **Assertion (A)** For two matrices A and B of order 3, $|A| = 2|B| = -3$ then if $|2AB|$ is -48.

   Reason(R) For a square matrix A, A(adj A)=(adj A)A=$|A|$ I

9. **Assertion (A)** Values of k for which area of the triangle with vertices (2, -6), (5,4) and (k,4) is 35 sq units are 12, 2.

	Reason(R)	Area of a triangle with vertices A (x_1, y_1), B (x_2, y_2) and C (x_3, y_3) is $\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$
10.	**Assertion (A)**	The points A(a, b+c), B(b, c+a) and C(c, a+b) are collinear.
	Reason(R)	Three points A (x_1, y_1) , B(x_2, y_2) and C(x3, y_3) are collinear if area of a triangle ABC is zero.
11.	**Assertion (A)**	Inverse of the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$ is the matrix $\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$
	Reason(R)	: Inverse of a square matrix A, if it exits is given by $A^{-1} = \frac{1}{IAI}$ adjA
12.	**Assertion (A)**	For a matrix A=$\begin{bmatrix} 2 & -1 \\ -3 & 4 \end{bmatrix}$, A. adj A =$\begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$
	Reason(R)	For a square matrix A , A(adj A) = (adj A)A=$\lvert A \rvert$ I
13.	**Assertion (A)**	In a square matrix of order 3 the minor of an element a_{22} is 6 then cofactor of $a_{22}$is -6.
	Reason(R)	Cofactor an element $a_{ij} = A_{ij} = (-1)^{i+j} M_{ij}$
14.	**Assertion (A)**	Inverse of a matrix A =$\begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ is the matrix $A^{-1} = \begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix}$
	Reason(R)	: Inverse of a square matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is $\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$.
15.	**Assertion (A)**	If A is an invertible matrix of order 2, and det A= 3 then det(A^{-1})is equal to $\frac{1}{3}$
	Reason(R)	If A is an invertible matrix of order 2 then det (A^{-1}) = det A
16.	**Assertion (A)**	The equation of the line joining (1,2) and (3,6) using determinants is y= 3x.
	Reason(R)	The area of ΔPAB is zero if P(x, y) is a point on the line joining a A and B.

Answers :

1	A	2	C	3	D	4	D	5	E
6	D	7	E	8	B	9	D	10	A
11	A	12	D	13	D	14	C	15	C
16	D								

CASE STUDY TYPE QUESTIONS

CS 1 Three shopkeepers Ujjwal, Lohith, and Kundan are using polythene bags, handmade bags and newspaper's envelope as carry bags. It is found that the shopkeepers Ujjwal, Lohith, and Kundan are using (20, 30, 40), (30, 40, 20), and (40, 20, 30) polythene bags, handmade bags, and newspapers envelopes respectively. They spent Rs.250, Rs.270, and Rs.200 on these carry bags respectively. Let the cost of polythene bag, handmade bag and newspaper envelope costs are x,y and z respectively.

Answer the following questions:

1 What is the Linear equation representing amount spent by Lohith on carry bags?

(a) $20x + 30y + 40z = 250$ (b) $30x + 40y + 20z = 270$

(c) $40x + 20y + 30z = 200$ (d) $250x + 270y + 200z = 0$

2 What is the Linear equation representing amount spent by Kundan on carry bags?

(a) $20x + 30y + 40z = 250$ (b) $30x + 40y + 20z = 270$

(c) $40x + 20y + 30z = 200$ (d) $250x + 270y + 200z = 0$

3 Adjoint of $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 2 \\ 4 & 2 & 3 \end{bmatrix} =$

(a) $\begin{bmatrix} 8000 & -1000 & -10000 \\ -1000 & -10000 & 8000 \\ -10000 & 8000 & -1000 \end{bmatrix}$ (b) $\begin{bmatrix} 8 & -1 & -10 \\ -1 & -10 & 8 \\ -10 & 8 & -1 \end{bmatrix}$

(c) $\begin{bmatrix} 20 & 30 & 40 \\ 30 & 40 & 20 \\ 40 & 20 & 30 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & 3 & 2 \\ 2 & 4 & 3 \\ 3 & 2 & 4 \end{bmatrix}$

4 What is the cost of one newspaper bag?

(a) Rs.1 (b) Rs.2

(c) Rs.3 (d) Rs.5

5 Find the total amount spent by ujjwal for handmade bags ?

(a) 100 (b) 200

(c)150 (d)250

CS 2 Each triangular face of the square pyramid of Peace in Kazakhstan is made up of 25 smaller equilateral triangles as shown in the figure.

Using the above information and concept of determinants,

Answer the following questions:

1 If the vertices of one of the smaller equilateral triangles are (0, 0), (3, $\sqrt{3}$) and (3, - $\sqrt{3}$), then the area of such triangle is

(a) $\sqrt{3}$sq. units (b) 2 $\sqrt{3}$ sq. units

(c) 3$\sqrt{3}$ sq. units (d) none of these

2 The lateral surface area of the Pyramid is

(a) 300$\sqrt{3}$ sq. unit (b) 75 sq. unit

(c) 75 $\sqrt{3}$ sq. unit (d) 300 sq. unit

3 The length of each altitude of a smaller equilateral triangle is

(a) 2 units (b) 3 units

(c) 2 $\sqrt{3}$ units (d) 4 units

4 If (2, 4), (2, 6) are two vertices of a smaller equilateral triangle, then the third vertex is

(a) $(2 \pm \sqrt{3}, 5)$ (b) $(2 \pm \sqrt{3}, \pm 5)$

(c) $(2 \pm \sqrt{5}, 3)$ (d) $(2 \pm \sqrt{5}, \pm 3)$

5 Let A (a, 0), B (0, b) and C (1, 1) be three points. If $\frac{1}{a}$ + $\frac{1}{b}$ = 1, then the three points are

(a) vertices of an equilateral triangle (b) vertices of a right-angled triangle

(c) collinear (d) vertices of an isosceles triangle

CS 3 Area of a triangle whose vertices are (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by the determinant $\Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$

Since, area is a positive quantity, so we always take the absolute value of the determinant A. Also, the area of the triangle formed by three collinear points is zero.

Based on the above information, answer the following questions.

1 Find the area of the triangle whose vertices are (-2, 6), (3, -6), and (1, 5).

(a) 30 sq. units

(b) 35 sq. units

(c) 40 sq. units

(d) 15.5 sq. units

2 If the points (2, -3), (k, -1) and (0, 4) are collinear, then find the value of 4k.

(a) 4

(b) $\frac{7}{140}$

(c) 47

(d) $\frac{40}{7}$

3 If the area of a triangle ABC, with vertices A (1, 3), B (0, 0) and C (k, 0) is 3 sq. units, then the value of k is

(a) 2

(b) 3

(c) 4

(d) 5

4 Using determinants, find the equation of the line joining the pointsA(1,2) & B(3,6) is.

(a) y = 2x

(b) x = 3y

(c) y = x

(d) 4x - y = 5

5 If A is (11, 7), B is(5, 5) and C is (-1, 3), then

(a) △ABC is scalene triangle

(b) A, B and C are collinear

(c) △ABC is equilateral triangle

(d) none of these

CASE STUDY

CS-1	1) B	2) C	3) B	4) B	5) C
CS-2	1) C	2) A	3) B	4) A	5) C
CS-3	1) D	2) D	3) A	4) A	5) B

CONTINUITY AND DIFFERENTIABILITY

Multiple choice questions -

1 A function f(x) is continuous at x=a (a ϵ Domain of f), if

(a)$f(a) = \lim_{x \to a+} f(x)$

(b) $\lim_{x \to a-} f(x) = \lim_{x \to a+} f(x)$

© $\lim_{x \to a-} f(x) = \lim_{x \to a+} f(x) = f(a)$

(d) $\lim_{x \to a-} f(x) = f(a)$

2 If f(x) = |x | +|x - 2|, then

(a) f(x) is continuous at x=0 but not at x=2

(b) f(x) is continuous at x=0 and at x=2

(c) f(x) is continuous at x=2 but not at x=0

(d)None of these

3 Suppose f(x) is defined on [a,b].Then the continuity of f(x) at x=a means

(a) $\lim_{x \to a+} f(x) = f(a)$

(b) $\lim_{x \to a-} f(x) = f(a)$

(c) $\lim_{x \to a+} f(x) = f(b)$

(d) $\lim_{x \to a-} f(x) = f(b)$

4 Suppose f(x) is defined on [a,b].Then the continuity of f(x) at x = b means

(a) $\lim_{x \to b+} f(x) = f(a)$

(b) $\lim_{x \to b-} f(x) = f(a)$

(c) $\lim_{x \to b+} f(x) = f(b)$

(d) $\lim_{x \to b-} f(x) = f(b)$

5 If the function f(x) = $\frac{x(e^{sinx} - 1)}{(1 - cosx)}$is continuous at x = 0, then f(0) is

a) 1

b) 0

c) 2

d) 1/2

6 Let f(x) = x |x|, then f'(0) is equal to

(a)1

(b) -1

(c) 0

(d) None of these

7 The function f(x) = $\begin{cases} \frac{\sin 3x}{x}, x \neq 0 \\ \frac{k}{2}, x = 0 \end{cases}$ is continuous at x=0, then k=

a)3

(b) 6

(c)9

(d) 12

8 The function f(x) = cot x is discontinuous on the set

(a) {x: x= nπ, nϵ Z} (b) {x: x= 2nπ, nϵ Z}
(c) {x: x= n$\pi/2$, nϵ Z} (d) {x: x= (2n+1) π, nϵ Z}

9 The function f(x) = x – [x] , where [.] denotes the greatest integer function is

(a) Continuous everywhere. (b) Continuous at integer points only.
(c) Continuous at non-integer points only (d) Differentiable everywhere

10 If f(x)= -$\sqrt{25-x^2}$, $then\ \lim_{x\to 1}\frac{f(x)-f(1)}{x-1}\ is\ equal\ to$

(a)1/24 (b)1/5

(c) $-\sqrt{24}$ (d)$\frac{1}{\sqrt{24}}$

11 If f(x) = $\begin{cases} x^2+3x+a\ ,\ x\le 1 \\ bx+2, x>1 \end{cases}$ is everywhere differentiable, then the values of a and b are

(a) a=3 & b=5 (b) a=0 & b=5

(c) a=0 & b=3 (d) a=3 & b=3

If f(x) = | cosx - sinx| , then f'($\pi/3$) is equal to

12 (a)$\frac{(\sqrt{3}+1)}{2}$ (b)$\frac{\sqrt{3}}{2}$

(c)$\frac{(\sqrt{3}-1)}{2}$ (d) None of these

13 If x – y = π, then $\frac{dy}{dx}$ =
a) 0 b) 1
c) -1 d) 2

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

a)2x cosx^2 b) 2x cosx

c) 2x sinx^2 d) 2x sinx

15 If 2x + 3y = sinx, then $\frac{dy}{dx}$ =

a)$\frac{sinx-3}{2}$ b) . $\frac{sinx-2}{3}$

c) $\frac{cosx-3}{2}$ d)$\frac{cosx-2}{3}$

16 If y = A sinx + B cosx ,then$\frac{d^2y}{dx^2}$ + y =

a)1

b) 2

c) 0

d) 2

17 If y = e^{x^3} , then $\frac{dy}{dx}$ =

a. 3x$^2e^{x^3}$

b. x$^2e^{x^3}$

c. . 3e^{x^3}

d. e^{x^3}

18 If y = log(logx) , x > 1 , then $\frac{dy}{dx}$ =

a. $\frac{x}{xlogx}$

b. $\frac{logx}{x}$

c. $\frac{x}{logx}$

d. $\frac{1}{xlogx}$

19 If x = 4t and y = $\frac{4}{t}$, then $\frac{dy}{dx}$ =

a. $\frac{1}{t^2}$

b. $\frac{-1}{t^2}$

c. $\frac{2}{t^2}$

d. $\frac{-2}{t^2}$

20 If x = $\sqrt{a^{\sin^{-1}t}}$ and y = $\sqrt{a^{\cos^{-1}t}}$, then $\frac{dy}{dx}$ =

a. $\frac{y}{x^2}$

b. $\frac{-y}{x}$

c. $\frac{x}{t^2}$

d. $\frac{-y}{t^2}$

21 y = $\sin^{-1}\frac{2x}{1+x^2}$, then $\frac{dy}{dx}$ =

a. $\frac{2}{1+x^2}$

b. $\frac{-2}{1+x^2}$

c. $\frac{2}{1-x^2}$

d. $\frac{-2}{1-x^2}$

22 If e^y(x + 1) = 1, then which of the following is true:

a. $\frac{d^2y}{dx^2} = (\frac{dy}{dx})^2$

b. $\frac{d^2y}{dx^2} = \frac{dy}{dx}$

c. $(\frac{d^2y}{dx^2})^2 = (\frac{dy}{dx})^2$

d. $\frac{d^2y}{dx^2} = \frac{dy}{dx}$

23 y = $\cos^{-1}(sinx)$,then $\frac{dy}{dx}$ =

a.0

b. 1

c. -1

d.2

24 The derivative of $\tan^{-1}(\frac{sinx}{1+cosx})$ with respect to x is

a. $\frac{1}{2}$ b. $\frac{x}{2}$
c. $\frac{-1}{2}$ d. $\frac{-x}{2}$

25 If x = a(cost + t sint) and y = a (sint – t cost), (if 0< t <$\frac{\pi}{2}$), then $\frac{d^2 y}{dx^2}$ =

a. $\frac{sec^2 t}{t}$ b.. $\frac{sec^3 t}{t}$
c. $\frac{sec^2 t}{at}$ d. $\frac{sec^3 t}{at}$

26 If $y = \tan^{-1}(\frac{1-x^2}{1+x^2})$ then $\frac{dy}{dx} =$

a. $\frac{1}{1+x^4}$ b. $\frac{-2x}{1+x^4}$
c. $\frac{-1}{1+x^4}$ d. $\frac{x^2}{1+x^4}$

27 The derivative of $log_{10}x$ w.r.t. 'x' is

a. 1/x b. x/10
c. 10/x d. none

28 If y = e^{tanx} then $(\cos^2 x)\frac{d^2y}{dx^2} = \cdots$

a.(1-sin 2x)$\frac{dy}{dx}$ b. – (1+ sin 2x)$\frac{dy}{dx}$
c. (1+ sin 2x)$\frac{dy}{dx}$ d. NONE

29 Let $f(x)$ = $\begin{cases} x+a \ \ if \ x \geq 1 \\ ax^2+1 < 1 \end{cases}$ then f is differentiable at x = 1 , if

a.a= 1 b. a= 0
c. a= 2 d. a= ½

30 Which of the followings is true about the greatest integer function f(x) = [x] ?

a. Everywhere continuous on R b. Nowhere continuous on R
c. Continuous on R – Z d. None of these

31 If $y = \sqrt{\sin x + y}$ then dy/dx =

a.$\frac{cosx}{2y-1}$ b. $\frac{cosx}{1-2y}$
c.$\frac{sinx}{2y-1}$ d. $\frac{sinx}{1-2y}$

32 The value of b for which the function $(x) = \begin{cases} 5x-4 & ; \quad 0 < x \leq 1 \\ 4x^2+3bx & ; \quad 1 < x < 2 \end{cases}$ is continuous at every point of its domain is…

a. -1 b. 0
c. 13/3 d. 1

33 Let $f(x) = |x| + |x - 1|$ then

a. f(x) is differentiable neither at x=0 nor at x=1

b. f(x) is differentiable at x=0 and x=1

c. f(x) is differentiable at x=0 but not at x=1

d. f(x) is differentiable at x=1 but not at x=0

34 For the curve $\sqrt{x} + \sqrt{y} = 1$, $dy/dx \quad at\ (1/4, 1/4)\ is$

a. ½

b. 1

c. -1

d. 2

35 $f(x)$ is a polynomial function with degree 7. Which order derivative of the function will be zero ?

a. 6

b. 7

c. 8

d. 5

Answers for MCQ's

1	c	2	b	3	a	4	d	5	c
6	c	7	b	8	a	9	c	10	d
11	a	12	a	13	B	14	a	15	d
16	c	17	a	18	D	19	b	20	b
21	a	22	a	23	C	24	a	25	d
26	b	27	d	28	C	29	d	30	c
31	a	32	a	33	A	34	c	35	c

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A)** The value of the constant 'k' so that f(x) = $\begin{cases} kx^2, if\ x \leq 2 \\ 3, if\ x > 2 \end{cases}$ is continuous at x =2 is 4/3.

   Reason(R) A function f(x) is continuous at a point x= a of its domain if $\lim_{x \to a} f(x) = f(a)$

2. **Assertion (A)** The function f(x) = $\begin{cases} 12x - 13, if\ x \leq 3 \\ 2x^2 + 5, if\ x > 3 \end{cases}$ is differentiable at x= 3.

   Reason(R) The function f(x) is differentiable at x = c of its domain if Left hand derivative of f at c= Right hand derivative of f at c.

3. **Assertion (A)** f(x) = | x – 1| + | x – 2| is continuous but not differentiable at x =1, 2.

   Reason(R) Every differentiable function is continuous

4. **Assertion (A)** If f(x) = | cosx | , then $f'\left(\frac{\pi}{4}\right) = \frac{-1}{\sqrt{2}}$ and $f'\left(\frac{3\pi}{4}\right) = \frac{1}{\sqrt{2}}$

   Reason(R) $f(x) = |\,cosx\,| = \begin{cases} cosx, if\ 0 \leq x \leq \pi/2 \\ -cosx, if\ \pi/2 < x \leq \pi \end{cases}$

5. **Assertion (A)** $\frac{d}{dx}(x^2 + x + 1)^4 = 4(x^2 + x + 1)^3(2x + 1)$

   Reason(R) $(\boldsymbol{fog})' = \boldsymbol{f}'[\boldsymbol{g}(\boldsymbol{x})].\boldsymbol{g}'(\boldsymbol{x})$

6. **Assertion (A)** If y= tan $5x^0$, then $\frac{dy}{dx} = \frac{5\pi}{180} sec^2(5x^0)$

   Reason(R) $\pi^c = 90^0$

7. **Assertion (A)** If y = $tan^{-1}\left(\frac{cosx+sinx}{sinx-cosx}\right)$, $\frac{-\pi}{4} < x < \frac{\pi}{4}$, then $\frac{dy}{dx} = -1$

   Reason(R) $\frac{cosx + sinx}{sinx - cosx} = tan\left(x + \frac{\pi}{4}\right)$

8. **Assertion (A)** If $x^2 + 2xy + y^3 = 42$, $then\ \frac{dy}{dx} = \frac{2\,(x+y\,)}{(2x+3\,y^2)}$

Reason(R) $$\frac{dy^n}{dx} = ny^{(n-1)}$$

9. **Assertion (A)** If y = $log_7(x^2 + 7x + 4), then\ \frac{dy}{dx} = \frac{(2x+7)}{(x^2+7x+4),}$

Reason(R) $log_b a = \frac{log_e a}{log_e b}$

10. **Assertion (A)** If x = at^2 and y = 2at where 't' is the parameter and 'a' is a constant, then $\frac{d^2y}{dx^2} = \frac{-1}{t^2}$.

