# KENDRIYA VIDYALAYA SANGATHAN

# CHANDIGARH REGION

# SUPPORT MATERIAL

# MATHEMATICS

# XII (2021-22)

## INDEX

## Chapter wise MCQs Term 1 Class XII (Mathematics)

# Chapter 1: Relations and Functions

## Section-A

## (Multiple Choice Questions)

In each of the Questions from 1 to 30 choose the correct option

Q 1 . Let A = {1, 2, 3} and consider the relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)}. Then R is
(a) reflexive but not symmetric
(b) reflexive but not transitive
(c) symmetric and transitive
(d) neither symmetric, nor transitive

Q 2. If R be a relation in the set N given by R = { ( a,b) : a - b = 5 , a > 7 } , then

(a) ( 7, 2 ) $\epsilon$ R
(b) ( 15,12 ) $\epsilon$ R
(c) ( 9 ,4 ) $\epsilon$ R
(d) ( 8, 2 ) $\epsilon$ R

Q 3. Let A = { a,b,c,d }, then a relation R = { ( a,a),(a,b),(a,c),(b,c),(b,d),(c,d),(d,a) } on set A is

(a) reflexive
(b) Symmetric
(c) Transitive
(d) none of these

Q 4.Let us define a relation R in R as aRb if a $\geq$ b. Then R is
(a) an equivalence relation
(b) reflexive, transitive but not symmetric
(c) symmetric, transitive but not reflexive
(d) neither transitive nor reflexive but symmetric

Q 5. Let R be the relation "is congruent to" on the set of all triangles in a plane is
(a) reflexive
(b) symmetric
(c) symmetric and reflexive
(d) equivalence

Q 6. Let R be a relation on the set N of natural numbers denoted by x R y $\Leftrightarrow$ x is a factor of y . Then, R is
(a) Reflexive and symmetric
(b) Transitive and symmetric
(c) Equivalence
(d) Reflexive, transitive but not symmetric

Q 7. Let S = {1, 2, 3, 4, 5} and let A = S × S. Define the relation R on A as follows:
(a, b) R (c, d) iff ad = cb. Then, R is
(a) reflexive only
(b) Symmetric only
(c) Transitive only
(d) Equivalence relation

Q 8. If R be the relation on Z ( the set of Integers) defined as R = { (a,b) : a,b ϵ Z and |a – b| is divisible by 4 }. Then R is
(a) reflexive
(b) Symmetric
(c) Transitive
(d) All of the above

Q 9. A relation R in the set {1,2,3} is given by R = {(1,2),(2,1),(3,3),(2,2)} . Which of the following ordered pairs should be added in R to make it Transitive
(a) ( 1,3 )
(b) ( 2,3 )
(c) ( 1,1 )
(d) ( 3,1 )

Q 10. Let set A = {a,b,c} and R is the relation in A given by R = {(a,a),(a,b),(a,c),(b,a),(c,c)}. Which of the following pairs be added in R to make it symmetric .
(a) ( c,a )
(b) ( b,b )
(c) ( b,c )
(d) None of these

Q 11 . A relation R on the set *A* of all triangles is given by R = {($T_1$, $T_2$): $T_1$ is similar to $T_2$}. Consider three right angle triangles $T_1$ with sides 3, 4, 5, $T_2$ with sides 5, 12, 13 and $T_3$ with sides 6, 8, 10. Which of the following pairs of triangles among $T_1$, $T_2$ and $T_3$ are related?
(a) ( $T_1$ , $T_2$ )
(b) ( $T_2$ , $T_3$ )
(c) ( $T_1$ , $T_3$ )
(d) All of these

Q 12. The maximum number of equivalence relations on the set A = {1, 2, 3} are
(a) 1
(b) 2
(c) 3
(d) 5

Q 13. If a relation R defined on the set A = { 1,2,3 } is given by R = { ( 1,2 ) }, then R is

(a) Reflexive
(b) Transitive
(c) Symmetric
(d) None of these

Q 14. Let A is the set of human beings in a town at a particular time. Which of the following is an Equivalence relation defined on set A

(a) { ( x,y ) : x and y work at the same place }

(b) { ( x,y ) : x is exactly 7cm taller than y }

(c) { ( x,y ) : x is sister of y }

(d) { ( x,y ) : x is father of y }

Q 15 . Let f: $X \rightarrow Y$ is a given function . A relation R on the set X is defined as R = { ( a,b ) : f(a) = f(b) }

Which of the following is true for relation R .