Reason(R) $\frac{d^2y}{dx^2} = \frac{d^2y}{dt^2} \div \frac{d^2x}{dt^2}$

11. **Assertion (A)** $\frac{dx^{sinx}}{dx} = x^{sinx}[\,(cosx\,)logx + \frac{sinx}{x}]$

Reason(R) $if\ y = x^{f(x)}\ then\ \frac{dy}{dx} = x^{f(x)}[f'(x)logx + \frac{f(x)}{x}]$

12. **Assertion (A)** f(x)=[x] greatest integer function is not differentiable at x=2

Reason(R) The greatest integer function is not continuous at any integer

13. **Assertion (A)** The derivative of log sinxw.r.t.$\sqrt{cosx}$ is $2\sqrt{cosx}\ cotx\ cosecx$

Reason(R) The derivative of u w.r.t. v is $\frac{\frac{du}{dx}}{\frac{dv}{dx}}$

14. **Assertion (A)** $if\ y = sin^{-1}\frac{2x}{1+x^2}\ then\ \frac{dy}{dx} = \frac{2}{1+x^2}$

Reason(R) $sin\,2\theta = \frac{2tan\theta}{1+tan^2\theta}$

Answers :

1	D	2	A	3	B	4	A	5	A
6	C	7	D	8	E	9	D	10	E
11	A	12	A	13	D	14	A		

CASE STUDY TYPE QUESTIONS

CS 1 Let f(x) be a real valued function, then its

Left Hand Derivative (L.H.D) at the point **a** is **f'(a-) =** $\lim_{x\to 0} \frac{f(a-h)-f(a)}{-h}$ and

Right Hand Derivative (R.H.D) at the point **a** is **f'(a+) =** $\lim_{x\to 0} \frac{f(a+h)-f(a)}{h}$**,** also a

function f(x) is said to be differentiable at **x= a** and if its L.H.D and R.H.D at **x = a**

exist and are equal. For the function f(x) = $\begin{cases} |x-3| & , x \geq 1 \\ \frac{x^2}{4} - \frac{3x}{2} + \frac{13}{4} & , x < 1 \end{cases}$

Answer the following questions:

1 L.H.D of f(x) at x = 1 is

(a) 1 (b). -1

(c) 0 (d) 2

2 f(x) is non differentiable at

(a) x = 1 (b) x = 2

(c) x = 3 (d) x = 4

3 Find the value of f '(2)

(a) 1 (b) 2

(c) 3 (d) -1

4 Find the value of f '(-1)

(a) 1 (b) -2

(c) 3 (d) -1

5 R.H.D of f(x) at x = 1 is

(a) 1 (b) -1

(c) 0 (d) 2

CS 2 A function f(x) is said to be continuous in an open interval (a,b) , if it is continuous at every point in the interval.

A function f(x) is said to be continuous in an closed interval [a,b] , if f(x) is continuous in (a,b) and

$\lim_{h\to 0} f(a+h)$ = **f(a)** and $\lim_{h\to 0} f(b-h)$ = **f(b).**

If function f(x) = $\begin{cases} \frac{\sin(a+1)x+\sin x}{x}, & x<0 \\ c, & x=0 \\ \frac{\sqrt{x+bx^2}-\sqrt{x}}{bx^{\frac{3}{2}}}, & x>0 \end{cases}$

Is continuous at x = 0 ,**then answer the following questions**:

1 The value of **a** is :

(a) -3/2 (b) 1/2

(c) 0 (d) -1/2

2 The value of **b**is :

(a) 1 (b) -1

(c) 0 (d) Any real number except 0

3 The value of **c**is :

(a) 1 (b) 1/2

(c) -1 (d) -1/2

4 The value of **c - a** **i**s :

(a) 1 (b) -1

(c) 0 (d) 2

5 The value of **a +c** is :

(a) 1 (b) -1

(c) 0 (d) 2

CS 3 Let x = f(t) and y = g(t) be the parametric forms with **t** as a parameter, then

$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx} = \frac{g'(t)}{f'(t)}$ where f '(t)$\neq$ 0.

On the basis of the above information answer the following questions:

1 The derivative of f (tanx) w.r.t g (secx) at x = $\frac{\pi}{4}$, where f ' (1) = 2 and g ' ($\sqrt{2}$) = 4 is :

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$

(c) 0 (d) 1

2 The derivative of $\sin^{-1}(\frac{2x}{1+x^2})$ w.r.t $\cos^{-1}(\frac{1-x^2}{1+x^2})$ is :

(a) 1 (b) -1

(c) 2 (d) 4

3 The derivative of e^{x^3} w.r.t logx is :

(a) e^{x^2} (b) $3x^2 .2. e^{x^3}$

(c) $3x^3. e^{x^3}$ (d) $3x^2e^{x^2}$ + 3x

4 The derivative of $\cos^{-1}(2x^2 - 1)$ w.r.t $\cos^{-1} x$ is :

(a) 2 (b) $\frac{-1}{2\sqrt{1-x^2}}$

(c) $\frac{2}{x}$ (d) $1 - x^2$

5 If y = $\frac{1}{4}u^4$ and u = $\frac{2}{3}x^3$, then $\frac{dy}{dx}$ = :

(a) $\frac{2}{27}x^9$ (b) $\frac{16}{27}x^{11}$

(c) $\frac{8}{27}x^9$ (d) $\frac{2}{27}x^{11}$

CS 4 A function f(x) will be discontinuous at **x = a** if f(x) has

1.Discontinuity of first kind:

$\lim_{h\to 0} f(a-h)$ **and** $\lim_{h\to 0} f(a+h)$ **, both exist,** but are **not equal**.

It is also known as irremovable discontinuity.

2.Discontinuity of second kind:

If **none** of the limits $\lim_{h\to 0} f(a-h)$ **and** $\lim_{h\to 0} f(a+h)$ **exist.**

3.Discontinuity of third kind:

Removable discontinuity

If $\lim_{h\to 0} f(a-h)$ **and** $\lim_{h\to 0} f(a+h)$ both **exist** and are **equal** , but **not equal** to f(a).

Based on the above information answer the following questions:

1 If f(x) = $\begin{cases} \frac{x^2-9}{x-3}, & x \neq 3 \\ 4, & x = 3 \end{cases}$

Then at x = 3

(a) f has removable discontinuity (b) f is continuous

(c) f has irremovable discontinuity (d) None of these

2 Let f(x) = $\begin{cases} x+2, if x \leq 4 \\ x+4, if x > 4 \end{cases}$

Then at x = 4 ,

(a) f has irremovable discontinuity. (b) f is continuous

(c) f has removable discontinuity (d) None of these

3 If f(x) = $\begin{cases} \frac{x^2-4}{x-2}, & x \neq 2 \\ 5, & x = 2 \end{cases}$

Then at x = 2

(a) f has removable discontinuity (b) f is continuous

(c) f has irremovable discontinuity (d) f is continuous if f(2) = 3.

4 Let f(x) = $\begin{cases} \frac{e^x - 1}{\log(1+2x)}, & x \neq 0 \\ 7, & x = 0 \end{cases}$

Then at x = 0,

(a) f has removable discontinuity (b) f is continuous

(c) f has irremovable discontinuity (d) f is continuous if f(0) = 2.

5 If f(x) = $\begin{cases} \frac{x-|x|}{x}, & x \neq 0 \\ 2, & x = 0 \end{cases}$

Then at x= 2,

(a) f has removable discontinuity (b) f is continuous

(c) f has irremovable discontinuity (d) f has discontinuity of 2^{nd} kind

CS 5 A function f(x) is said to be continuous at **x = c** ,if the function is defined at x = c and if the value of the function at x = c equals the limit of the function at x = c .

i. e $\lim_{x \to c} f(x)$ = **f(c) .**

If the function f(x) is not continuous at **x = c** , we say that f is discontinuous at c, and c is called the point of discontinuity of f.

Based on the above information answer the following questions:

1 The number of points of discontinuity of f(x) =[x], in [3,7] is :

(a) 4 (b) 5

(c) 6 (d) 8

2 Suppose f and g are two real functions continuous at a real number c then :

(a)f + g is continuous at x = c (b) f + g is discontinuous at x = c.

(c) f + g may or may not be continuous at x = c (d) None of these

3 Find the value of k, so that the given function f(x) is continuous at x = 5.

f (x) = $\begin{cases} kx + 1, & x \leq 5 \\ 3x - 5, & x > 5 \end{cases}$

(a) 3/5 (b) 1/5

(c) 4/5 (d) 9/5

4 If f(x) = $|x|$ is continuous and g(x) = sinx is continuous , then:

(a) sin$|x|$ is continuous. (b) sin$|x|$ is discontinuous.

(c) sin $|x|$ may or may not be continuous. (d) None of these.

5 Find the value of k, so that the given function f(x) is continuous at x = 2.

$$f(x) = \begin{cases} kx^2, & x \leq 2 \\ 3, & x > 2 \end{cases}$$

(a) 1 (b) 1/4

(c) 3/4 (d) 11/4

CASE STUDY

CS-1	1) b	2) c	3) d	4) b	5) d
CS-2	1) a	2) d	3) b	4) d	5) b
CS-3	1) a	2) a	3) c	4) a	5) b
CS-4	1) a	2) a	3) a	4) a	5) c
CS-5	1) a	2) a	3) d	4) a	5) c

APPLICATIONS OF DERIVATIVES

Multiple choice questions -

INCREASING AND DECREASING FUNCTIONS

1 Find the intervals in which the functions f(x) = $x^2 - 4x + 6$ is strictly increasing

(a) $(-\infty, 2) \cup (2, \infty)$ (b) $(2, \infty)$

(c) $(-\infty, 2)$ (d) $(-\infty, 2] \cup [2, \infty)$

2 The function $f(x) = 3 - 4x + 2x^2 - \frac{1}{3}x^3$ is

(a) Increasing on $\Re$ (b) Decreasing on $\Re$

(c) Neither increasing nor decreasing (d) None of these

3 The real function f(x) = $2x^3 - 3x^2 - 36x + 7$ is:

(a) Strictly increasing in $(-\infty, -2)$ and strictly decreasingin$(-2, \infty)$ (b) Strictly decreasing in $(-2, 3)$

© Strictly decreasing in $(-\infty, 3)$ and strictly increasing in $(3, \infty)$ (d) Strictly decreasing in $(-\infty, -2) \cup (3, \infty)$

4 The function f(x) = $-x^3 + 3x^2 - 3x + 100, \forall x \in \mathcal{R}$ is

(a) Strictly increasing (b) Strictly decreasing

(c) Neither increasing nor decreasing (d) Decreasing

5 In which interval the function f(x) = $3x^2 - 7x + 5$ is strictly increasing

(a) $\left(-\infty, \frac{7}{6}\right)$ (b) $(-\infty, \infty)$

(c) $\left(0, \frac{7}{6}\right)$ (d) $\left(\frac{7}{6}, \infty\right)$

6 The interval on which the function f(x) = $2x^3 + 9x^2 + 12x - 1$ is decreasing is

(a) $[-1, \infty)$ (b) $[-2, -1]$

(c) $(-\infty, -2]$ (d) $[-1, 1]$

7 The function $f(x) = 1 - x^3 - x^5$ is decreasing for

(a) $1 \le x \le 5$ (b) $x \le 1$

(c) $x \ge 1$ (d) all values of x

8 If y = x(x – 3)^2 decreases for the values of ‘x’ given by

(a) $1 < x < 3$ (b) $x < 0$

(c) $x > 0$ (d) $0 < x < \frac{3}{2}$

9 The function $f(x) = x - \frac{1}{x}, x \in \Re, x \neq 0$ is

(a) Increasing for all $x \in \Re$ (b) Decreasing for all $x \in \Re$

(c) Increasing for all $x \in (0, \infty)$ (d) Neither increasing nor decreasing

10 The function $f(x) = \frac{5}{x} + 2$ is strictly decreasing in

(a) $\mathcal{R}$ (b) $\mathcal{R} - \{0\}$

(c) $[0, \infty)$ (d) None

11 Find the interval in which f(x) = log (1 + x) – $\frac{x}{2+x}$ is increasing.

(a) $(0, \infty)$ (b) $(-\infty, 0)$

(c) $(-\infty, 3)$ (d) none of these

12 The function f(x) = tanx – x

(a) Always increases (b) Always decreases

(c) Never increases (d) Sometimes increases and sometimes decreases

13 The function f(x) = x + sinx is

(a) Always increasing (b) Always decreasing

(c) Increasing for certain range of x (d) None of these

14 The interval in which $f(x) = sinx + cosx, 0 \leq x \leq 2\pi$ is strictly decreasing in

(a) $\left[0, \frac{\pi}{2}\right]$ (b) $\left(\frac{\pi}{4}, \frac{5\pi}{4}\right)$

(c) $(\frac{5\pi}{4}, 2\pi]$ (d) $[0, \frac{\pi}{4})$

15 The function f(x) = 4sin^{3}x – 6sin^{2}x + 12 sinx + 100 is strictly

(a) Increasing in $\left(0, \frac{3\pi}{2}\right)$ (b) Decreasing in $\left(\frac{\pi}{2}, \pi\right)$

(c) Decreasing in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d) Decreasing in $\left(0, \frac{\pi}{2}\right)$

16 The length of the longest interval, in which the function f(x) = 3sinx – 4sin^{3}x is increasing, is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$

(c) $\frac{3\pi}{2}$ (d) π

17 The function f(x) = sin3x is strictly decreasing on

(a) $\left[0, \frac{\pi}{6}\right]$ (b) $\left[0, \frac{\pi}{4}\right]$

(c) $\left[\frac{\pi}{6}, \frac{\pi}{2}\right]$ (d) $\left[0, \frac{\pi}{2}\right]$

18 Which of the following functions is decreasing on $\left(0, \frac{\pi}{2}\right)$

(a) Sin2x (b) tan x

(c) cosx (d) cos3x

19 The function f(x) = logx is strictly increasing on

(a) $(0, \infty)$ (b) $(-\infty, 0)$

(c) $(-\infty, \infty)$ (d) None

20 The function y = $2x^2 - \log|x|$, $x \neq 0$ decreases when x ∈

(a) $(-1, 1)$ (b) $\mathcal{R} - \{-\frac{1}{2}, \frac{1}{2}\}$

(c) $(-\frac{1}{2}, 0) \cup (\frac{1}{2}, \infty)$ (d) $(-\infty, -\frac{1}{2}) \cup (0, \frac{1}{2})$

21 The function f(x) = e^{2x} is strictly increasing on

(a) $(0, \infty)$ (b) $(-\infty, 0)$

(c) $(-\infty, \infty)$ (d) None

22 The intervals in which $y = x^2 e^{-x}$ is increasing

(a) $(-\infty, \infty)$ (b) (– 2, 0)

(c) $(2, \infty)$ (d) (0, 2)

23 The function f(x) = x – [x] in the interval [0, 1] is

(a) Increasing (b) Decreasing

(c) Neither increasing and decreasing (d) None of the above.

24 The function f(x) = $x^3 - 9kx^2 + 27x + 30$ is increasing on $\mathcal{R}$, if

(a) $-1 \leq k < 1$ (b) k <– 1 or k > 1

(c) 0 < k < 1 (d) – 1 < k < 0

25 The value of 'b'for which the function f(x) = x + cosx + b is strictly decreasing over $\mathcal{R}$ is :

(a) b < 1 (b) No value of b exists

(c) b ≤ 1 (d) b ≥ 1

Answers:

Q: 1	(b)	Q: 2	(b)	Q: 3	(b)	Q: 4	(b)	Q: 5	(d)
Q: 6	(b)	Q: 7	(d)	Q: 8	(a)	Q: 9	(a)	Q: 10	(b)
Q: 11	(a)	Q: 12	(a)	Q: 13	(a)	Q: 14	(b)	Q: 15	(b)
Q: 16	(a)	Q: 17	(c)	Q: 18	(c)	Q: 19	(a)	Q: 20	(d)
Q: 21	(c)	Q: 22	(d)	Q: 23	(a)	Q: 24	(a)	Q: 25	(b)

RATE OF CHANGE OF QUANTITIES

01 The side of an equilateral triangle is increasing at the rate of 2 cm/s. The rate at which area increases when the side is 10 cm is

(a) 10 cm^2/sec (b) 10/3 cm^2/sec

(c)√3 cm^2/sec (d) 10)√3 cm^2/sec

02 The radius of a sphere is changing at the rate of 0.1 cm/sec. the rate of change of its surface area when the radius is 200 cm is

(a) 8π cm^2/sec (b) 12πcm^2/sec

(c) 160πcm^2/sec (d) 200 cm^2/sec

03 A cone whose height is equal to its diameter is increasing in volume at the rate of 40 cm3/sec. At what rate is the radius is increasing when its circular base area is 1 m^2?

(a) 1 mm/sec (b) 0.001 cm/sec

(c) 2 mm/sec (d) 0.002 cm/sec

04 The distance moved by the particle in time 't' is given by $x = t^3 - 12t^2 + 6t + 8$. At the instant when its acceleration is zero, the velocity is?

(a)42 (b) – 42

(c) 47 (d) – 48

05 For what values of 'x' is the rate of increase of x3 – 5x2 + 5x + 8 is twice the rate of increase of 'x'?

(a) – 3, –1/3 (b) – 3, 1/3

(c) 3, –1/3 (d) 3, 1/3

06 The radius of a circular plate is increasing at the rate of 0.01 cm/sec. The rate of increase of its area when the radius is 12 cm, is

(a) 144 π cm^2/sec (b) 2.4 π cm^2/sec

(c) 0.24 π cm^2/sec (d) 0.024 π cm^2/sec

07 If the rate of change of volume of a sphere is equal to the rate of change of its radius, then its radius is equal to

(a) 1 unit (b) $\sqrt{2\pi}$ units

(c) $\frac{1}{\sqrt{2\pi}}$ units d) $\frac{1}{2\sqrt{\pi}}$ units

08 If the rate of change of area of a circle is equal to the rate of change of its diameter, then its radius is equal to

(a) $\frac{2}{\pi}$ units (b) $\frac{1}{\pi}$ units

(c)$\frac{\pi}{2}$ units (d) π units

09 The distance moved by a particle travelling in a straight line in t seconds is given by $s = 45t + 11t^2 - t^3$. The time taken by the particle to come to rest is

(a) 9 sec (b) 5/3 sec

(c) 3/5 sec (d) 2 sec

10 A man 2 meters tall walks away from a lamp post 5 meters height at the rate of 4.8km/hr. The rate of increase of the length of his shadow is

(a) 1.6 km/hr (b) 6.3 km/hr

(c) 5 km/hr (d) 3.2 km/hr

Answers:

Q: 01	(d)	Q: 02	(c)	Q: 03	(d)	Q: 04	(b)	Q: 05	(d)
Q: 06	(c)	Q: 07	(d)	Q: 08	(b)	Q: 09	(a)	Q: 10	(d)

MAXIMA AND MINIMA

01 The function $f(x) = x^x$ has a stationary point at

(a) x = e (b) x = $\frac{1}{e}$

(c) x = 1 (d) x = $\sqrt{e}$

02 At $x = \frac{5\pi}{6}$, f(x) = 2 sin3x + 3 cos3x is

(a) Maximum (b) Minimum

(c) Zero (d) Neither maximum nor minimum

03 The function f(x) = $2x^3 - 3x^2 - 12x + 4$, has

(a) Two points of local maximum (b) Two points of local minimum

(c) One maxima and one minima (d) No maxima or minima

04 Find all the points of local maxima and local minima of f(x) = $(x - 1)^3 (x + 1)^2$

(a) $1, -1, -\frac{1}{5}$ (b) 1, – 1

(c) $1, -\frac{1}{5}$ (d) $-1, -\frac{1}{5}$

05 Find the points at which f(x) = $(x - 2)^4 (x + 1)^3$ has points of inflection

(a) x = – 1 (b) x = 1

(c) x = 2 (d) x = $\frac{1}{2}$

06 If x is real, the minimum value of $x^2 - 8x + 17$ is

(a) – 1 (b) 0

(c) 1 (d) 2

07 The least value of the function $f(x) = ax + \frac{b}{x}$ (a > 0, b > 0, x > 0) is

(a) $\sqrt{ab}$ (b) $2\sqrt{ab}$

(c) $\frac{\sqrt{ab}}{2}$ (d) ab

08 For all real x, the minimum value of $\frac{1-x+x^2}{1+x+x^2}$ is

(a) 0 (b) 1

(c) 3 (d) $\frac{1}{3}$

09 The maximum value of $[x(x-1)+1]^{\frac{1}{3}}, 0 \le x \le 1$ is

(a) $(3)^{\frac{1}{3}}$ (b) $\frac{1}{2}$

(c) 1 (d) 0

10 Find the maximum value of f(x) = sin(sinx) for all $x \in \Re$

(a) – sin 1 (b) sin 6

(c) sin 1 (d) – sin 3

11 The maximum value of sinx. cosx is

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$

(c) $\sqrt{2}$ (d) $2\sqrt{2}$

12 The maximum value of $x^{\frac{1}{x}}, x > 0$ is

(a) $e^{\frac{1}{e}}$ (b) $\left(\frac{1}{e}\right)^e$

(c) 1 (d) None

13 The maximum value of $\left(\frac{1}{x}\right)^x$ is:

(a) e (b) e^e

(c) $e^{\frac{1}{e}}$ (d) $(\frac{1}{e})^{\frac{1}{e}}$

14 The function $f(x) = \frac{logx}{x}$ has maximum at x =

(a) $\frac{1}{e}$ (b) e

(c) $-\frac{1}{e}$ (d) – e

15 It is given that at x = 1, the function f(x) = $x^3 - 12x^2 + kx + 7$ attains maximum value, then the value of 'k'

(a) 10 (b) 12

(c) 21 (d) 13

16 The sum of two positive numbers is 14 and their sum is least, then the numbers are

(a) 6, 7 (b) 7, 7

(c) 10, 4 (d) 9, 5

17 Divide 20 into two parts such that the product of one part and the cube of the other is maximum. The two parts are

(a) 10, 10 (b) 12, 8

(c) 15, 5 (d) None of these

18 The area of a trapezium is defined by function f and given by $f(x) = (10 + x)\sqrt{100 - x^2}$, then the area when it is maximised is:

(a) 75 cm^2 (b) $7\sqrt{3}$ cm^2

(c) $75\sqrt{3}$ cm^2 (d) 5cm^2

19 The point on the curve $x^2 = 2y$ which is nearest to the point (0, 5)

(a) $(2\sqrt{2}, 4)$ (b) $(2\sqrt{2}, 0)$

(c) (0, 0) (d) (2, 2)

20 The smallest value of the polynomial $x^3 - 18x^2 + 96x$ in [0, 9] is

(a) 126 (b) 0

(c) 135 (d) 160

21 Let f(x) = $2x^3 - 3x^2 - 12x + 5$ on [– 2, 4]. The relative maximum occurs at x =

(a) – 2 (b) – 1

(c) 2 (d) 4

22 The absolute minimum value of the function f(x) = 2sinx in $\left[0, \frac{3\pi}{2}\right]$ is

(a) – 2 (b) 2

(c) 1 (d) – 1

23 The least value of the function f(x) = 2cosx + x in the closed interval $\left[0, \frac{\pi}{2}\right]$ is:

(a) 2
(b) $\frac{\pi}{6} + \sqrt{3}$
(c) $\frac{\pi}{2}$
(d) The least value does not exist

24 For what value of 'x' in the interval [0, π] does the function f(x) = sin2x attains the maximum value

(a) $\frac{\pi}{2}$
(b) $\frac{\pi}{4}$
(c) $\frac{\pi}{3}$
(d) $\frac{\pi}{6}$

25 The maximum value of the slope of the curve $y = -x^3 + 3x^2 + 9x - 27$ is:

(a) 0
(b) 12
(c) 16
(d) 32

26 The shortest distance between line y – x = 1 and curve $x = y^2$ is

(a) $\frac{4}{\sqrt{3}}$
(b) $\frac{\sqrt{3}}{4}$
(c) $\frac{3\sqrt{2}}{8}$
(d) $\frac{8}{3\sqrt{2}}$

27 The function $f(x) = x + \frac{4}{x}$ has

(a) A local maximum at x = 2 and local minima at x = – 2
(b) A local minimum at x = 2 and local maximum at x = – 2
(c) Absolute maxima at x = 2 and absolute minima at x = – 2
(d) Absolute minima at x = 2 and absolute maxima at x = – 2

Q: 01	(b)	Q: 02	(a)	Q: 03	(c)	Q: 04	(a)	Q: 05	(a)
Q: 06	(c)	Q: 07	(b)	Q: 08	(d)	Q: 09	(c)	Q: 10	(c)
Q: 11	(b)	Q: 12	(a)	Q: 13	(c)	Q: 14	(b)	Q: 15	(c)
Q: 16	(b)	Q:17	(c)	Q: 18	(c)	Q: 19	(a)	Q: 20	(b)
Q: 21	(b)	Q: 22	(a)	Q: 23	(c)	Q: 24	(b)	Q: 25	(b)
Q: 26	(c)	Q: 27	(b)						

Answers:

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1) **Assertion (A)** : The function f(x) = $x^3 - 3x^2 + 6x - 100$ is strictly increasing on R

Reason (R) : A strictly increasing functions is an injective function.

2) **Assertion (A)** : The function $y = [x(x-2)]^2$ is increasing in (0, 1) ∪ (2, ∞)

Reason (R) : $\frac{dy}{dx} = 0$, when x = 0, 1, 2.

3) **Assertion** (A) : The function $y = \log(1+x) - \frac{2x}{2+x}$ is decreasing throughout its domain.

Reason (R) : The domain of the function $y = \log(1+x) - \frac{2x}{2+x}$ is (- 1, ∞).

4) **Assertion (A):** $f(x) = \frac{1}{x-7}$ is decreasing $x \in \mathcal{R} - \{7\}$.

Reason(R) :$f'(x) < 0, \forall x \neq 7$.

5) **Assertion (A)** **:** $f(x) = e^x$ is an increasing function, $\forall x \in \mathcal{R}$

Reason (R) **:**If $f'(x) \leq 0$, then f(x) is an increasing function.

6) **Assertion (A)** **:**Let $f(x) = e^{\frac{1}{x}}$ is defined for all real values of x.

Reason **:** $f(x) = e^{\frac{1}{x}}$ is always decreasing as $f'(x) < 0$ in $x \in \mathcal{R}$

7) **Assertion (A)** **:** $f(x) = log x$is defined for all x∈(0, ∞).

Reason (R) : If $f'(x) > 0$, then f(x) is strictly increasing function.

8) **Assertion (A)** :If $f(x) = \log(cosx)$, x > 0 is strictly decreasing in $\left(0, \frac{\pi}{2}\right)$.

Reason (R) :If $f'(x) \geq 0$, then f(x) is strictlyincreasing function

9) **Assertion (A)** :If $f(x) = \log(sinx)$, x > 0 is strictly decreasing in $\left(\frac{\pi}{2}, \pi\right)$.

Reason (R) :If $f'(x) \geq 0$, then f(x) is strictly increasing function

10)Consider the function f(x) = $\sin^4 x + \cos^4 x$.

Assertion (A): f(x) is increasing in $\left[0, \frac{\pi}{4}\right]$.

Reason (R): f(x) is decreasing in $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$.

11)**Assertion (A)** :If $f(x) = \tan^{-1}(sinx + cosx)$, x > 0 is always strictly increasing function in the interval $x \in \left(0, \frac{\pi}{4}\right)$

Reason (R) :For the given function f(x), $f'(x) > 0$if $x \in \left(0, \frac{\pi}{4}\right)$.

12)**Assertion (A)** :If $f(x) = \sin\left(2x + \frac{\pi}{4}\right)$ is strictly increasing in $x \in \left(\frac{3\pi}{8}, \frac{5\pi}{8}\right)$

Reason (R) :The function given above is strictly increasing and decreasing in$\left(\frac{3\pi}{8}, \frac{5\pi}{8}\right)$

13)**Assertion (A)** :If $f(x) = \cos\left(2x + \frac{\pi}{4}\right)$ is strictly increasing in $x \in \left(\frac{3\pi}{8}, \frac{7\pi}{8}\right)$

Reason (R) :The function given above is strictly increasing in $\left(\frac{3\pi}{8}, \frac{7\pi}{8}\right)$

14)**Assertion (A)** :If $f(x) = a(x + \sin x)$ is increasing function if a$\in (0, \infty)$

Reason (R) :The given function f(x) is increasing only if a$\in (0, \infty)$

15)**Assertion (A)** :For all values of 'a', $f(x) = sinx - ax + b$ is decreasing on $x \in \mathcal{R}$.

Reason (R) :Given function f(x) is decreasing only if a$\in [1, \infty)$

16)**Assertion** :function $f(x) = x + \frac{1}{x}$ is strictly increasing in the interval (-1, 1)

Reason : Derivative f'(x) < 0 in the interval

17)**Assertion**: Both sinx and cosx are decreasing functions in $\left(\frac{\pi}{2}, \pi\right)$

Reason : If a differentiable function decreases in (a, b), then its derivatives also decreases in (a, b).

18)**Assertion**: function f(x) = $x^3 - 3x^2 + 3x + 2$ is always increasing

Reason(R): Derivative f'(x) is always negative.

19)**Assertion** : y = sinx is increasing in the interval $\left(\frac{\pi}{2}, \pi\right)$

Reason : $\frac{dy}{dx}$ is negative in the given interval

20)**Assertion:** Let f: R →R be a function such that f(x) = $x^3 + x^2 + 3x$ + sinx. Then f is an increasing function.

Reason : If $f'(x_0) < 0$, then f(x) is decreasing function.

Answers :

1	B	2	B	3	D	4	A	5	C
6	A	7	A	8	B	9	D	10	B
11	A	12	C	13	A	14	D	15	D
16	D	17	C	18	C	19	D	20	B

CASE STUDY TYPE QUESTIONS

CS 1 A potter made a mud vessel, where the shape of the pot is based on f(x) = |x − 3| + | x-2|, where f(x) represents the height of the pot.

1 When x > 4 What will be the height in terms of x ?

2 When the x value lies between (2,3) then what is the function?

CS 2 The shape of a toy is given as $f(x) = 6(2x^4 - x^2)$. To make the toy beautiful 2 sticks which are perpendicular to each other were placed at a point (2,3), above the toy.

1 Which value is abscissa of critical point?
2 Find the second order derivative of the function at x = 5.
3 At which of the following intervals will f(x) be increasing?

CS 3 $P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.

1 What will be the production when the profit is maximum?

2 What will be the maximum profit?

3 Find the interval in which the profit is strictly increasing.

4 When the production is 2units what will be the profit of the company?

5 What will be production of the company when the profit is Rs. 38,250?

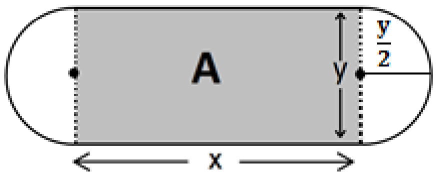
CS 4 The Relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$ where x is the number of days exposed to sunlight.

1 What is the rate of growth of the plant with respect to sunlight?
2 What is the number of days it will take for the plant to grow to the maximum height?
3 What is the maximum height of the plant?
4 What will be the height of the plant after 2 days?

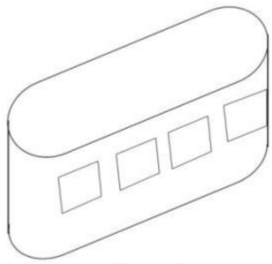
5 If the height of the plant is $\frac{7}{2}$ cm, then find the number of days it has been exposed to the sunlight ?

CS 5 An architect designs a building for a multi-national company. The floor consists of a rectangular region with semicircular ends having a perimeter of 200m as shown below:

Design of Floor



Building



Based on the above information answer the following:

1 If x and y represent the length and breadth of the rectangular region, then write the relation between the variables 'x' and 'y'?

2 Express the area of the rectangular region A as a function of x ?

3 Write the maximum value of thearea A ?

4 The CEO of the multi-national company is interested in maximizing the area of the whole floor including the semi-circular ends. For this to happen, whtat should be the valve of x?

5 Write the extra area generated if the area of the whole floor is maximized?

CS 6 Sonam wants to prepare a sweet box for Diwali at home. For making lower part of box, she takes a square piece of card board of side 18cm. based on the above information, answer the following questions.

Based on the above information, Answer the following questions.

1 If x cm be the length of each side of the square cardboard which is to be cut off from corner of the square piece of side 18 cm, then write the interval in which x must lie?

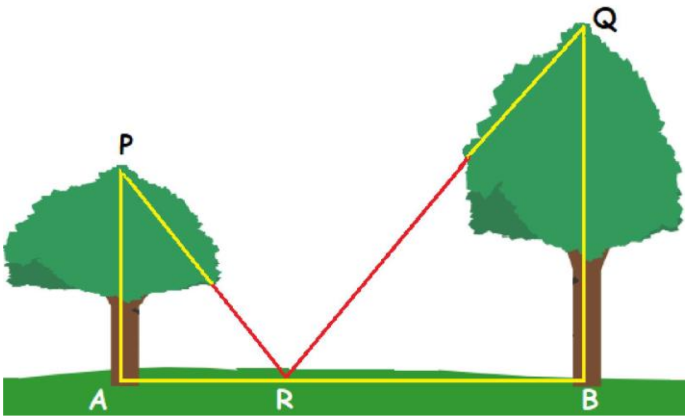
2 Express the volume of the open box formed by folding up the cutting corner in terms of 'x'?

3 Write the values of x for which $\frac{dV}{dx} = 0$?

4 Sonam is interested in maximizing the volume of the box. So, what should be the side of the square to be cut off so that the volume of the box is maximum?

5 What is the maximum value of the volume ?

CS 8 Reeta goes for walk in a Community Park daily. She notices two specific trees in a line (as seen in the figure below), whose heights are AP =16 m and BQ = 22 m respectively, are 20 m apart from each other. She stands at a point (*say*, at R) in between these trees such that AR = x m.



Using the information given above, answer the following:

1 Express $RP^2 + RQ^2$ in terms of 'x'?

2 Find $\frac{d}{dx}(RP^2 + RQ^2)$in terms of 'x'?

3 If $RP^2 + RQ^2$ is minimum, then find 'x'?

4 If $f(x) = RP^2 + RQ^2$, and $f'(x) = 20$, then find 'x'?

5 What is the distance BR, for the value of x obtained above Q.NO.(3)?

CS 8 A mobile company in a town has 500 subscribers on its list and collects fixed charges of Rs. 300/-per subscriber per year.The company proposes to increase the annual subscription and it is believed that for everyincrease of RS.1/-, one subscriber will discontinue the service of this company.

Based on the information given above, answer the following :

1 Suppose the mobile company increases Rs.x/-, then write the function R (x), which represents
the earning of the company?

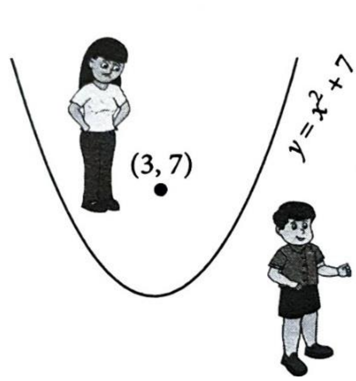
2 $Write\ \frac{d}{dx}[R(x)]$?

3 $Write\ \frac{d^2}{dx^2}[R(x)]$?

4 What increase will bring maximum earning for the company?

5 What is the change in the earning of company after the increment in the subscription is rolled out by the mobile company?

CS 9 A student Arun is running on a playground along the curve given by $y = x^2 + 7$. Another student Manita standing at point (3, 7) on playground wants to hit Arun by paper ball when Arun is nearest to Manita.



Based on the above information, answer the following questions.

1 Write Arun's position at any value of 'x' in co-ordinate form.

2 Write the distance (say D) between Arun and Manita in terms of 'x'.

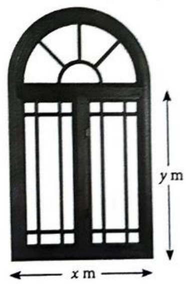
3 For which real value (s) of first derivative of D^2w.r.t. 'x' will vanish?

4 Find the position of Arun when Manita will hit the paper hall.

5 Write the minimum value of D?

CS 10

Rohan, a student of class XII, visited his uncle's flat with his father. He observe that the window of the house is in the form of a rectangle surmounted by a semi circular opening having perimeter 10m as shown in the figure.



Based on the above information, answer the following questions:

1 If x and y represents the length and breadth of the rectangular region, then write the relation between x and y ?

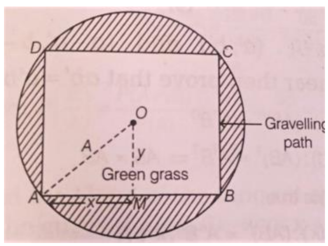
2 Write the area (A) of the window ?

3 Rohan is interested in maximizing the area of the whole window, for this to happen, write the value of 'x' ?

4 Write the Maximum area of the window?

5 For maximum value of A, what isthe breadth of rectangular part of the window?

CS 11 In a society there is a garden in the shape of rectangle inscribed in a circle of radius OA =10 m as shown in the figure.



Based on the above information, answer the following questions.

1 If 2x and 2y denotes the length and breadth in meters, of the rectangular part, then write the relation between the variables ?

2 Write the area (A) of green grass, in terms of x?

3 Write the maximum value of A ?

4 Write the length of rectangle, when A is maximum?

5 Find the area of gravelling path ?

CS 12 Shreya got a rectangular parallelepiped shaped box and spherical ball inside it as return gift. Sides of the box are k, 2k, k/3, while radius of the ball is r.

Based on the above information, answer the following questions.

1 If S represents the sum of volume of parallelopiped and sphere, then write S in terms of 'k' and 'r'.

2 If sum of the surface areas of box and ball are given to be constant k^2, then write 'x'?

3 Find the radius of the ball, when S is minimum?

4 Write the Relation between length of the box and radius of the ball ?

5 Write the Minimum value of S?

CS 13 A tin can manufacturer designs a cylindrical tin can for a company making sanitizer and disinfector. The tin can is made to hold 3 liters of sanitizer or disinfector.

Based on the above information, answer the following questions.

1 If 'r' cm be the radius and 'h' cm be the height of the cylindrical tin can, then the surface area expressed as a function of 'r' as

2 The radius that will minimize the cost of the material to manufacture the tin can is

3 The height that will minimize the cost of the material to manufacture the tin can is

4 If the cost of material used to manufacture the tin can is Rs.100/m^2 and $\sqrt[3]{\frac{1500}{\pi}} \approx 7.8$, then minimum cost is approximately

5 To minimize the cost of the material used to manufacture the tin can, we need to minimize the _______.

CS 14 Read the following passage and answer the questions given below:

The relation between the height of the plant ('y' in cm) with respect to its exposure to the sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$, where 'x' is the number of days exposed to the sunlight for x ≤ 3.