(a) Reflexive

(b) Transitive

(c) Symmetric

(d) Equivalence

Q 16. Let A = { 1,2,3 } The number of Equivalence relations containing ( 1,2 )

(a) 1

(b) 2

(c) 3

(d) 4

Q 17. Let A = { 1,2,3 } .Then number of relations containing ( 1,2 ) and ( 1,3 ) which are Reflexive and Symmetric but not Transitive is

(a) 1

(b) 2

(c) 3

(d) 4

Q 18. The function f : $R \rightarrow R$ defined by f(x) = $|x|$ is

(a) Onto

(b) Not onto

(c) Bijective

(d) Neither one one nor onto

Q 19. The number of all one one functions from A = { 4,5,6 } to itself is

(a) 2

(b) 4

(c) 6

(d) 8

Q 20. A function f : { 1,2,3 } $\rightarrow$ { 1,2,3 } is given to be one one . then f must be

(a) a constant function

(b) an onto function

(c) an into function

(d) none of these

Q 21.Let g(x) = $x^2 - 4x - 5$, then

(a) g is one-one on R

(b) g is not one-one on R

(c) g is bijective on R (d) None of these

Q 22.The mapping f : N → N is given by $f(n) = 1 + n^2$, n ∈ N when N is the set of natural numbers is

(a) one-one and onto

(b) onto but not one-one

(c) one-one but not onto

(d) neither one-one nor onto

Q 23.The function f : R → R given by $f(x) = x^3 - 1$ is

(a) a one-one function

(b) an onto function

(c) a bijection

(d) neither one-one nor onto

Q 24. A constant function f : A→B will be onto if

( a ) if n ( A ) = n ( B )

( b ) If n( A ) = 1

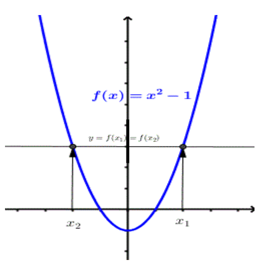
( c ) if n( B ) = 1

( d ) If n ( A ) > n ( B )

Q 25. The functions f(x) = Sinx and g(x) = Cosx defined on the Interval $[\,0\,, \frac{\pi}{2}\,]$ are one one functions . Then f + g will be

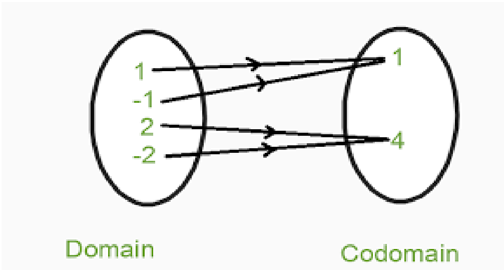
(a) One One
(b) Not One one
(c) Bijective
(d) None of these

Q 26. The function drawn in adjoining figure is




(a) One One
(b) Bijective
(c) Many One
(d) None of these

Q 27. The given figure is arrow diagram of a function




The given function in figure is

(a) One One Onto

(b) One One Into

(c) Many One Onto

(d) Many One Into

Q 28. Which of the following functions is bijective

(a) $f : N \to N$ given by $f(x) = x^2$

(b) $f : Z \to Z$ given by $f(x) = x^2$

(c) $f : N \to N$ given by $f(x) = x^3$

(d) $f : R \to R$ given by $f(x) = 3 - 4x$

Q 29. For the function $f : R \to R$ given by $f(x) = x^4$, choose the correct option

(a) f is one one onto

(b) f is many one onto

(c) f is one one but not onto

(d) f is neither one one nor onto

Q 30. The function $f : R_+ \to [-5, \infty)$ given by $f(x) = 9x^2 + 6x - 5$ is bijective

The Pre image of y for this function is

(a) $x = \frac{\sqrt{y+6} - 1}{3}$

(b) $x = \frac{-\sqrt{y+6} - 1}{3}$

(c) $x = \frac{\pm\sqrt{y+6} - 1}{3}$

(d) None of these

## Section-B

## (Assertion and Reasoning based MCQs)

Directions : In the following Questions from 1 to 10 the Assertions (A) and Reason(s) (R) statements have been given . Read both the statements carefully and choose the correct alternative from the following:

(A) Both the Statements A and R are correct and the R is the correct explanation of the A
(B) Both the Statements A and R are correct and the R is not the correct explanation of the A
(C) The Statement A is true but the Statement R is false.
(D) The Statement A is false but the statement R is true.
(E) Both the statements are false.