1 Find the rate of growth of the plant with respect to the number of days exposed to the sunlight. 2 Marks

2 Does the rate of growth of the plant increase or decrease in the first three days? What will be the height of the plant after 2 days? 2 Marks

CASE STUDY:

CS-1	1. 2X – 5	2.1			
CS-2	1.$\pm\frac{1}{2}$	2.3588	3.$\left(-\frac{1}{2},0\right)\cup\left(\frac{1}{2},\ \infty\right)$		
CS-3	1.12.5	2. Rs.38281.25	3. (0, 12.5)	4.Rs.37, 730	5. 15
CS-4.	1. 4 – x	2. 4	3. 8 cm	4. 6 cm	5.1
CS-5.	1. 2x + π y = 200	2.$\frac{2}{\pi}(100x-x^2)$	3.$\frac{5000}{\pi}m^2$	4.0 m	5. No change. Both areas are equal
CS-6.	1. (0, 9)	2.$V=x(18-2x)(18-2x)$	3. 3, 9	4. 3 cm	5. 432 cm^3
CS – 7	1.2x^2 – 40 x + 1140	2. 4x – 40	3. 10m	4.15.0 m	5.10.0m
CS – 8	1.150000 + 200 x – x^2	2. 200 – 2x	3. – 2	4. Rs.100/-	5. Rs.10000/-
CS - 9	1.(x, x^2 + 7)	2.$\sqrt{(x-3)^2+x^4}$	3.1	4. (1, 8)	5.$\sqrt{5}$
CS – 10	1. 2x + 2y = 10	2. $A=5x-\frac{x^2}{2}-\frac{\pi x^2}{8}$	3. $\frac{20}{4+\pi}$	4. $\frac{50}{4+\pi}$	5. $\frac{10}{4+\pi}$
CS – 11	1. $x^2+y^2=100$	2. $4x\sqrt{100-x^2}$	3. 200 m^2	4. $10\sqrt{2}$ m	5. 100 (π - 2) m^2
CS – 12	1. $\frac{2k^3}{3}+\frac{4}{3}\pi r^3$	2. $\sqrt{\frac{k^2-4\pi r^2}{6}}$	3. $\sqrt{\frac{k^2}{54+4\pi}}$	4. k = 3r	5. $\frac{k^3}{3(4\pi+54)^{\frac{1}{2}}}$
CS – 13	1. $2\pi r^2+\frac{6000}{r}$	2. $\sqrt[3]{\frac{1500}{\pi}}$ cm	3. $2\sqrt[3]{\frac{1500}{\pi}}$ cm	4. Rs.11.538	5. Total surface area
CS – 14	1. $\frac{dy}{dx}$ = 4 - x	2. 6cm			

INTEGRALS

Multiple choice questions -

1. $\int e^{5logx}\,dx$ *is equal to*

(a) $\frac{x^5}{5} + c$

(b) $\frac{x^6}{6} + c$

(c) $5x^4 + c$

(d) $6x^5 + c$

2. $\int \frac{secx}{secx - tanx}\,dx$ *equals to*

(a) $secx - tanx + c$

(b) $secx + tanx + c$

(c) $tanx - secx + c$

(d) $-(secx + tanx) + c$

3. $\int x^4 logx\,dx$ *is equal to*

(a) $\frac{x^5}{5}(logx - 5) + c$

(b) $\frac{x^5}{5}(logx + 5) + c$

(c) $\frac{x^5}{5}\left(logx - \frac{1}{5}\right) + c$

(d) $\frac{x^5}{5}\left(logx + \frac{1}{5}\right) + c$

4. $\int \frac{dx}{\sqrt{9 - 4x^2}}$ *is equal to*

(a) $\frac{x}{2}\ log\left|x + \sqrt{9 - 4x^2}\right| + c$

(b) $\frac{x}{2}\ log\left|x - \sqrt{9 - 4x^2}\right| + c$

(c) $\frac{1}{2}\ sin^{-1}(2x) + c$

(d) $\frac{1}{2}\ sin^{-1}\left(\frac{2x}{3}\right) + c$

5. $\int \frac{dx}{(9 + 4x^2)}$ *is equal to*

(a) $tan^{-1}(2x) + c$

(b) $tan^{-1}\left(\frac{2x}{3}\right) + c$

(c) $\frac{1}{3} tan^{-1}\left(\frac{2x}{3}\right) + c$

(d) $\frac{1}{6} tan^{-1}\left(\frac{2x}{3}\right) + c$

6. $\int \frac{dx}{\sqrt{x} + x}$ *is equal to*

(a) $log\left|\sqrt{x}\right| + c$

(b) $log\left|1 + \sqrt{x}\right| + c$

(c) $2.\, log\left|1 + \sqrt{x}\right| + c$

(d) $4.\, log\left|1 + \sqrt{x}\right| + c$

7. $\int x^2 e^{x^3}\, dx$ *is equal to*

(a) $\frac{1}{3}e^{x^3}+c$

(b) $\frac{1}{3}e^{x^4}+c$

(c) $\frac{1}{2}e^{x^3}+c$

(d) $\frac{1}{2}e^{x^2}+c$

8. $\int 2^{x+2} dx$ *is equal to*

(a) $2^{x+2}+c$

(b) $2^{x+2}log2+c$

(c) $\frac{2^{x+2}}{log2}+c$

(d) $2.\frac{2^x}{log2}+c$

9. $\frac{d}{dx}\left(f(x)\right)=logx, then\ f(x) equals$:

(a) $-\frac{1}{x}+c$

(b) $x(logx-1)+c$

(c) $x(logx+x)+c$

(d) $\frac{1}{x}+c$

10. $\int \frac{dx}{16+9x^2}$ *is equal to*

(a) $\frac{1}{4}\tan^{-1}\left(\frac{3x}{4}\right)+c$

(b) $\frac{1}{12}\tan^{-1}\left(\frac{3x}{4}\right)+c$

(c) $\frac{1}{3}\tan^{-1}\left(\frac{3x}{4}\right)+c$

(d) $\frac{1}{12}\tan^{-1}\left(\frac{9x}{16}\right)+c$

11 $\int_{-1}^{1}\frac{|x-2|}{x-2}\,dx, x\neq 2$ *is equal to*

(a) 1

(b) -1

(c) 2

(d) -2

12 Assertion (A): $\int_2^8 \frac{\sqrt{10-x}}{\sqrt{x}+\sqrt{10-x}}\,dx=3$

Reason (R): $\int_a^b f(x)dx=\int_a^b f(a+b-x)dx$

(a) Both (A) and (R) are true and (R) is the correct explanation of (A)

(b) Both (A) and (R) are true and (R) is not the correct explanation of (A)

(c) (A) is true and (R) is false

(d) (A) is false, but (R) is true.

13 $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\sec^2 x\, dx$ *is equal to*

(a) -1

(b) 0

(c) 1

(d) 2

14 $If \int_{0}^{a} 3x^2 dx = 8, then\ the\ value\ of\ a\ is\ equal\ to$:

(a) 2 (b) 4

(c) 8 (d) 10

15 $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x.\cos^2 x\ \ dx\ \ is\ equal\ to$

(a) 1 (b) π

(c) $\frac{\pi}{2}$ (d) 0

16 $\int \frac{e^x(1+x)}{\cos^2(xe^x)}\ dx\ is\ equal\ to$

(a) $\tan(xe^x) + c$ (b)$\cot(xe^x) + c$

(c) $\cot(e^x) + c$ (d) $\tan[e^x(1+x)] + c$

17 $\int_{-2}^{2} |x| dx\ is\ equal\ to$

(a) 0 (b) 2

(c) 4 (d) 8

18 $\int_{0}^{\frac{\pi}{8}} \tan^2(2x)\ \ dx\ is\ equal\ to$

(a) $\frac{4-\pi}{8}$ (b) $\frac{4+\pi}{8}$

(c) $\frac{4-\pi}{4}$ (d) $\frac{4-\pi}{2}$

19 $\int \frac{2^{x+1} - 5^{x-1}}{10^x}\ \ is\ equal\ to$

(a)$\frac{2}{ln5} 5^x + \frac{1}{5ln2} 2^x + c$ (b) $-\frac{2}{ln5} 5^{-x} + \frac{1}{5ln2} 2^{-x} + c$

(c)$\frac{1}{2ln5} 5^{-x} + \frac{1}{5ln2} 2^{-x} + c$ (d) None of the above

20 $\int_{0}^{2\pi} |sinx| dx\ \ is\ equal\ to$

(a) 0 (b) 1

(c) 2 (d) 4

21 $\int_0^a \frac{dx}{(1+4x^2)} = \frac{\pi}{8}$, then the value of a is equal to

(a) 0 (b) 1

(c) 2 (d) $\frac{1}{2}$

22 $\int_0^{\pi/6} \sec^2\left(x - \frac{\pi}{6}\right) dx$

(a) $\frac{1}{\sqrt{3}}$ (b) $-\frac{1}{\sqrt{3}}$

(c) $\sqrt{3}$ (d) $-\sqrt{3}$

23 If $\frac{d}{dx}[f(x)] = ax + b$ and $f(0) = 0$, then f(x) equal to

(a) a+b (b) $\frac{a}{2}x^2 + bx$

(c) $\frac{a}{2}x^2 + bx + c$ (d) b

24 $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} (x^3 + xcosx + \tan^5 x)dx is\ equal\ to$

(a) $2\int_0^{\frac{\pi}{4}} (x^3 + xcosx + \tan^5 x)dx$ (b) 1

(c) $2\int_{-\frac{\pi}{4}}^{0} (x^3 + xcosx + \tan^5 x)dx$ (d) 0

25 $\int \frac{x-5}{(x-3)^3} e^x\, dx$ $is\ equal\ to$

(a) $\frac{e^x}{x-3} + c$ (b) $\frac{e^x}{(x-3)^2} + c$

(c) $\frac{e^x}{(x-3)^3} + c$ (d) None of the above

26 $\int \tan^2(3x + 5)dx\ is\ equal\ to$

(a) $\frac{1}{3x+5} tan\ \ (3x + 5) - x + c$ (b) $\frac{1}{3} tan\ \ (3x + 5) + x + c$

(c) $\frac{1}{3} tan\ \ (3x + 5) - x + c$ (d) $\frac{1}{3x+5} tan\ \ (3x + 5) + x + c$

27 Anti derivative of $\frac{tanx-1}{tanx+1}$ $with\ respect\ to\ x\ is$

(a) $\sec^2\left(\frac{\pi}{4} - x\right) + c$ (b) $-\sec^2\left(\frac{\pi}{4} - x\right) + c$

(c) $log\left|sec\left(\frac{\pi}{4} - x\right)\right| + c$ (d) $-log\left|sec\left(\frac{\pi}{4} - x\right)\right| + c$

28 $$\int_0^{\frac{\pi}{4}} \sqrt{1+cos2x}dx =$$

(a) $\sqrt{2}$ (b) 0

(c) $\frac{1}{\sqrt{2}}$ (d) 1

29 $$\int_0^{\frac{\pi}{2}} \frac{1}{1+\sqrt{cotx}}\ dx\ is\ equal\ to$$

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

30 $$\int_0^1 \tan(\sin^{-1} x)\ dx\ \ is\ equal\ to$$

(a) 2 (b) 0

(c) -1 (d) 1

31 $$\int \frac{e^x}{x+1}[1+(x+1)\log(x+1)]\ dx\ is\ equal\ to$$

(a) $\frac{e^x}{x+1}+c$ (b) $\frac{e^x.x}{x+1}+c$

(c) $e^x \log(x+1)+e^x+c$ (d) $e^x \log(x+1)+c$

32 $$\int \frac{\sec^2 x}{\sqrt{\tan^2 x+4}}\ dx\ is\ equal\ to$$

(a) $log\left|tnax+\sqrt{tan^2x+4}\right|+c$ (b) $log\left|tnax-\sqrt{tan^2x+4}\right|+c$

(c) $log\left|tnax+\sqrt{tan^2x-4}\right|+c$ (d) $log\left|tanx-\sqrt{tan^2x-4}\right|+c$

33 $$\int \frac{\sin^3 x+\cos^3 x}{\sin^2 x.\cos^2 x}\ dx\ is\ equal\ to$$

(a) $secx-cosecx+c$ (b) $secx+cosecx+c$

(c) $tanx-cotx+c$ (d) $tanx+cotx+c$

34 $$\int \frac{sinx-cosx}{\sqrt{1+sin2x}}\ dx\ is\ equal\ to\ \ \left(0<x<\frac{\pi}{2}\right)$$

(a) $log|sinx+cosx|+c$ (b) $-log|sinx+cosx|+c$

(c) $log|sinx-cosx|+c$ (d) $-log|sinx-cosx|+c$

35 $$\int e^x(cosx-sinx)cosec^2x\ dx\ is\ equal\ to$$

(a) $e^x cosecx+c$ (b) $e^x secx+c$

(c) $-e^x cosecx+c$ (d) $-e^x secx+c$

36 $\int \frac{\tan^4 \sqrt{x}.\sec^2 \sqrt{x}}{\sqrt{x}}\, dx$ *is equal to*

(a)$\frac{5}{2} tan^5(\sqrt{x}) + c$

(b) $\frac{2}{5} tan^5(\sqrt{x}) + c$

(c)) $2tan^5(\sqrt{x}) + c$

(d) $5tan^5(\sqrt{x}) + c$

37 $\int \frac{x-3}{(x-1)^3} e^x\, dx$ *is equal to*

(a)$\frac{e^x}{x-1} + c$

(b)$-\frac{e^x}{x-1} + c$

(c) $\frac{e^x}{(x-1)^2} + c$

(d)$-\frac{e^x}{(x-1)^2} + c$

38 $\int_0^{\frac{\pi}{2}} \frac{\sqrt{cosx}}{\sqrt{sinx} + \sqrt{cosx}}\, dx$ *is equal to*

(a)$\frac{\pi}{2}$

(b) π

(c) $\frac{\pi}{4}$

(d)$\frac{\pi}{8}$

39 $\int \frac{(x+2)(x+2logx)^3}{x}\, dx$ *is equal to*

(a)$(x + 2logx)^3 + c$

(b)$3(x + 2logx)^2 + c$

(c) $\frac{(x+2logx)^3}{4} + c$

(d)$\frac{(x+2logx)^4}{4} + c$

40 $\int \left(\frac{1}{x} - \frac{1}{2x^2}\right) e^{2x} dx$ *is equal to*

(a) $\frac{e^{2x}}{2} + c$

(b)$\frac{e^{2x}}{2x} + c$

(c) $\frac{e^x}{2} + c$

(d)$\frac{e^x}{2x} + c$

41 $\int \frac{1}{\cos^2 x.(1 - tanx)^2} dx$ *is equal to*

(a)$\frac{1}{tanx-1} + c$

(b)$\frac{1}{(tanx-1)^2} + c$

(c) $\frac{1}{1-tanx} + c$

(d)$\frac{1}{(1-tanx)^2} + c$

42 $\int \frac{dx}{x^2 + 4x + 13}$ *is equal to*

(a)$log(x^2 + 4x + 13) + c$

(b)$\frac{1}{3}\ tan^{-1}\left(\frac{x+2}{3}\right) + c$

(c) $log|2x + 4| + c$

(d)$\frac{2x+4}{(x^2+4x+13)^2} + c$

43 $\int \frac{3 - 5sinx}{\cos^2 x} dx =$

(a)$3tanx - 5secx + c$

(b) $3tanx + 5secx + c$

(c) $5tanx - 3secx + c$

(d) $3tanx - 5cotx + c$

44 $\int \frac{cos2x + 2\sin^2 x}{\cos^2 x} dx$ *is equal to*

(a) $cos^2x + c$ (b) $-tanx + c$

(c) $tanx + c$ (d) $sec^2x + c$

45 $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \cot^{\frac{3}{2}} x} dx$ *is equal to*

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{12}$

46 $\int \frac{1}{x(1 + logx)} dx$ *is equal to*

(a) $log|1 + logx| + c$ (b) $\frac{1}{1+logx}$

(c) $log|x(1 + logx)| + c$ (d) None of the above

47 $\int_{2}^{3} 3^x\, dx$ *is equal to*

(a) $\frac{24}{ln3}$ (b) $\frac{18}{ln4}$

(c) $\frac{18}{ln3}$ (d) $\frac{24}{ln4}$

48 $\int_{0}^{2\pi} \cos^5 x\, dx$ *is equal to*

(a) 2π (b) π

(c) 1 (d) 0

49 $\int_{1}^{3} (x^2 + 1)dx$ *is equal to*

(a) $\frac{16}{3}$ (b) $\frac{22}{3}$

(c) $\frac{32}{3}$ (d) $\frac{34}{3}$

50 $\int \frac{\sin^2 x - \cos^2 x}{sinx.\, cosx} dx$ *is equal to*

(a) $log|sinx.\, cosx| + c$ (b) $log|secx.\, cosecx| + c$

(c) $-log|sinx.\, cosx| + c$ (d) $-log|secx.\, cosecx| + c$

Answers for MCQ's:

1. b	2. b	3. c	4. d	5. d
6. c	7. a	8. c	9. b	10. b
11. a	12. a	13. d	14. a	15. d
16. a	17. c	18. a	19. b	20. d
21. d	22. a	23. b	24. d	25. b
26. c	27. c	28. d	29. c	30. d
31. d	32. a	33. b	34. b	35. c
36. b	37. c	38. c	39. d	40. b
41. c	42. b	43. a	44. c	45. d
46. a	47. c	48. d	49. c	50. b

APPLICATIONS OF THE INTEGRALS

Multiple choice questions -

1. The area of the region bounded by the curve $y = x + 1$ and the lines x = 2 and x = 3 is…….

   (a) $\frac{11}{2}$ $sq.units$ (b) $\frac{15}{2}$ $sq.units$

   (c) $\frac{7}{2}$ sq. units (d) 2 $sq.units$

2. The area of the region bounded by the curve $x = 2y + 3$ and the lines y = 1 and y = -1 is…….

   (a) 6 $sq.units$ (b) 8 $sq.units$

   (c) 4 $sq.units$ (d) $\frac{3}{2}$ $sq.units$

3. The area bounded by the line $x + y = 3$ and the axes is …..

   (a) 2 $sq.units$ (b) $\frac{9}{4}$ $sq.units$

   (c) $\frac{9}{2}$ $sq.units$ (d) $\frac{9}{5}$ $sq.units$

4. The area bounded by the lines $x = 0, y = 0$ and $x + y = 1$ is…….

   (a) 2 sq. units (b) $\frac{1}{2}$ $sq.units$

   (c) $\frac{3}{2}$ $sq.units$ (d) $\frac{2}{3}$ $sq.units$

5. The area of the region bounded by the line $2y = 5x + 7$, x-axis and the line x=2 and x = 8 is……

   (a) 90 sq. units (b) 6 sq. units

   (c) 96 sq. units (d) 10 sq. units

6. The area of the region bounded by the line $2y + x = 8$, x-axis and the lines x=2 and x=4 is……

   (a) 5 sq. units (b) 6 sq. units

   (c) 3 sq. units (d) None of these

7. The area enclosed by the circle $x^2 + y^2 = a^2$ is ….

   (a) πa^2 $sq.units$ (b) a^2 $sq.units$

   (c) 2π $sq.units$ (d) $\pi^2 a^2$ $sq.units$

8. The area enclosed by the circle $x^2 + y^2 = 2$ is equal to ….

   (a) 4π $sqare$ $units$ (b) 2π $sqare$ $units$

   (c) $2\sqrt{2}\pi$ $sqare$ $units$ (d) $4\pi^2$ $sqare$ $units$

9. The area of the region bounded by the circle $x^2 + y^2 = 1$ is equal to ….

(a) 2π sq. units (b) π sq. units

(c) 3π sq. units (d) 4π sq. units

10. The area of the region bounded by the circle $x^2 + y^2 = 8$ is equal to ….

(a) 2π sq. units (b) π sq. units

(c) 3π sq. units (d) 8π sq. units

11. The area under the curve $y = \sqrt{a^2 - x^2}$ including between the lines x = 0 and x = a is…….

(a) $\frac{\pi a^2}{4}$ $sq.units$ (b) $\frac{a^2}{4}$ $sq.units$

(c) πa^2 $sq.units$ (d) 4π $sq.units$

12. If we draw the region $\{(x, 0)/y = \sqrt{4 - x^2}\}$ and x-axis then the area of the region is…….

(a) 2π sq. units (b) π sq. units

(c) 3π sq. units (d) 4π sq. units

13. If we draw a rough sketch of the curve $y = \sqrt{x - 1}$ in the interval [1, 5], then the area under the curve and between the lines x = 1 and x = 5 is …..

OR

The area enclosed between the curve $y = \sqrt{x - 1}$, the x-axis and the line x = 5

(a) $\frac{16}{3}$ sq. units (b) $\frac{8}{3}$ sq. units

(c) $\frac{16}{9}$ sq. units (d) None of these

14. The area of the region bounded by the curve $y = \sqrt{16 - x^2}$ and x-axis is….

(a) 8π $sq.units$ (b) 20π sq. units

(c) 20π sq. units (d) 256π sq. units

15. The area of the region bounded by the circle $x^2 + y^2 = 4$ and the lines x=0 and x=2 in the first quadrant is …..

(a) π $sq.units$ (b) $\frac{\pi}{2}$ $sq.units$

(c) $\frac{\pi}{3}$ $sq.units$ (d) $\frac{\pi}{4}$ $sq.units$

16. The area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$is…….

(a) $2\pi ab$ $sq.uinits$ (b) $\pi a^2 b^2$ $sq.units$

(c) πab $sq.uinits$ (d) $a^2 b^2$ $sq.units$

17. The area of the region bounded by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is…..

(a) 20π sq. units (b) $20\pi^2$ $sq.units$

(c) $16\pi^2$ $sq.units$ (d) 25π sq. units

18. The area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ is…..

(a) 16π sq. units (b) $12\ \pi^2$ $sq.units$

(c) 12π sq. units (d) 144 π sq. units

19 The area of the region bounded by the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is.....

(a) 6π sq. units (b) $36\,\pi^2\,sq.units$

(c) $6\pi^2\,sq.units$ (d) 18 π sq. units

20. The area of the region bounded by the curve $x^2=4y$, line x = 2 and x- axis is.......

(a) $1\,sq.units$ (b) $\frac{4}{3}\,sq.units$

(c) $\frac{8}{3}\,sq.units$ (d) $\frac{2}{3}\,sq.units$

21. The area of the region bounded by the curve $y=x^2$ and the line y=16 is.....

(a) $\frac{32}{3}\,sq.units$ (b) $\frac{256}{3}\,sq.units$

(c) $\frac{64}{3}\,sq.units$ (d) $\frac{128}{3}\,sq.units$

22. The area of the region lying in the first quadrant, bounded by the curve $y=9x^2$, x = 0, y = 1 and y = 4 is .....

(a) $\frac{14}{9}\,sq.units$ (b) $\frac{14}{3}\,sq.units$

(c) $\frac{16}{3}\,sq.units$ (d) $\frac{13}{9}\,sq.units$

23. The area of the region bounded by the curve $x=y^2$, y-axis and the line y=3 and y=4 is ....

(a) $\frac{37}{3}\,sq.units$ (b) $37\,sq.units$

(c) $\frac{27}{3}\,sq.units$ (d) $\frac{73}{3}\,sq.units$

24. Area of the region bounded by the curve $y^2=4x, y-axis\ and\ the\ line\ y=3\ is$ ...

(a) $2\,sq.units$ (b) $\frac{9}{4}\,sq.units$

(c) $\frac{9}{2}\,sq.units$ (d) $\frac{9}{5}\,sq.units$

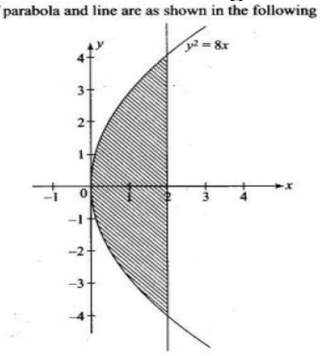
25. The area of the region bounded by $y^2=4x, x=1, x=4\ and\ x-axis$ in the first quadrant is......

(a) $\frac{28}{3}\,sq.units$ (b) $\frac{23}{8}\,sq.units$

(c) $\frac{19}{3}\,sq.units$ (d) $\frac{19}{28}\,sq.units$

26. Find the area of the region from the following figure.

Graphs of parabola and line are as shown in the following figure.



(a) $\frac{16}{3}$ sq. units (b) $\frac{23}{3}$ sq. units
(c) $\frac{32}{3}$ sq. units (d) $\frac{61}{3}$ sq. units

27. The area under the curve $y = 2\sqrt{x}$ included between the lines x = 0 and x = 1 is....
(a) $\frac{4}{3}$ $sq. units$ (b) $\frac{3}{4}$ $sq. units$
(c) $\frac{5}{7}$ $sq. units$ (d) $\frac{7}{9}$ $sq. units$

28. The area bounded by the curve $y = x^2 - 4, and\ the\ lines y = 0$ and y = 5 is ……….
(a) $\frac{38}{3}$ $sq. units$ (b) $\frac{76}{3}$ $sq. units$
(c) $\frac{19}{3}$ $sq. units$ (d) $\frac{57}{4}$ $sq. units$

29. The area of the region bounded by the lines $y = x, x = 3\ and\ y - axis\ is$ ....
(a) $\frac{1}{5}$ $sq. units$ (b) $\frac{9}{4}$ $sq. units$
(c) $\frac{9}{2}$ $sq. units$ (d) $\frac{4}{5}$ $sq. units$

30. If we draw a rough sketch of the graph of y = x then the area under the curve above the x-axis and the lines x = 2 and x = 3 is ……
(a) $\frac{5}{2}$ $sq. units$ (b) $\frac{9}{2}$ $sq. units$
(c) $\frac{3}{2}$ $sq. units$ (d) $\frac{2}{3}$ $sq. units$

31. The area enclosed by the lines y = 0, y = x, x = 1, x = 2 is …….
(a) $\frac{9}{2}$ $sq. units$ (b) $\frac{5}{2}$ $sq. units$
(c) $\frac{3}{2}$ $sq. units$ (d) $\frac{2}{3}$ $sq. units$

32. The area of the region bounded by the curve $y = x^2$ and the lines x = 2, x =3, and x-axis is ……
(a) $\frac{26}{3}$ $sq. units$ (b) $\frac{23}{3}$ $sq. units$
(c) $\frac{19}{3}$ $sq. units$ (d) $\frac{9}{2}$ $sq. units$

33. The area of the region lying in the first quadrant and bounded by $y = 4x^2$, x = 0, y = 1, and y = 4 is …..
(a) $\frac{5}{3}$ $sq. units$ (b) $\frac{7}{3}$ $sq. units$
(c) $\frac{19}{3}$ $sq. units$ (d) $\frac{9}{2}$ $sq. units$

34. The area of the region lying in the first quadrant and bounded by $y = 9x^2$, x = 0, y = 1 and y = 4 is………
(a) $\frac{5}{3}$ $sq. units$ (b) $\frac{14}{9}$ $sq. units$
(c) $\frac{19}{3}$ $sq. units$ (d) $\frac{9}{2}$ $sq. units$

35. Area bounded by the curve $y = x^3$, the x-axis and the ordinates x = -2 and x = 1 is…

(a) $-9\ sq.units$ (b) $\frac{-15}{4}\ sq.unis$

(c) $\frac{15}{4}\ sq.unis$ (d) $\frac{17}{4}\ sq.unis$

36. The area bounded by the curve $y = x^4$; and the line x = 1, x = 5 and x-axis is…..

(a) $\frac{3124}{9}\ sq.units$ (b) $\frac{3124}{3}\ sq.units$

(c) $\frac{3124}{5}\ sq.units$ (d) $\frac{3124}{7}\ sq.units$

37. The area of the curve $y = |x|$ bounded by the line x = 2 and y-axis is……

(a) 2 sq. units (b) 4 sq. units

(c) 3 sq. units (d) 1 sq. unit

38. The area bounded by the curves$y = |x|, and\ x = -1\ and\ x = 1$ is…….

(a) 2 sq. units (b) 4 sq. units

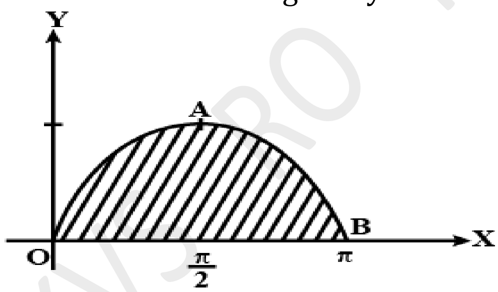
(c) 3 sq. units (d) 1 sq. unit

39. The area bounded by the curve $y = x|x|$, x-axis and the ordinates x = -1 and x =1 is…..

(a) 0 $sq.units$ (b) $\frac{1}{3}\ sq.units$

(c) $\frac{2}{3}\ sq.units$ (d) $\frac{4}{3}\ sq.units$

40. The area of the shaded region by the curve y = sin $x$in the figure



(a) 2 sq. units (b) 4 sq. units

(c) 3 sq. units (d) 1 sq. unit

41. The area of the region bounded by the curve $y = \sin x$ between the ordinates $x = 0\ and\ x = \frac{\pi}{2}\ is$ ….

(a) 2 sq. units (b) 4 sq. units

(c) 3 sq. units (d) 1 sq. unit

42. The area of the region bounded by the curve $y = \cos x$ between the ordinates $x = 0\ and\ x = \pi\ is$ ….

(a) 2 sq. units (b) 4 sq. units

(c) 3 sq. units (d) 1 sq. unit

43. The area bounded by the curve $y = e^x$, x- axis and ordinates x =0 and x = 2 is ….

(a) $e^2\ sq.units$

(b) $(e^2 - 1)\ sq.units$

(c) $2e\ sq.units$

(d) None of these

44.. If the area above the x- axis bounded by the curves $y = 2^{kx}$ and x = 0 and x = 2 is $\frac{3}{\log_e 2}$ then the value of k is …..

(a) 2

(b) 4

(c) 3

(d) 1

45 The area of the region bounded by the curve $x = at^2\ and\ y = 2at$ between the ordinates corresponding t = 1 and t = 2 is …..

(a) $\frac{56a^2}{3}\ sq.units$

(b) $\frac{38a^2}{3}\ sq.units$

(c) $\frac{64a^2}{3}\ sq.units$

(e) $\frac{24a^2}{3}\ sq.units$

Answers for MCQ's

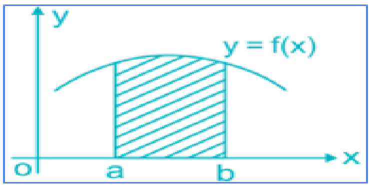
1	c	2	a	3	c	4	b	5	c
6	a	7	a	8	b	9	b	10	d
11	a	12	a	13	a	14	a	15	a
16	c	17	a	18	c	19	a	20	d
21	b	22	a	23	a	24	b	25	a
26	c	27	a	28	a	29	c	30	a
31	c	32	c	33	b	34	b	35	d
36	c	37	a	38	d	39	c	40	a
41	d	42	a	43	b	44	d	45	a

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

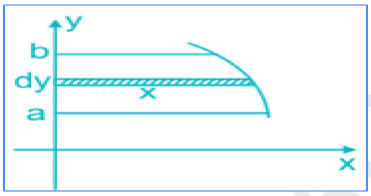
A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A):**



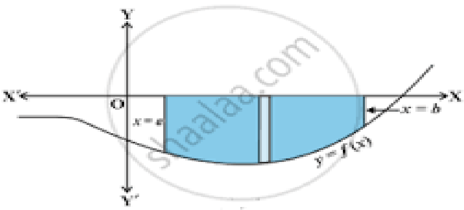
The area of the region bounded by the curve $y = f(x)$, x-axis and the lines x = a and x = b is given by $\int_a^b ydx = \int_a^b f(x)dx$

Reason (R) :



The area of the region bounded by the curve $x = g(y)$, y-axis and the lines y = a and y = b is given by $\int_a^b xdy = \int_a^b g(y)dy$

2. **Assertion (A):**



Area = $\left|\int_a^b f(x)dx\right|$

Reason (R): If the curve under consideration lies below x-axis, then $f(x) < 0$ from x = a to x = b, the area bounded by the curve y = f(x) and the ordinates x = a, x = b and x- axis is negative. But, if the numerical value of the area is to be taken into consideration, then Area = $\left|\int_a^b f(x)dx\right|$

3. **Assertion (A):** The area bounded by $y^2 = 4x \text{ and } x = 1 \text{ is } \frac{8}{3} \text{ sq. units}$

Reason (R): The area bounded by $y^2 = 4ax \text{ and } x = a \text{ is } \frac{8}{3}a^2 \text{ sq. units}$

4. **Assertion (A):** The area bounded by $\frac{x^2}{25} + \frac{y^2}{9} = 1 \text{ is } 15\pi \text{ sq. units}$

Reason (R): The area bounded by $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ is } \pi ab \text{ sq. units}$

5. **Assertion (A):** The area enclosed by the circle $x^2 + y^2 = 32 \text{ is } 32\pi \text{ sq. units}$

Reason (R): The area enclosed by the circle $x^2 + y^2 = a^2 \text{ is } \pi a^2 \text{ sq. units}$

6. **Assertion (A):**The area under the curve $y = \sqrt{a^2 - x^2}$ including between the lines x = 0 and x = a in the first quadrant is $\frac{\pi a^2}{4} \text{ sq. units}$

Reason (R): The area bounded by the curve $y = \sqrt{a^2 - x^2}$ is $\frac{\pi a^2}{4} \text{ sq. units}$

7. **Assertion (A):** The area of the parabola $y^2 = 8x$ bounded by its latus rectum is $\frac{8}{3}$sq. units

Reason (R): The area of the parabola $y^2 = 4ax$ bounded by its latus rectum is $\frac{8a^2}{3}$sq. units

8. **Assertion (A):** Area of the region bounded by $y^2 = 4x, x = 1, x = 4 \text{ and } y = 0$ is $\frac{28}{3}$ sq. units.

Reason (R): Area under a curve $y = f(x)$ and above x-axis lying between the ordinates x = a and x = b is given by $\int_a^b f(x)dx$

9. **Assertion (A):** Area of the region given by $\{(x, y)|y^2 \le 6x, 2 \le x \le 5, x, y \ge 0\}$is $\frac{21}{2} \text{ sq. units}$.

Reason (R): Area under a curve $x = f(y)$ lying to the right of y-axis and between the lines y = a and y = b is given by $\int_a^b f(y)dy$

10. **Assertion (A):** The area bounded by the curve $y = \cos x$ in the first quadrant with co-ordinate axes is 1 sq. unit

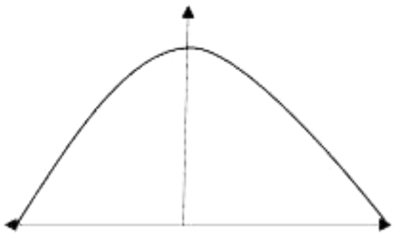
Reason (R): $\int_0^{\pi/2} \cos x \, dx = 1$

Answers :

1	b	2	a	3	a	4	a	5	a
6	c	7	a	8	a	9	d	10	a

CASE STUDY TYPE QUESTIONS

1. The bridge connects two hills 100 feet apart. The arch of the bridge is 10 feet above the road at the middle of the bridge as shown in the figure. Based on the above information answer the following questions.



(i) Write the equation of the parabola designed on the bridge?

(ii) Evaluate the value of the integral $\int_{-50}^{50} \frac{x^2}{250} dx$

(iii) Verify the integrand of the integral $\int_{-50}^{50} \frac{x^2}{250} dx$ is even function or odd function

(iv) Find the area formed by the curve $x^2 = 250y, y - axis, y = 0 \; and \; y = 10$

2. A farmer has a piece of land. He wishes to divide equally in his two sons to maintain peace and harmony in the family. If his land is denoted by area bounded by curve $y^2 = 4x$ and x = 4, above the x-axis and to divide the area equally he draws a line x = a.
Based on the above information answer the following questions.

(i) Find the area bounded by the curve $y^2 = 4x$ and x = a

(ii) Find the area bounded by the curve $y^2 = 4x$ and x = 4

(iii) Evaluate $\int_a^4 2\sqrt{x} \; dx$

(iv) What is the value of a?

3. An architect designs a building whose lift (elevation) is from outside of the building attached to the walls. The floor (base) of the lift (elevation)is in semi-circular shape. The floor of the elevator (lift) whose circular edge is given by the equation $x^2 + y^2 = 4$ and the straight edge (line)is given by the equation y = 0.
Based on the above information answer the following questions.

(i) Write the length of each vertical strip of the region between the curves $x^2 + y^2 = 4$ and y = 0

(ii) Write the length of each horizontal strip of the region between the curves $x^2 + y^2 = 4$ and y = 0, in the first quadrant.

(iii) Write the area of a vertical strip given between $x^2 + y^2 = 4$ and y = 0

(iv) Find the area of the region of the floor of the lift of the building?

4. A student designs a boat with triangular sail on the walls and three edges (lines) at the triangular sail are given by the equations $x = 0, y = 0$ *and* $y + 2x - 4 = 0$ respectively.

(i) Write the length of each vertical strip of the sail?

(ii) Find the point of intersection of the edges (lines) $y = 0$ *and* $y + 2x - 4 = 0$

(iii) Write the length of each horizontal strip of the sail?

(iv) Find the area of the region bounded by the line $y + 2x - 4 = 0$, x = 0 and y = 0

5. A student designs an open air Honeybee nest on the branch of a tree, whose plane figure is parabolic form $x^2 = 4y$ and the branch of tree is given by a straight line y=4.
Based on the above information, answer the following questions.

(i) Find the point of intersection of the parabola $x^2 = 4y$ and straight line y = 4

(ii) Write the length of each horizontal strip of the bounded region

(iii) Write the length of each vertical strip of the bounded region

(iv) Find the area of the region bounded by the parabola $x^2 = 4y$ and the line y=4

CASE STUDY

CS-1	(i) $x^2 \quad = -250y$	(ii) $\frac{1000}{3}$	(iii) An even function	(iv) $\frac{1000}{3}$
CS-2	(i) $\frac{4}{3}a^{\frac{3}{2}}$	(ii) $\frac{32}{3}$	(iii) $\frac{4}{3}\left(4^{\frac{3}{2}} - a^{\frac{3}{2}}\right)$	(iv) $2^{\frac{4}{3}}$
CS-3	(i) $\sqrt{4 - x^2}$	(ii) $\sqrt{4 - y^2}$	(iii) $\sqrt{4 - x^2}dx$	(iv) 2π sq.units
CS-4	(i) 4-2x	(ii) (2, 0)	(iii) $\frac{1}{2}$(4-y)	(iv) 4 sq. units
CS-5	(i) (-4, 4) and (4, 4)	(ii) $4\sqrt{y}$	(iii) $\frac{1}{4}(16 - x^2)$	(iv) $\frac{64}{3}$ sq. units

DIFFERENTIAL EQUATIONS

Multiple choice questions -

1 Order of differential equation corresponding to family of curves $y = Ae^{2x} + Be^{-2x}$ is

(a) 2 (b) 1
(c) 3 (d)4

2 The order of the differential equation corresponding to the family of curves $yc(x - c)^2$, c is constant

(a) 1 (b) 2
(c) 3 (d)does not exist

3 General solution of the differential equation $\log\frac{dy}{dx} = 2x + y$ is

(a) $e^{-y} = \frac{1}{2}e^{2x} + C$ (b) $\frac{1}{e^x} + \frac{1}{2}e^{2x} + C$
(c) $-e^{-y} = \frac{1}{2}e^{2x} + C$ (d) $e^y = \frac{1}{2}e^{2x} + C$

4 The particular solution of the differential equation $\frac{dy}{dx} = y \tan x$, given that y = 1 when x = 0 is dx

(a) $y = \cos x$ (b) $y = \sec x$
(c). $y = \tan x$ (d) $y = \sec x \tan x$

5 Differential equation representing the family of curves $(x + a)^2 + 2y^2 = a^2$ is of order

(a) 1 (b) 2
(c) 3 (d) none of these

6 $y = e^{-x} + ax + b$ is a solution of differential equation

(a) $e^{-x} y'' = 1$ (b) $e^x y'' = 1$
(c) $e^x (y')^2 = 1$ (d) $e^{-x} (y')^2 = 1$

7 $y = e^{m \cos^{-1} x}$ is a solution of differential equation

(a) $1 - x^2 y' = my$ (b) $(1 - x^2) y'' + xy' - m^2 y = 0$
(c) $(1 - x^2) y'' - xy' - m^2 y = 0$ (d)$(1 - x^2) y'' - xy' + m^2 y = 0$

8 Degree of differential equation $t^2\frac{d^2s}{dt^2} - st(\frac{ds}{dt})^2 = 5$ is

(a) 1 (b) 2
(c) 3 (d)none of these

9 For the solution of differential equation $\frac{dy}{dx}+\frac{y}{x}= x^2$, the integrating factor is

(a) $\frac{y}{x}$ (b) x

(c) y (d) −x

10 Degree of differential equation $\left(\frac{d^3y}{dx^3}\right)^{\frac{2}{3}} = x$ is

(a) 1 (b) 2

(c) 3 (d) none of these

11 Differential equation $e^x \frac{dy}{dx}=3y^3$ can be solved using the method of

(a) separating the variables (b) homogeneous equations

(c) linear differential equation of first order (d) none of these

12 The sum of order and degree of the differential equation $\frac{d^2y}{dx^2}+3(\frac{dy}{dx})^3=e^x$ is

(a) 2 (b) 3

(c) 5 (d) 4

13 If p and q are degree and order of a differential equation $\frac{dy}{dx} + \frac{1}{\frac{dy}{dx}} = 9$ then 2p+q is

(a) 5 (b) 4

(c) 3 (d) 7

14 Integrating factor of the deferential equation $\frac{dy}{dx}$=x+y is

(a) -1 (b) 1

(c) e^{-x} (d) none of these

15 The number of arbitrary constants in the general solution of differential equation of fourth order are

(a) 0 (b) 2

(c) 3 (d) 4

16 The number of arbitrary constants in the particularsolution of a differential equation of m order is___________, where m is an integer.

(a) m (b) 1/m

(c) 0 (d) 1

17 The highest order derivative of the dependent variable with respect to the independent variable involved in the given differential equation is called____ of the differential equation.

(a) homogenious (b) power

(c) degree (d) order

18 An equation involving derivatives of the dependent variable with respect to independent variables is called a/ an_____

(a) ordinary differential equation (b) partial differential equation
(c) differential equation (d) linear equations

19 A solution of differential equation which containsarbitrary constants is called the _______ of the differential equation

(a) solution (b) optimal solution
(c) general solution (d) particular solution

20 A differential equation involving derivatives of thedependent variable with respect to only One independent variable is called a/an ______________.