Q 1 . Statement A : A relation R = { ( 1,1 ) , ( 1,2 ) , ( 1,3 ) , ( 2,2 ) , ( 3,2 ) , ( 3,3 ) } defined on the . A = { 1,2,3 } is reflexive

Statement R : A relation R on the set A is reflexive if ( a,a ) ϵ R for every a ϵ A .

Q 2 . Statement A : Let R = { ( x,y ) : x is a multiple of y } . then R is reflexive and transitive but not symmetric

Statement R : A relation R is an equivalence relation iff it is reflexive and symmetric .

Q 3 . Statement A : The relation R on the set N×N , defined by (a, b) R (c, d) ⇔ a+d = b+c for all (a, b), (c, d) ∈ N×N is an equivalence relation

Statement R: Any relation R is an equivalence relation, if it is reflexive, symmetric and transitive

Q 4. Statement A : The relation R on the set of Real Numbers defined as R = { ( m,n ) : $m \leq n^2$ } is neither reflexive nor symmetric but is Transitive

Statement R : A relation r is equivalence if it is reflexive and symmetric

Q 5 . Statement A : The function f : R→R defined as $f(x) = \begin{cases} \mathbf{0}, & \textbf{if x is rational} \\ \mathbf{1}, & \textbf{if x is irrational} \end{cases}$ is bijective

Statement R:A function is said to be bijective if it is both one one and onto

Q 6 . Statement A: The function f : N → N defined by $f(n) = \begin{cases} \frac{n+1}{2}, & \textbf{if n is odd} \\ \frac{n}{2}, & \textbf{if n is even} \end{cases}$ is not bijective

Statement R:A function f : A → B is Bijective if it is both One One and Onto

Q 7 . Statement A : The function f : R → R defined as $f(x) = x^3$ is Onto but not One One

Statement R : A function f : R →R is bijective if it is both One One and Onto.

Q 8 . Statement A : The Greatest integer Function f : R → R given by f( x ) = [ x ] is not one one .

Statement R :A function f : A → B is said to be injective if f ( a) = f ( b ) ⇒ a = b

Q 9 . Statement A : The function f : $R - \left\{\frac{7}{5}\right\} \to R - \left\{\frac{3}{5}\right\}$ defined by f(x) = $\frac{3x+4}{5x-7}$ is Bijective

Statement R: A function f : A → B is Onto if Range of f = B

Q 10 . Statement A :For two sets A and B a function f : A × B → B × A is defined as f ( a,b ) = ( b,a ) is bijective

Statement R : A function f : X → Y is said to be bijective if it is both Injective and surjective

## Section-C ( Case Study Based MCQs )

Q 1. Rani a teacher of mathematics was explaining the concept of straight line and its properties to her students . She told them to denote the set of all the straight lines in a plane as A . To make the concept more clear she took all the students in the playground and told them to stand along the line 2x – y = 5 .

On the basis of the above information answer the following Questions

( I ) If R = { ( $L_1$ , $L_2$ ) : $L_1$ is parallel to $L_2$ and $L_2$ is 2x – y = 5 } is a relation , then which of the following can be taken as $L_1$

(a ) 2x – 2y = 10

( b ) x + 2y = 5

( c ) 6x – 3y = 7

( d ) 2x + y = 5

( ii ) If $R = \{ ( L_1 , L_2 ) : L_1$ is parallel to $L_2$ , where $L_1$ and $L_2 \in A \}$ , then the relation R is

( a ) Symmetric but not reflexive

( b ) Reflexive and Symmetric but not transitive

( c ) equivalence

( d ) only reflexive

( iii ) If $R = \{ ( L_1 , L_2 ) : L_1$ is perpendicular to $L_2$ ,where $L_1$ and $L_2 \in A \}$.Then the relation R is

( a ) Symmetric but not reflexive

( b ) Symmetric but neither reflexive and nor transitive

( c ) equivalence

( d ) Not symmetric

( iv ) The Relation $R = \{ ( L_1 , L_2 ) : L_1$ is parallel to $L_2$ , where $L_1$ and $L_2 \in A \}$ is