(a) ordinary differential equation (b) partial differential equation
(c) differential equation (d) linear equations

Answers for MCQ's

1	a	2	a	3	c	4	b	5	a
6	b	7	c	8	a	9	b	10	b
11	a	12	b	13	a	14	c	15	d
16	c	17	d	18	c	19	c	20	a

CASE STUDY TYPE QUESTIONS

CS 1 A Veterinary doctor was examining a sick cat brought by a pet lover. When it was brought to the hospital, it was already dead. The pet lover wanted to find its time of death. He took the temperature of the cat at 11.30 pm which was 94.6°F. He took the temperature again after one hour; the temperature was lower than the first observation. It was 93.4°F. The room in which the cat was put is always at 70°F. The normal temperature of the cat is taken as 98.6°F when it was alive. The doctor estimated the time of death using Newton law of cooling which is governed by the differential equation: dT/dt $\propto$ $(T - 70)$, where 70°F is theroom temperature and T is the temperature of the object at time t. Substituting the two different observations of T and t made, in the solution of the differential equation dT/dt = $(T - 70)$ where k is a constant of proportion, time of death is calculated.

1. State the degree of the above given differential equation.
2. Which method of solving a differential equation helped in calculation of the time of death?
   (a) Variable separable method (b) Solving Homogeneous differential equation
   (c) Solving Linear differential equation (d) all of these
3. If the temperature was measured 2hours after11.30pm, will the time of death change? (Yes/No)
4. The solution of the differential equation dT/dt=k$(T-70)$i~~s~~ given by,
   (a) log|T−70|=kt+C (b). log|T−70|=log|kt|+C
   (c) T− 70=kt +C (d) T− 70=kt C
5. I ft=0 when T is 72, then the value of c is
   (a) -2 (b). 0
   (c) 2 (d) log 2

CS 2

Polio drops are delivered to 50K children in a district. The rate at which polio drops are given is directly proportional to the number of children who have not been administered the drops. By the end of second week half the children have been given the polio drops. How many will have been given the drops by the end of third week can be estimated using the solution to the differential equation $\frac{dy}{dx}$ = (50-y) where x denotes the number of weeks and y the number of children who have been given the drops.

1. State the order of the above given differential equation.

2. Which method of solving a differential equation can be used to solve equation $\frac{dy}{dx}$ = (50-y)

(a) Variable separable method (b) Solving Homogeneous differential equatio

(c) Solving Linear differential equation (d) all of these

3. The solution of the differential equation $\frac{dy}{dx}$ = (50-y)

(a) log| 50–y|=kx+ C (b) -log| 50– y|= kx+ C

(c) log| 50–y|=log|kx|+C (d) 50–y=kx+C

4. The value of c in the particular solution given that y(0)=0andk=0.049is.

(a) log 50 (b) log1/50

(c) 50 (d) -50

5. Which of the following solutions may be used to find the number of children who have been given the polio drops?

(a) $y=50-e^{-kx}$ (b) $y=50-e^{kx}$

(c) $y=50(1-e^{-kx})$ (d) $y= 50(e^{kx}-1)$

CASE STUDY ANSWERS:

CS-1	1) degree 1	2) a	3) no	4) a	5) d
CS-2	1) order 1	2) a	3) b	4) b	5) c

VECTORS

Multiple choice questions -

1 If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following are incorrect

(a) $\vec{b} = \lambda\vec{a}$

(b) $\vec{a} = \mp\vec{b}$

(c) The respective components of $\vec{a}$ and $\vec{b}$ are proportional

(d) Both the vectors $\vec{a}$ and $\vec{b}$ have same direction, but different magnitudes

2 If $\vec{a}$ is non zero vector of magnitude 'a' and λ a non-zero scalar then $\lambda\vec{a}$ is unit vector if

(a) $\lambda = 1$

(b) $\lambda = -1$

(c) $a = |\lambda|$

(d) $a = 1/|\lambda|$

3 Area of rectangle having vertices A,B,C and D with position vectors -i+1/2 j+4k, i+1/2 j+4k,, i-1/2 j+4k and -i-1/2 j+4k,respectively is

(a) 1/2

(b) 1

(c) 2

(d)4

4 If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$,then $\vec{a}.\vec{b} \geq 0$ only when

(a) $0< \theta < \pi/2$

(b) $0\leq \theta \leq \pi/2$

(c) $< \theta < \pi$

(d) $0\leq \theta \leq \pi$

5 Let $\vec{a}$ and $\vec{b}$ are two vectors and θ is the angle between two vectors $\vec{a}$ and $\vec{b}$ .Then $\vec{a} + \vec{b}$ is a unit vector if

a) $\theta = \pi/4$

b) $\theta = \pi/3$

c) $\theta = \pi/2$

d) $\theta = 2\pi/3$

6 The value of $\hat{\imath}.(\hat{\jmath}x\hat{k}) + \hat{\jmath}.(\hat{\imath}x\hat{k}) + \hat{k}.(\hat{\imath}x\hat{\jmath})$

a) 0

b) -1

c) 1

d) 3

7 If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$,then $|\vec{a}.\vec{b}| = |\vec{a} \times \vec{b}|$ when θ is equals to

a) 0

b) $\pi/4$

c) $\pi/2$

d) π

8 A vector is equally inclined to axes is

a) $\hat{\imath} + \hat{\jmath} + \hat{k}$
b) $\hat{\imath} - \hat{\jmath} + \hat{k}$
c) $\hat{\imath} - \hat{\jmath} - \hat{k}$
d) $-\hat{\imath} + \hat{\jmath} + \hat{k}$

9 For which value of, p, is $p(\hat{\imath} + \hat{\jmath} + \hat{k})$ *a unit vector*

a) $\pm 1/\sqrt{3}$
b) $\pm\sqrt{3}$
c) ± 1
d) $\pm 1/3$

10 The cosine of angle which the vector $\sqrt{2}\hat{\imath} + \hat{\jmath} + \hat{k}$ *makes with y- axis are*

a) 1
b) 1/2
c) 1/4
d) 1/3

11 The angle between two vectors $\vec{a}$ and $\vec{b}$with magnitudes 1 and 2 respectively and $|\vec{a} \times \vec{b}| = \sqrt{3}$is

a) 0^0
b) $\pi/3$
c) $\pi/4$
d) $\pi/6$

12 The area of a parallelogram whose one diagonal is $2\hat{\imath} + \hat{\jmath} - 2\hat{k}$ *and one side is*$\widehat{3\imath} + \hat{\jmath} - \hat{k}$ *is*

a) 6
b) $3\sqrt{2}$
c) $6\sqrt{2}$
d) 5

13 If $(2\hat{\imath} + 6\hat{\jmath} - 14\hat{k})$ *x*$(\hat{\imath} - \lambda\hat{\jmath} + 7\hat{k})$ *= 0 then the value of* λ *is*

a) 27/2
b) -27/2
c) 3
d) -3

Answers for MCQ's

1	d	2	d	3	c	4	b	5	c
6	c	7	b	8	a	9	a	10	b
11	b	12	b	13	d				

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A)** The vectorsa=$\hat{\imath}-3\hat{\jmath}-5\hat{k}$ and b= $\hat{\imath}-3\hat{\jmath}-5\hat{k}$ are perpendicular to each other
Reason(R) $\vec{a}\times\vec{b}$ is a vector perpendicular to both a and b

2. **Assertion (A)** The points A(-2,3,5),B(1,2,3),C(7,0,-1) are collinear
Reason(R) A,B and C are collinear if $|\overrightarrow{AB}|+|\overrightarrow{BC}|=|\overrightarrow{CA}|$

3. **Assertion (A)** The projection of vector $\hat{\imath}+3\hat{\jmath}+7\hat{k}$ on the vector $7\hat{\imath}-\hat{\jmath}+8k$ is $60/\sqrt{114}$
Reason(R) If α,β and γ are the angles made by vector a=a_1i+a_2j+a_3k with coordinate axes then l =$a_1/|\vec{a}|$,m= $a_2/|\vec{a}|$,n= $a_3/|\vec{a}|$,

4. **Assertion (A)** $\widehat{\vec{a}=\imath}+3\hat{\jmath}+\widehat{4k}$ and $\widehat{\vec{b}=\imath}+3\hat{\jmath}+\widehat{5k}$ *represents two adjacent sides of a parallelogram is* $3\sqrt{14}$ *square units*
Reason(R) $(\vec{a}-\vec{b})$ x$(\vec{a}+\vec{b})=|\vec{a}|2-|\vec{b}|^2$

5. **Assertion (A)** In triangle ABC,$\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=\vec{0}$
Reason(R) If $\overrightarrow{OA}=\vec{a}$,$\overrightarrow{OB}=\vec{b}$, $\overrightarrow{OC}=\vec{c}$ then $\overrightarrow{AB}=\vec{a}$+b (triangle law of addition)

6. **Assertion (A)** If I is the incentre of triangle ABC, then $\overrightarrow{IA}|\overrightarrow{BC}|+\overrightarrow{IB}|\overrightarrow{CA}|+\overrightarrow{IC}|\overrightarrow{AB}|=0$
Reason(R) The position vector of the centroid of triangle ABC is $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}/3$

7. **Assertion (A)** $\vec{a}$= i+pj+2k and $\vec{b}$= 2i+3j+qk are parallel vectors if p = 3/2,q= 4
Reason(R) $\vec{a}$ = a_1i+a_2j+a_3k and $\boldsymbol{b}$ = b_1i+b_2j+b_3k are parallel $a_1/a_2=b_1/b_2=c_1/c_2$

8. **Assertion (A)** If $\vec{p}=(\vec{a}+\vec{b}-\vec{c})$, $\vec{q}=(2\vec{a}+\boldsymbol{b})$ and $\vec{r}=(\vec{b}+t\vec{c})$ are collinear, where a,b c are three non-coplanar vectors then the value of t is -2
Reason(R) If p,qr arecollinear, thenPQ∥ PR

9. **Assertion (A)** The adjacent sides of a parallelogram are along with $\vec{a}$ = i+2j and $\vec{b}$ = 2i+j the angle between the diagonal is 150^0

Reason(R) Two vectors are perpendicular then their dot product is zero

10. **Assertion (A)** If $(\vec{a}\, x\vec{b})^2 + (\vec{a}.\vec{b})^2 = 144$ and $|\vec{a}| = 4$ and $|\vec{b}| = 9$

Reason(R) If a and b are any two vectors, then $(\vec{a}\, x\vec{b})^2$ is equals to $(\vec{a})^2(\vec{b})^2 - (\vec{a}.\vec{b})^2$

11. **Assertion (A)** The projection of vector a = 2i+3j+2k on the vector b = i+2j+k is $5/3\sqrt{6}$

Reason(R) The projection of vector a on vector b is $(a.b)/|\vec{b}|$

12 **Assertion (A)** If vector a and vector b represent the adjacent sides of a triangle as shown in the figure then its area is $½|\vec{a} x \vec{b}|$

Reason(R) Area of triangle ABC = $½\ |\vec{a}||\vec{b}|\ sin\theta$ *where* θ *is the angle between the adjacent sides a and b*

13. **Assertion (A)** For any three vectors a,b and c [a b c] =[b c a] = [c a b]

Reason(R) Cyclic permutation of three vectors does not change the value of the scalar triple product

14 **Assertion (A)** Let A(a),B(b),C(c) be three points such that vectors a = 2i+j+k,b = 3i-j+3k and c = -i+7j-5kthen OABC is tetrahedron ,where o is the origin

Reason(R) Let A(a),B(b),C(c) be three points such that vectors a,b and c are non-coplanar then OABC is tetrahedron ,where o is the origin

Answers :

1	D	2	A	3	B	4	C	5	D
6	C	7	B	8	A	9	D	10	D
11	C	12	A	13	A	14	D		

THREE DIMENSIONAL GEOMETRY

Multiple choice questions -

1. If the direction ratios of a line are 1, 1, 2, then the direction cosines of a line is

   (A) $\pm\left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}\right)$ (B) $\pm\left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}\right)$

   (C) $\pm\left(\frac{1}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}\right)$ (D) $\pm\left(\frac{-1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}\right)$

2. The direction ratios of the line passing through the points $P(2, 3, 5)$ and $Q(-1, 2, 4)$ is

   (A) $(3, -1, 1)$ (B) $(-3, 1, 1)$

   (C) $(3, 1, 1)$ (D) $(3, -1, -1)$

3. If a line makes an angle of $30^0, 60^0, 90^0$ with the positive direction of x, y, z-axis respectively, then its direction cosines are

   (A) $\pm\left(\frac{\sqrt{3}}{2}, \frac{1}{2}, 1\right)$ (B) $\pm\left(\frac{\sqrt{3}}{2}, \frac{-1}{2}, 0\right)$

   (C) $\pm\left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 0\right)$ (D) $\pm\left(\frac{\sqrt{3}}{2}, \frac{1}{2}, 0\right)$

4. The x – coordinate of a point on the line joining the points Q(2, 2, 1) and R(5, 1, -2) is 4. Find its Z-coordinate.

   (A) 1 (B) 2

   (C) -1 (D) 4

5. The x – coordinate of a point on the line joining the points Q(2, 2, 1) and R(5, 1, -2) is 4. Find its Z-coordinate.

   (A) $\frac{4}{5}$ (B) $\frac{4}{3}$

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

6. The image of the point $(1, 6, 3)$ in the line l is $(1, 0, 7)$ then its foot of the perpendicular is

   (A) $(1, 3, 5)$ (B) $(2, 6, 10)$

   (C) $(1, 3, 7)$ (D) $(6, 3, 4)$

7. The coordinates of the foot of the perpendicular drawn from the point $(2, 5, 7)$ on the X-axis are given by

   (A) $(2, 0, 0)$ (B) $(0, 5, 0)$

   (C) $(0, 0, 7)$ (D) $(0, 5, 7)$

8. P is a point on the line segment joining the points $(3, 2, -1)$and $(6, 2, -2)$. If X-coordinate of P is 5, then the Y-coordinate is

(A)2 (B)1

(C) -1 (D) -2

9. If α, β, γ are the angles that a line makes with the positive direction of x, y, z axis respectively, then the direction cosines of the line are

(A)$sin\alpha, sin\beta, sin\gamma$ (B)$cos\alpha, cos\beta, cos\gamma$

(C) $tan\alpha, tan\beta, tan\gamma$ (D) $sec\alpha, sec\beta, sec\gamma$

10. The distance of a point $P(a, b, c)$ from X-axis is

(A)$\sqrt{a^2 + c^2}$ (B)$\sqrt{a^2 + b^2}$

(C) $\sqrt{b^2 + c^2}$ (D) $b^2 + c^2$

11. The equation of X-axis in the space are

(A)$x = 0, y = 0$ (B)$x = 0, z = 0$

(C) $x = 0$ (D) $y = 0, z = 0$

12. A line makes equal angles with coordinate axis. Direction cosines of this line are

(A)$\pm(1,1,1)$ (B)$\pm\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

(C) $\pm\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$ (D) $\pm\left(\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}\right)$

13. If a line makes angles $\frac{\pi}{2}, \frac{3\pi}{4}$, and $\frac{\pi}{4}$ with x, y, z axis, respectively, then its direction cosines are

(A)$\pm\left(1, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ (B)$\pm\left(0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

(C) $\pm\left(0, \frac{-\sqrt{3}}{2}, \frac{1}{\sqrt{2}}\right)$ (D) $\pm\left(0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

14. If a line makes angles α, β, γ with the positive directions of the coordinate axis, then the value of $sin^2\alpha + sin^2\beta + sin^2\gamma$ is

(A) 3 (B)4

(C)2 (D) - 1

15. If a line makes angle of $\frac{\pi}{4}$ with each of y and z axis, then the angle which it makes with x – axis is

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

(C)$\frac{\pi}{4}$ (D) $\frac{3\pi}{4}$

16. The area of the quadrilateral ABCD, where $A(0, 4, 1)$, $B(2, 3, -1)$, $C(4, 5, 0)$ and $D(2, 6,2)$ is equal to

(A) 9 (B)18

(B) (C)27 (D) 81

17. The direction cosines of the vector $(2\hat{\imath} + 2\hat{\jmath} - \hat{k})$ are ………………

(A)$\pm(2, 2, -1)$ (B)$\pm\left(\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

(C) $\pm\left(\frac{2}{3}, \frac{2}{3}, \frac{-1}{3}\right)$ (D) $\pm\left(\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}, \frac{-1}{\sqrt{3}}\right)$

18. The vector equation of the line $\frac{x-5}{3} = \frac{y+4}{7} = \frac{6-z}{2}$ is

(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)$\vec{r} = (3\hat{\imath} + 7\hat{\jmath} + 2\hat{k}) + \lambda(5\hat{\imath} - 4\hat{\jmath} + 6\hat{k})$

(D) $\vec{r} = (3\hat{\imath} + 7\hat{\jmath} + 2\hat{k}) + \lambda(5\hat{\imath} - 4\hat{\jmath} - 6\hat{k})$

19. The vector equation of the line through the points $(3, 4, -7)$ and $(1, -1, 6)$ is

(A)$\vec{r} = (3\hat{\imath} + 4\hat{\jmath} - 7\hat{k}) + \lambda(2\hat{\imath} - 5\hat{\jmath} - 13\hat{k})$

(B)$\vec{r} = (\hat{\imath} - \hat{\jmath} + 6\hat{k}) + \lambda(2\hat{\imath} + 5\hat{\jmath} + 13\hat{k})$

(C)$\vec{r} = (\hat{\imath} - \hat{\jmath} + 6\hat{k}) + \lambda(2\hat{\imath} + 5\hat{\jmath} + \hat{k})$

(D) $\vec{r} = (3\hat{\imath} + 4\hat{\jmath} - 7\hat{k}) + \lambda(-2\hat{\imath} - 5\hat{\jmath} + 13\hat{k})$

20. The equation of a line which is parallel to $2\hat{\imath} + 5\hat{\jmath} + \hat{k}$ and passing through the point $(5, -2, 4)$ is

(A)$\frac{x-5}{2} = \frac{y+2}{5} = \frac{6-z}{1}$ (B)$\frac{x+5}{2} = \frac{y-2}{5} = \frac{z+4}{1}$

(C)$\frac{x-5}{2} = \frac{y+2}{5} = \frac{z-4}{1}$ (D) $\frac{x-2}{5} = \frac{y-5}{-2} = \frac{z-1}{4}$

21. If a line makes angles α, β, γ with the positive directions of the coordinate axis, then the value of $cos2\alpha + cos2\beta + cos2\gamma$ is

(A)2 (B)-1

(C)1 (D) 2

22. The angle between the two diagonals of a cube is

(A)$\frac{\pi}{6}$ (B)$\frac{\pi}{4}$

(C)$cos^{-1}\left(\frac{1}{3}\right)$ (D) $cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

23. The angle between the lines $\frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $\frac{x-1}{1} = \frac{2y+3}{3} = \frac{z+5}{2}$ is

(A)$\frac{\pi}{6}$ (B)$\frac{\pi}{4}$

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

24. If the lines $6x - 2 = 3y + 1 = 2z - 2$ and $\frac{x-2}{\lambda} = \frac{2y-5}{-3}, z = -2$ are perpendicular, then $\lambda =$

(A)3 (B)2

(C)-3 (D)1

25. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$, is

(A) 0 (B) $\frac{\pi}{6}$

(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

26. The straight line $\frac{x-3}{3} = \frac{y-2}{1} = \frac{z-1}{0}$ is

(A) parallel to x-axis (B) parallel to y-axis

(C) parallel to z-axis (D) perpendicular to z-axis

27. If the straight lines $\frac{x-1}{k} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x-2}{3} = \frac{y-3}{k} = \frac{z-1}{2}$ are intersecting at a point, then the integral value of k is

(A) 2 (B) -2

(C) -5 (D) 5

28. If the straight lines $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ are intersecting at a point, then the value of k is

(A) $\frac{3}{2}$ (B) $\frac{9}{2}$

(C) $\frac{-2}{9}$ (D) $\frac{-3}{2}$

29. The perpendicular distance of the point $P(1,2,3)$ from the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$ is

(A) 7 (B) 5

(C) 0 (D) None of these

30. The lines $x = 5, \frac{y}{3-\alpha} = \frac{z}{-2}$ and $x = 2, \frac{y}{-1} = \frac{z}{2-\alpha}$ are perpendicular then the value of α is

(A) $\frac{2}{3}$ (B) 3

(C) 4 (D) $\frac{7}{3}$

Answers for MCQ's

1	A	2	C	3	D	4	C	5	B
6	A	7	A	8	A	9	B	10	C
11	D	12	B	13	D	14	C	15	A
16	A	17	C	18	B	19	D	20	C
21	B	22	C	23	C	24	A	25	D
26	D	27	C	28	B	29	A	30	D

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

1. **Assertion (A):** If a line makes angle α, β, γ with the positive directions of the coordinate axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$.

Reason(R): If l, m, n are direction cosines of a line, then $l^2+m^2+n^2=1$.

2. **Assertion (A):** If a line makes angle α, β, γ with the positive directions of the coordinate axes, then $\cos^2\alpha+\cos^2 \beta + \cos^2 \gamma = 1$.

Reason(R): If l, m, n are direction cosines of a line , then $l^2+m^2+n^2=1$.

3. **Assertion (A):** If a line makes angle α, β, γ with the positive directions of the coordinate axes, then $\cos2\alpha+\cos2\beta + \cos2\gamma = 1$.

Reason(R): l, m, n are direction cosines of a line , then $l^2+m^2+n^2=1$.

4. **Assertion (A):** if a is an integer , then the straight lines

$\vec{r} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k} + \lambda\,(a\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$ and $\vec{r} = 2\hat{\imath} + 3\hat{\imath} + \hat{k} + \mu(3\hat{\imath} + a\hat{\jmath} + 2\hat{k})$ interests at a point for a= -5

Reason(R): Two straight lines intersect if the shortest distance between them is zero.

5. The equations of two straight lines $\frac{x-1}{2} = \frac{y+3}{1} = \frac{z-2}{-3}$ and $\frac{x-2}{1} = \frac{y-1}{-3} = \frac{z+3}{2}$.

Assertion (A): The given lines are coplanar.

Reason(R): The equations $2r - s = 1, r + 3s = 4, 3r + 2s = 5$ are Consistent

6. **Assertion (A):** The shortest distance between the lines $\frac{x}{2} = \frac{y}{-1} = \frac{z}{2}$ and $\frac{x-1}{4} = \frac{y-1}{-2} = \frac{z-1}{4}$ is $\sqrt{2}$.

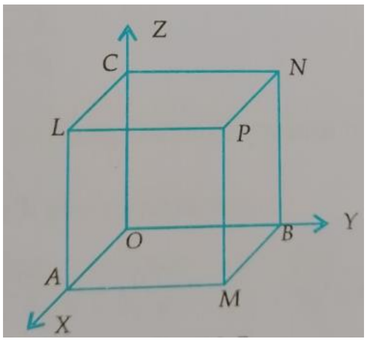
Reason(R): The shortest distance between two parallel lines is the perpendicular distance from any point on one of the lines to the other line.

Answers :

1	A	2	A	3	D	4	A	5	A
6	A								

CASE STUDY TYPE QUESTIONS

CS1. A student made a cube of side 10 cm with one vertex at the origin and edges along the coordinate axes as shown in the following figure.



Based on the above information, answer the following.

(i) The coordinates of the vertex P are

(A) $(10, 10, 10)$ (B) $(10, -10, 10)$

(C) $(-10, 10, 10)$ (D) $(10, -10, -10)$

(ii) Direction cosines of the diagonal OP are

(A) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (B) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

(C) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ (D) $-\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

(iii) Direction cosines of the diagonal CM are

(A) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (B) $-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

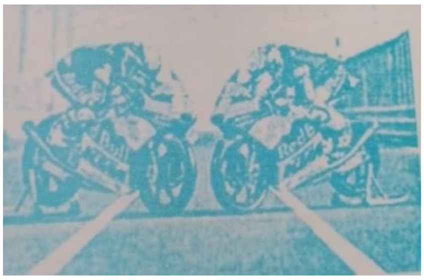
(C) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ (D) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

(iv) Acute angle between the two diagonals of a cube is

(A) $cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (B) $cos^{-1}\left(\frac{1}{3}\right)$

(C) $cos^{-1}\left(\frac{2}{3}\right)$ (D) $sin^{-1}\left(\frac{1}{3}\right)$

CS 2. Two motorcycles A and B are running at the speed more than allowed speed on the roads represented by the lines $\vec{r} = \lambda(\hat{\imath} + 2\hat{\jmath} - \hat{k})$ and $\vec{r} = (3\hat{\imath} + 3\hat{\jmath}) + \mu(2\hat{\imath} + \hat{\jmath} + \hat{k})$ respectively.

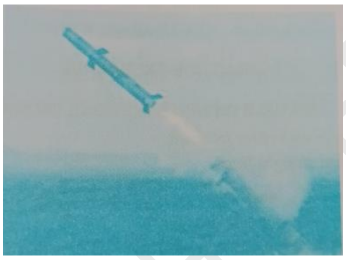


Based on the above information, answer the following questions.

(i) Find the shortest distance between the given lines.

(ii) Find the point at which the motorcycles may collide.

CS 3. The equation of motion of a missile are $x = 3t, y = -4t, z = t$ where t is given in seconds, and the distance is measured in kilometers.



Based on the above information, answer the following questions:

(i) What is the path of the missile ?

(A)straight line (B)Parabolic

(C) Circular (D) Elliptical

(ii) Which of the following points lie on the path of the missile ?

(A)$(6,8,2)$ (B)$(6,-8,-2)$

(C) $(6,-8,2)$ (D) $(-6,-8,2)$

(iii) At what distance will the rocket be from the starting point (0,0,0) in 5 seconds ?

(A)$\sqrt{550}\ km$ (B)$\sqrt{650}\ km$

(C)$\sqrt{450}\ km$ (D) $\sqrt{750}\ km$

(iv) If the position of the rocket at a certain instant of time is (5, -8,10) , then what will be the height of the rocket from the ground? (The ground is considered as the xy-plane)

(A)$12\ km$ (B)$11\ km$

(C)$20\ km$ (D) $10\ km$

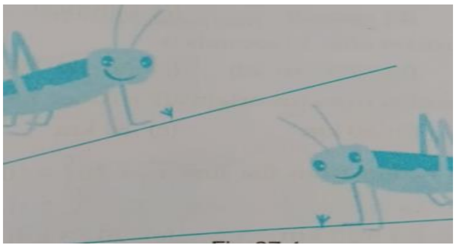
(v) For what value of k are the lines $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{k}$ and $\frac{x-2}{-2} = \frac{y-3}{-1} = \frac{z-5}{7}$ perpendicular?

(A) *1* (B) *2*

(C) *3* (D) None of these

CS 4. An insect is crawling along the line lines $\vec{r} = (6\hat{\imath} + 2\hat{\jmath} + 2\hat{k}) + \lambda(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$ in the space and another insect is crawling along the line

$\vec{r} = -4\hat{\imath} - \hat{k} + \mu(3\hat{\imath} - 2\hat{\jmath} - 2\hat{k})$ in the space.



Based on the above information, answer the following questions:

(i) The Cartesian parametric equations of the line along which first insect is crawling are

(A) $x = 6 + \lambda, y = 2 - 2\lambda, z = z + \lambda$

(B) $x = 6 + \lambda, y = 2 - 2\lambda, z = z + 2\lambda$

(C) $x = \lambda - 6, y = -2\lambda + 2, z = 2\lambda - 2$

(D) $x = \lambda - 6, y = -2\lambda - 2, z = 2\lambda + 2$

(ii) The direction cosines of the line along which second insect is crawling are

(A) $\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$ (B) $3, -2, -2$

(C) $\frac{3}{3\sqrt{17}}, \frac{-2}{\sqrt{17}}, \frac{-2}{\sqrt{17}}$ (D) $\frac{3}{\sqrt{17}}, \frac{2}{\sqrt{17}}, \frac{2}{\sqrt{17}}$

(iii) The shortest possible distance between the insects is

(A) *9* (B) *3*

(C) 6 (D) 18

CASE STUDY

CS-1	i) A	ii) A	iii) C	iv) D	
CS-2	i) 0	ii) (1, 2, -1)			
CS-3	i) A	ii) C	iii) B	iv) D	v) A
CS-4	i) B	ii) C	iii) A		

LINEAR PROGRAMMING

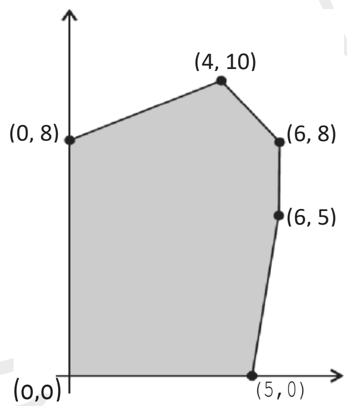
MULTIPLE CHOICE QUESTIONS

1 The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0,40), (20,40),(60,20),(60,0).The objective function is Z= 4x+3y,Compare the quantity in Column A and Column *B*

Column A	Column *B*
Maximum of Z	325

(a) The quantity in column A is greater
(b)The quantity in column *B* is greater
(c) The two quantities are equal.
(d) The relationship cannot be determined on the basis of the information supplied.

2 The feasible solution for a LPP is shown in given figure. Let Z=3x-4y be the objective function. Minimum of Z occurs at



(a) (0,0)
(b) (0,8)
(c) (5,0)
(d) (4,10)

3 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
(a) p=2q
(b) p=q/2
(c) p=3q
(d) p=q

4 The set of all feasible solutions of a LPP is a ____ set.
(a) Concave
(b) Convex
(c) Feasible
(d) None of these

5 Corner points of the feasible region for an LPP are (0,2), (3,0), (6,0), (6,8) and (0,5). Let F=4x+6y be the objective function. Maximum of F – Minimum of F =
(a) 60
(b) 48
(c) 42
(d) 18

6 In a LPP, if the objective function Z = ax+by has the same maximum value on two corner points of the feasible region, then every point on the line segment joining these two points give the same……….value.

(a) minimum (b) maximum
(c) zero (d) none of these

7 In the feasible region for a LPP is …….., then the optimal value of the objective function Z = ax+by may or may not exist.

(a) bounded (b) unbounded
(c) in circled form (d) in squared form

8 A linear programming problem is one that is concerned with finding the …A … of a linear function called …B… function of several values (say x and y), subject to the conditions that the variables are …C… and satisfy set of linear inequalities called linear constraints.

(a) Objective, optimal value, negative (b) Optimal value, objective, negative
(c) Optimal value, objective, non-negative (d) Objective, optimal value, non-negative

9 Maximum value of the objective function Z = ax+by in a LPP always occurs at only one corner point of the feasible region.

(a) true (b) false
(c) can't say (d) partially true

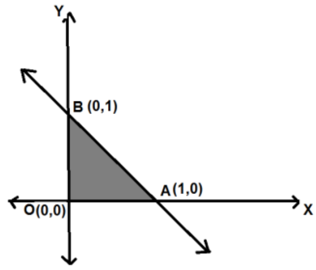
10 Region represented by $x \geq 0, y \geq 0$ is:

(a) First quadrant (b) Second quadrant
(c) Third quadrant (d) Fourth quadrant

11 Z =3x + 4y,

Subject to the constraints x+y 1, $x,y \geq 0$.

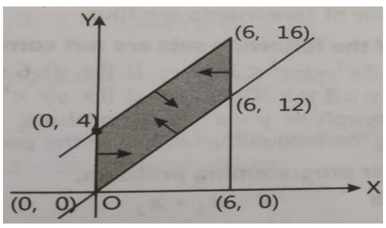
the shaded region shown in the figure as OAB is bounded and thecoordinatesof corner points O, A and B are (0,0),(1,0) and (0,1), respectively.



The maximum value of Z is 2.

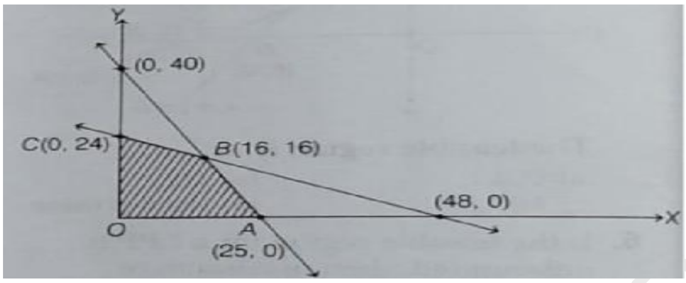
(a) true (b) false
(c) can't say (d) partially true

12 The feasible region for an LPP is shown shaded in the figure. Let Z = 3x-4y be objective function. Maximum value of Z is:



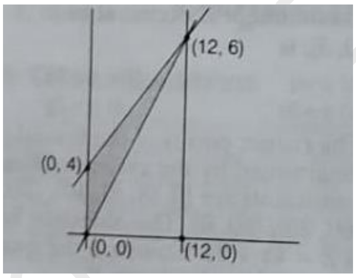
(a) 0 (b) 8
(c) 12 (d) -18

13 The maximum value of Z = 4x+3y, if the feasible region for an LPP is as shown below, is



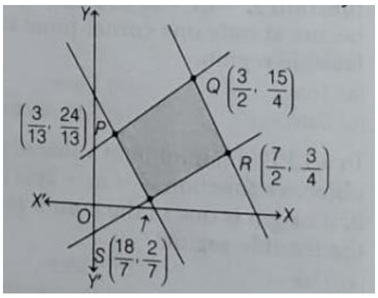
(a) 112 (b) 100
(c) 72 (d) 110

14 The feasible region for an LPP is shown shaded in the figure. Let Z = 4x-3y be objective function. Maximum value of Z is:



(a) 0 (b) 8
(c) 30 (d) -18

15 In the given figure, the feasible region for a LPP is shown. Find the maximum and minimum value of Z = x+2y.



(a) 8, 3.2 (b) 9, 3.14
(c) 9, 4 (d) none of these

16 The linear programming problem minimize Z= 3x+2y,subject to constraints x+y≤8, 3x+5y ≤ 15, x,y ≥0, has
(a) One solution (b) No feasible solution
(c) Two solutions (d) Infinitely many solutions

17 The graph of the inequality $2x+3y > 6$ is:

(a) half plane that contains the origin
(b) half plane that neither contains the origin nor the points of the line $2x+3y = 6$
(c) whole XOY-plane excluding the points on the line $2x+3y = 6$
(d) entire XOY-plane

18 Of all the points of the feasible region for maximum or minimum of objective function the points

(a) Inside the feasible region
(b) At the boundary line of the feasible region
(c) Vertex point of the boundary of the feasible region
(d) None of these

19 The maximum value of the object function $Z = 5x + 10y$ subject to the constraints $x + 2y \leq 120$, $x + y \geq 60$, $x - 2y \geq 0$, $x \geq 0$, $y \geq 0$ is

(a) 300
(b) 600
(c) 400
(d) 800

20 $Z = 6x + 21y$, subject to $x + 2y \geq 3$, $x + 4y \geq 4$, $3x + y \geq 3$, $x \geq 0$, $y \geq 0$. The minimum value of Z occurs at

(a) (4, 0)
(b) (28, 8)
(c) (2,2/7)
(d) (0, 3)

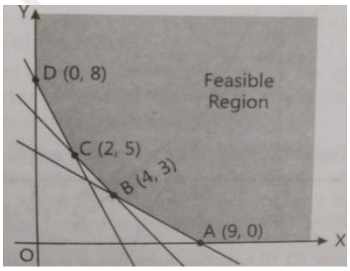
21 Shape of the feasible region formed by the following constraints $x + y \leq 2$, $x + y \geq 5$, $x \geq 0$, $y \geq 0$

(a) No feasible region
(b) Triangular region
(c) Unbounded solution
(d) Trapezium

22 Maximize $Z = 4x + 6y$, subject to $3x + 2y \leq 12$, $x + y \geq 4$, $x, y \geq 0$.

(a) 16 at (4, 0)
(b) 24 at (0, 4)
(c) 24 at (6, 0)
(d) 36 at (0, 6)

23 Feasible region for an LPP shown shaded in the following figure. Minimum of $Z = 4x+3y$ occurs at the point:



(a) (0,8)
(b) (2,5)
(c) (4,3)
(d) (9,0)

24 The region represented by the inequalities
$x \geq 6$, $y \geq 2$, $2x + y \leq 0$, $x \geq 0$, $y \geq 0$ is

(a) unbounded
(b) a polygon
(c) exterior of a triangle
(d) None of these

25 Minimize $Z = 13x - 15y$ subject to the constraints: $x + y \leq 7$, $2x - 3y + 6 \geq 0$, $x \geq 0$, $y \geq 0$.

(a) -23
(b) -32
(c) -30
(d) -34

Answer Key:-

Q: 1	b	Q: 2	b	Q: 3	b	Q: 4	a	Q: 5	a
Q: 6	b	Q: 7	b	Q: 8	c	Q: 9	b	Q: 10	a
Q: 11	b	Q: 12	a	Q: 13	a	Q: 14	c	Q: 15	b
Q: 16	b	Q: 17	b	Q: 18	c	Q: 19	b	Q: 20	c
Q: 21	a	Q: 22	d	Q: 23	b	Q: 24	d	Q: 25	c

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is NOT the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.
E) Both A and R are false

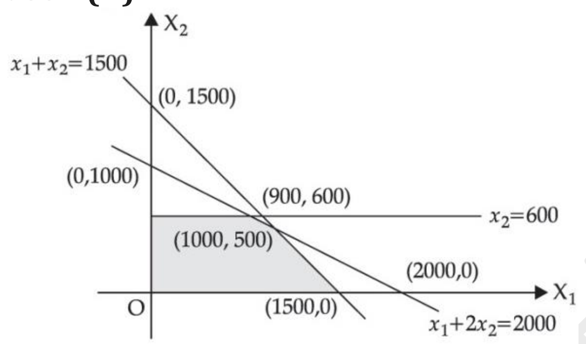
1. **Assertion (A):** Feasible region is the set of points which satisfy all of the given constraints.
   Reason (R): The optimal value of the objective function is attained a the points on X-axisonly.

2. **Assertion (A):** It is necessary to find objective function value at every point in the feasible region to find optimum value of the objective function.
   Reason(R): For the constrains2x+3y≤6, 5x+3y≤15, x≥0 and y≥0 cornner points of the feasible region are (0,2), (0,0) and (3,0).

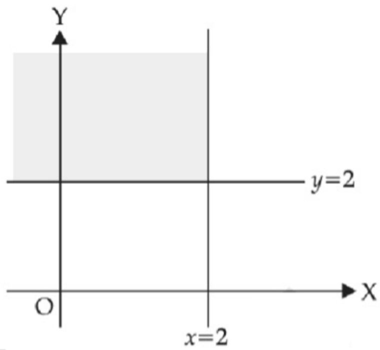
3. **Assertion (A):** It is necessary to find objective function value at every point in the feasible region to find optimum value of the objective function.
   Reason(R): For the constrains2x+3y≤6, 5x+3y≤15, x≥0 and y≥0 cornner points of the feasible region are (0,2), (0,0) and (3,0).

4. **Assertion (A)** : For the constraints of linear optimizing function $Z = x_1 + x_2$ given by $x_1 + x_2 \leq 1$, $3x_1 + x_2 \geq 1$, $x \geq 0$ and $y \geq 0$ there is no feasible region.
Reason (R): $Z = 7x + y$, subject to $5x + y \leq 5$, $x + y \geq 3$, $x \geq 0$, $y \geq 0$. The corner points of the feasible region are $\left(\frac{1}{2}, \frac{5}{2}\right)$ $(0,3)$ *and* $(0,5)$.

5. **Assertion (A):** For the constraints of a LPP problem given by $x_1 + 2x_2 \leq 2000$,
$x_1 + x_2 \leq 1500$, $x_2 \leq 600$ and $x_1, x_2 \geq 0$ the points (1000, 0), (0, 500), (2, 0) lie in the positive bounded region, but point (2000, 0) does not lie in the positive boundedregion.
Reason (R):



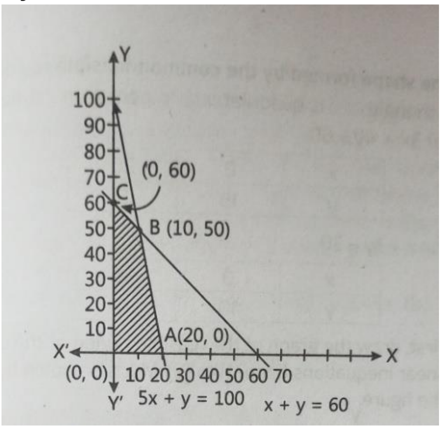
6. **Assertion (A):**The graph of $x \leq 2$ and $y \geq 2$ will be situated in the first and second quadrants.
Reason (R):



7. **Assertion (A):** The maximum value of $Z = 11x+7y$
Subject to the constraints are
$2x+y \leq 6$,
$x \leq 2$,
$x, y \geq 0$.
Occurs at the point (0,6).
Reason (R): If the feasible region of the given LPP is bounded, then the maximum and minimum values of the objective function occurs at corner points.

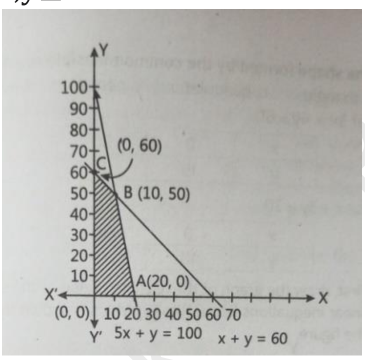
8. **Assertion (A):**If an LPP attains its maximum value at two corner points of the feasible region then it attains maximum value at infinitely many points.
Reason (R): if the value of the objective function of a LPP is same at two corners then it is same at every point on the line joining two corner points.

9. Consider, the graph of constraints stated as linear inequalities as below:
$5x+y\leq 100$,
$x+y\leq 60$,
$x,y\geq 0$.



Assertion (A): The points (10,50), (0,60) , (10,10) and (20,0) are feasible solutions.
Reason (R): Points within and on the boundary of the feasible region represent feasible solutions of the constraints.

10. Consider, the graph of constraints stated as linear inequalities as below:
$5x+y\leq 100$,
$x+y\leq 60$,
$x,y\geq 0$.



Assertion (A): (25,40) is an infeasible solution of the problem.
Reason (R): Any point inside the feasible region is called an infeasible solution.

11. **Assertion (A):** The region represented by the set $\{(x,y): 4\leq x^2+y^2\leq 9\}$ is a convex set.
Reason (R): The set $\{(x,y): 4\leq x^2+y^2\leq 9\}$ represents the region between two concentric circles of radii 2 and 3.

12. **Assertion (A):**For an objective function Z= 15x + 20y, corner points are (0,0), (10,0), (0,15) and (5,5). Then optimal values are 300 and 0 respectively.
Reason (R): The maximum or minimum value of an objective function is known as optimal value of LPP. These values are obtained at corner points.

13. **Assertion (A): For the LPP** Z= 3x+2y, subject to the constraints x+2y≤2; x≥0; y≥ *0* both maximum value of Z and Minimum value of Z can be obtained.
Reason (R): If the feasible region is bounded then both maximum and minimum values of Z exists.

14. **Assertion (A):**The linear programming problem, maximize Z = x+2y subject to constraints x-y≤10,2x + 3y≤20 and x≥0; y≥ *0*. It gives the maximum value of Z as 40/3.
Reason (R): To obtain maximum value of Z, we need to compare value of Z at all the corner points of the shaded region.

15. **Assertion (A):**Consider the linear programming problem. Maximise Z=4x+y Subject to constraints x+ y≤50; x+ y≥100 and x, y ≥0. Then, maximum value of Z is 50.
Reason (R): If the shaded region is bounded then maximum value of objective function can be determined.

ASSERTION AND REASONING ANSWERS:

1	C	2	D	3	D	4	A	5	A
6	A	7	A	8	A	9	A	10	C
11	D	12	A	13	A	14	A	15	D

CASE STUDY

CS 1 A train can carry a maximum of 300 passengers. A profit of Rs. 800 is made on each executive class and Rs. 200 is made on each economy class. The IRCTC reserves at least 40 tickets for executive class. However, atleast 3 times as many passengers prefer to travel by economy class, than by executive class. It is given that the number of executive class ticket is Rs. x and that of economy class ticket is Rs. y. Optimize the given problem.

Based on the above information, answer the following questions.

1 The objective function of the LPP is:
(a) Maximise Z = 800x + 200y (b) Maximise Z = 200x + 800y
(c) Minimise Z = 800x + 200y (d) Minimise Z = 200x + 800y

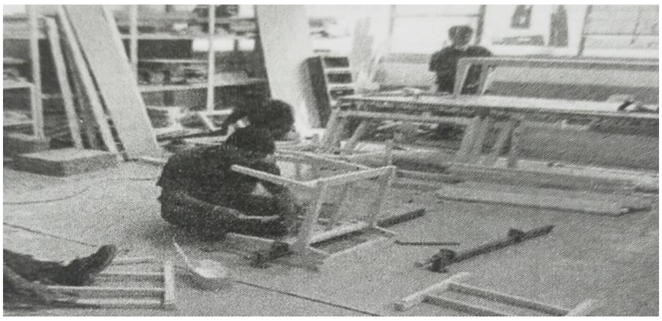
2 Which among these is a constraint for this LPP?
(a) x+y≥300 (b) y≥3x
(c) x≤40 (d) y≤3x

3 Which among these is not a corner point for this LPP?
(a) (40,120) (b) (40, 260)
(c) (30, 90) (d) (75, 225)

4 The maximum profit is:
(a) Rs.56000 (b) Rs. 84000
(c) Rs. 205000 (d) Rs. 105000

5 Which corner point the objective function has minimum value?
(a) (40,120) (b) (40, 260)
(c) (30, 90) (d) (75, 225)

CS 2 A manufacturing company makes two models X and Y of a product. Each piece of model X requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of model Y requires 12 labour hours of fabricating and 3 labour hours for finishing, the maximum labour hours available for fabricating and finishing are 180 and 30 respectively. The company makes a profit of Rs. 8000 on each piece of model X and Rs. 12000 on each piece of model Y. Assume x is the number of pieces of model X and y is the number of pieces of model Y.



Based on the above information, answer the following questions.

1 Which among these is not a constraint for this LPP?

(a) 9x+12y≥180 (b) 3x+4y≤60

(c) x+3y≤30 (d) None of these

2 The shape formed by the common feasible region is:

(a) Triangle (b) Quadrilateral

(c) Pentagon (d) hexagon

3 Which among these is a corner point for this LPP?

(a) (0,20) (b) (6,12)

(c) (12,6) (c) (10,0)

4 Maximum of Z occurs at

(a) (0,20) (b) (0,10)

(c) (20,10) (d) (12,6)

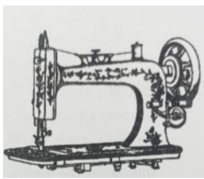
5 The sum of maximum value of Z is:

(a) 168000 (b) 160000

(c) 120000 (d) 180000

CS 3 Suppose a dealer in rural area wishes to purchase a number of sewing machines. He has only Rs. 5760 to invest and has space for atmost 20 items for storage. An electronic sewing machine costs him Rs. 360 and a manually operated sewing machine Rs. 240. He can sell an electronic sewing machine at a profit of Rs. 22 and a manually operated sewing machine at a profit of Rs.18.

Based on the above information, answer the following questions.



1 Let x and y denote the number of electronic sewing machines and manually operated sewing machines purchased by the dealer. If it is assumed that the dealer purchased atleast one of the given machines then:

(a) x+y≥ 0 (b) x+y< 0

(c) x+y> 0 (c) x+y≤ 0

2 Let the constraints in the given problem is represented by the following inequalities:
$x+y\leq 20$; $360x+240y\leq 5760$ and $x,y\geq 0$. Then which of the following point lie in its feasible region.

(a) (0,24) (b) (8,12)

(c) (20,2) (d) None of these

3 If the objective function of the given problem is maximize Z = 22x+18y, then its optimal value occur at:

(a) (0,0) (b) (16,0)

(c) (8,12) (d) (0,2)

4 Suppose the following shaded region APDO, represent the feasible region corresponding to mathematical formulation of the given problem.
Then which of the following represent the coordinates of one of its corner points.

(a) (0,24) (b) (12,8)

(c) (8,12) (d) (6,14)

5 If an LPP admits optimal solution at two consecutive vertices of a feasible region, then

(a) The required optimal solution is at a mid pointof the line joining two points.

(b) The optimal solution occurs at every point on the line joining these points.

(c) The LPP under consideration is not solvable.

(d) The LPP under consideration must be reconstructed.

ANSWERS:

CASE STUDY

CS-1	1) A	2) B	3) C	4) D	5) A
CS-2	I) A	2) B	3) C	4) D	5) A
CS-3	I)C	2) B	3) C	4) C	5) B

PROBABILITY

Multiple choice questions -

1 If A and B are two events such that A ≠ □, B ≠ □ then

A) P(A/B) = P(A) P(B) C) P(A/B) = $\frac{P(A\cap B)}{P(B)}$

B) P(A/B) P(B/A) = 1 D) P(A/B) = P(A)/P(B)

2 If A and B are any two events such that P(A) + P(B) – P(A and B) = P(A), then

A) P(B/A) = 1 C) P(A/B) = 0

B) P(A/B) = 1 D) P(B/A) = 0

3 If P(A/B) > P(A) then which of the following is true

A) P(B/A) < P(B) C) P(A∩B) < P(A) P(B)

B) P(B/A) >P(B) D) P(B/A) = P(B)

4 If A and B are such that P(B) ≠ 1, then P(A'/B') equals

A) 1 – P(A/B) C) $\frac{1- P(A\cup B)}{P(B')}$

B) 1 – P(A'/B) D) P(A')/P(B')

5 If P(A) = 0.3, P(B) = 0.4 and P(A∪B) = 0.6 then P(A/B) + P(B/A) =

A) $\frac{1}{4}$ C) $\frac{5}{12}$

B) $\frac{1}{3}$ D) $\frac{7}{12}$

6 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

A) $\frac{1}{4}$ C) $\frac{5}{12}$

B) $\frac{1}{3}$ D) None

7 If A and B are two events such that P(A) = $\frac{1}{2}$, $P(B) = \frac{1}{3}$ and P(A/B) = $\frac{1}{4}$, then P(A'∩ B') equals

A) $\frac{1}{12}$ C) $\frac{1}{4}$

B) $\frac{3}{4}$ D) $\frac{3}{16}$

8 If A and B are two events such that $P(B) = \frac{3}{5}$, P(A/B) = $\frac{1}{2}$ and P(A∪ B) = $\frac{4}{5}$ then P(B/A') equals

A) $\frac{1}{5}$ C) $\frac{1}{2}$

B) $\frac{3}{10}$ D) $\frac{3}{5}$

9 A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the probability of getting exactly 1 red ball is

A) $\frac{45}{196}$ C) $\frac{15}{56}$

B) $\frac{135}{392}$ D) $\frac{15}{29}$

10 Two cards are drawn at random and without replacement from a pack of 52 playing cards the probability that both the cards are spade.

A) $\frac{1}{17}$ B) $\frac{1}{16}$ C) $\frac{16}{17}$ D) None

11 Probability of solving specific problem independently by A and B are 1 /2 and 1 /3 respectively. If both try to solve the problem independently, the probability that the problem is solved is

A) $\frac{1}{5}$ B) $\frac{1}{4}$ C) $\frac{2}{3}$ D) None

12 Two events A and B will be independent, if

(A) A and B are mutually exclusive (B) $P(A'B') = [1 - P(A)] [1 - P(B)]$

(C) $P(A) = P(B)$ (D) $P(A) + P(B) = 1$

13 A person has undertaken a construction job. The probabilities are 0.65 that there will be strike, 0.80 that the construction job will be completed on time if there is no strike, and 0.32 that the construction job will be completed on time if there is a strike. the probability that the construction job will be completed on time is

A) 0.588 B) 0.4 C)0.488 D) 0.5

14 Probability that A speaks truth is 0.8. A coin is tossed. A reports that a head appears. The probability that actually there was head is

A) $\frac{4}{5}$ B) $\frac{1}{2}$ C) $\frac{1}{5}$ D) $\frac{2}{5}$

15 A and B are two students. Their chances of solving a problem correctly are $\frac{1}{3}$ and $\frac{1}{4}$ respectively. If the probability of their making a common error is $\frac{1}{20}$, then the probability of their answer to be correct is ---

A) $\frac{1}{12}$ B) $\frac{1}{40}$ C) $\frac{13}{120}$ D) $\frac{10}{13}$

16 In a college, 30% students fail in physics, 25% fail in Mathematics and 10% fail in both. One student is chosen at random. The probability of that she fails in Physics if she fails in Mathematics is

A) $\frac{1}{10}$ B) $\frac{2}{5}$ C) $\frac{9}{20}$ D) $\frac{1}{3}$

17 A and B are two independent events and $P(A) = \frac{1}{2}$, $P(B) = p$ and $P(A \cup B) = \frac{3}{5}$ Find the value of p

A) $\frac{1}{10}$ B) $\frac{2}{5}$ C) $\frac{1}{5}$ D) $\frac{1}{3}$

18 Three integers are chosen at random from the first 20 integers. The probability that their product is even is

A) $\frac{2}{19}$ B) $\frac{3}{29}$ C) $\frac{17}{19}$ D) $\frac{4}{19}$

19 A card is picked at random from a pack of 52 cards. Given that the picked card is king, the probability of this card to be a card of club is

A) $\frac{1}{3}$ B) $\frac{4}{13}$ C) $\frac{1}{4}$ D) $\frac{1}{2}$

20 A person writes 4 letters and addresses 4 envelopes. If the letters are placed in the envelopes at random, then the probability that all letters are not placed in the right envelopes is

A) $\frac{1}{4}$ B) $\frac{1}{24}$ C) $\frac{15}{24}$ D) $\frac{23}{24}$

21 From the set {1, 2, 3, 4, 5} two numbers are a and b (a ≠ b) are chosen at random. The probability that $\frac{a}{b}$ is an integer is

A) $\frac{1}{3}$ B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) $\frac{3}{5}$

21 If the probability distribution of a random variable X is as given below

X	-2	-1	0	1	2	3
P(X)	$\frac{1}{10}$	k	$\frac{1}{5}$	2k	$\frac{3}{10}$	k

Then the value of k is

A) $\frac{1}{10}$ B) $\frac{2}{10}$ C) $\frac{3}{10}$ D) $\frac{7}{10}$

B)

22 If the probability distribution of a random variable X is as given below

X	2	3	4	5
P(X)	$\frac{1}{10}$	k	$\frac{1}{5}$	2k

Then the value of E(X) is

A) 8 B) 16 C) 32 D) 48

Answers for MCQ's

1	C	2	B	3	B	4	C	5	D
6	B	7	C	8	D	9	C	10	A
11	C	12	B	13	C	14	A	15	D
16	B	17	C	18	C	19	C	20	D
21	B	22	A						

ASSERTION AND REASONING TYPE QUESTIONS

In the following question a statement of Assertion (A) is followed by a statement of Reason(R).Pick the correct option:

A) Both A and R are true and R is the correct explanation of A.

B) Both A and R are true but R is NOT the correct explanation of A.

C) A is true but R is false.

D) A is false but R is true.

E) Both A and R are false.

1 **Assertion**: 20 persons are sitting in a row. Two of these persons are selected at random. The probability that the two selected persons are not together is 0.9

Reason : if $\bar{A}$ denotes the negation of an event A, then P($\bar{A}$) = 1 – P(A)

2 **Assertion:** The probability of drawing either a king or a spade from a pack of 52 cards is 4/13

Reason: For any two events A and B P(A∪B) = P(A) + P(B) – P(A∩B)

3 Consider the system of equations ax + by = 0: cx + dy = 0

where a, b, c and d ∈ {0, 1}

Assertion: The probability that the system of equations has a unique solution is 3/8

Reason: The probability that the system of equations has a solution is 1

4 4 numbers are chosen at random without replacement from the set {1, 2, ----20}

Assertion : The probability that the chosen numbers when arranged in some order form an A.P. is 1/85

Reason: If the four chosen numbers form an A.P. then the set of all possible values common difference is {$\pm$1, $\pm$2, $\pm$3, $\pm$4, $\pm$5}

5 **Assertion :** The probabilities of solving new problem by 3 students are $\frac{1}{2}$, $\frac{1}{3}$, $and\ \frac{1}{4}$Respectively. The probability that the problem will be solved by them is $\frac{1}{4}$.

Reason: If A, B and C are independent events , then the probability at least one of them happens is 1 - P($\bar{A}$) P($\bar{B}$) P(C)

6 **Assertion :** If A and B are two events such that P(A) = 1, then A and B are independent events

Reason: A and B are independent events iff $P(A\cap B) = P(A)P(B)$

7 **Assertion:** Mutually exclusive events cannot be independent

Reason: Two independent events are always mutually exclusive

8 **Assertion :** Let A and B are two events such that P(A/B) = p, P(A) = p, P(B) = $\frac{1}{3}$ and $P(A\cup B) = \frac{5}{9}$ Then $p = \frac{2}{3}$.

Reason: Let A and B are two events such that P(A/B) = P(A) then A and B are independent events.

Answers :

1	A	2	A	3	B	4	C	5	A
6	A	7	C	8	D				

CASE STUDY TYPE QUESTIONS

CS 1 A coach is training 3 players. He observes that the player A can hit a target 4 times in 5 shots, player B can hit 3 times in 4 shots and the player C can hit 2 times in 3 shots

From this situation answer the following:

1 Let the target is hit by A, B: the target is hit by B and, C: the target is hit by A and C.

Then, the probability that A, B and, C all will hit, is

(a) 4/5 (b). 3/5

(c) 2/5 (d) 1/5

2 Referring to (i), what is the probability that B, C will hit and A will lose?

(a) 1/10 (b) 3/10

(c) 7/10 (d) 4/10

3 With reference to the events mentioned in (i), what is the probability that 'any two of A, B and C will hit?

(a) 1/30 (b) 11/30

(c) 17/30 (d) 13/30

4 What is the probability that 'none of them will hit the target'?

(a) 1/30 (b) 1/60

(c) 1/15 (d) 2/15

5 What is the probability that at least one of A, B or C will hit the target?

(a) 59/60 (b) 2/5

(c) 3/5 (d) 1/60

CS 2 The reliability of a COVID PCR test is specified as follows:

Of people having COVID, 90% of the test detects the disease but 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random, given the COVID PCR test, and the pathologist reports him/her as COVID positive.

Based on the above information, answer the following

1 What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID?

(a) 0.001 (b) 0.1

(c) 0.8 (d) 0.9

2 What is the probability of the 'person to be tested as COVID positive' given that 'he is actually not having COVID'?

(a) 0.01 (b) 0.99

(c) 0.1 (d) 0.001

3 What is the probability that the 'person is actually not having COVID?

(a) 0.998 (b) 0.999

(c) 0.001 (d) 0.111

4 What is the probability that the 'person is actually having COVID given that 'he is tested as COVID positive'?

(a) 0.83 (b) 0.0803

(c) 0.083 (d) 0.089

5 What is the probability that the 'person selected will be diagnosed as COVID positive'?

(a) 0.1089 (b) 0.01089

(c) 0.0189 (d) 0.189

CS 3 In answering a question on a multiple choice test for class XII, a student either knows the answer or guesses. Let 3/5 be the probability that he knows the answer and 2/5 be the probability that he guesses. Assume that a student who guesses at the answer will be correct with probability 1/3. Let E1, E2, E be the events that the student knows the answer, guesses the answer and answers correctly respectively.

Based on the above information, answer the following

1 What is the value of P(E1)?

(a) 2/5 (b). 1/3

(c) 1 (d) 3/5

2 Value of P(E | E1) is

(a) 1/3 (b) 1

(c) 2/3 (d) 4|5

3 $\sum$ P(E|Ek) P(Ek)

k=2

k=1 Equals

(a) 11/15 (b) 4/15

(c) 1/5 (d) 1

4 Value of $\sum$ P(Ek)

(a) 1/3 (b) 1/5

(c) 1 (d) 3/5

5 What is the probability that the student knows the answer given that he answered it correctly?

(a) 2/11 (b) 5/3

(c) 9/11 (d) 13/3

CASE STUDY ANSWERS:

CS-1	1) c	2) a	3) d	4) b	5) a
CS-2	1) d	2) a	3) b	4) c	5) b
CS-3	1) d	2) b	3) a	4) c	5) c