( a ) Empty

( b ) Finite

( c ) Universal

( d ) None of the above

( v ) ) If $R = \{ ( L_1 , L_2 ) : L_1$ is perpendicular to $L_2$ and $L_2$ is $2x - y = 5 \}$ is a relation , then which of the following can be taken as $L_1$

(a ) $2x - 2y = 10$

( b ) $x + 2y = 3$

( c ) $x - 2y = 3$

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

Q 2. In a school there are two sections of class XII , section A and section B . For a competition three students from each section were selected . Set A= { a , b , c } and set B = { d , e , f } represent students of section A and B respectively . On the basis of this information answer the following Questions

( i ) The number of relations that can be defined from set A to set B is

(a ) 16 ( b ) 32 ( c ) 64 ( d ) 512

( ii ) How many functions can be defined from set A to set B

(a ) 8 ( b ) 27 ( c ) 45 ( d ) 56

( iii ) How many bijective functions can be defined from set A to set B

( a ) 4 ( b ) 6 ( c ) 8 ( d ) 12

( iv ) The number of reflexive relations from set A to set B is

( a ) 128 ( b ) 90 ( c ) 64 ( d ) 16

( v ) The number of Equivalence relations on set B is

( a ) 5 ( b ) 6 ( c ) 7 ( d ) 8

# Chapter 2: Inverse Trigonometric Functions

## Section-A

## (Multiple Choice Questions)

Q1.The value of the expression cot $\left[\boldsymbol{cos}^{-1}\left(\frac{7}{25}\right)\right]$ is

(A) $\frac{25}{24}$ (B) $\frac{25}{7}$(C) $\frac{24}{25}$(D) $\frac{7}{24}$

Q2. The value of the expression 2 $\boldsymbol{sec}^{-1}\,\mathbf{2} + \boldsymbol{sin}^{-1}\left(\frac{1}{2}\right)$ is

(A) $\frac{13\pi}{6}$(B) $\frac{\pi}{6}$(C) $\frac{5\pi}{6}$(D) $\frac{7\pi}{6}$

Q3.sin $(\boldsymbol{tan}^{-1}\boldsymbol{x})$ , $|\boldsymbol{x}| < \mathbf{1}$ ***is equal to***

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

Q4. The value of the expression$\boldsymbol{cos}^{-1}\left(\boldsymbol{cos}\,\frac{13\pi}{6}\right)$ is

(A) $\frac{13\pi}{6}$(B) $\frac{\pi}{6}$(C) -$\frac{\pi}{6}$(D) - $\frac{13\pi}{6}$

Q5. The value of the expression$\boldsymbol{tan}^{-1}\left(\boldsymbol{tan}\,\frac{7\pi}{6}\right)$ is

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

Q6. The value of the expression$\boldsymbol{sin}^{-1}\left(\boldsymbol{sin}\,\frac{3\pi}{5}\right)$ is

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

Q7.The value of the expression$\boldsymbol{sin}^{-1}\left(\boldsymbol{sin}\,\frac{2\pi}{3}\right)$ is

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

Q8. The value of the expression$\boldsymbol{tan}^{-1}\left(\boldsymbol{tan}\,\frac{3\pi}{4}\right)$ is

(A) - $\frac{3\pi}{6}$(B) $\frac{\pi}{4}$(C) - $\frac{\pi}{4}$(D) none

Q9.The value of the expression$\boldsymbol{cos^{-1}\left( cos\,\frac{7\pi}{6}\right)}$ is

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

Q10. The value of the expression sin $\left[\frac{\pi}{3} - \boldsymbol{sin^{-1}}\left(-\frac{1}{2}\right)\right]$ is

(A) $\mathbf{1}$(B) $\frac{1}{2}$(C) $\mathbf{0}$(D) $\frac{\sqrt{3}}{2}$

Q11. The value of the expression $\boldsymbol{tan^{-1}\sqrt{3} - cot^{-1}(-\sqrt{3})}$ is

(A) $\frac{\pi}{2}$(B) $-\frac{\pi}{2}$(C) $\frac{\pi}{3}$(D)$\mathbf{0}$

Q12.$\boldsymbol{tan^{-1}\sqrt{3} - sec^{-1}(-2)}$is equal to

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

Q13.$\boldsymbol{tan^{-1}}(\mathbf{1})$ + $\boldsymbol{cos^{-1}}\left(-\frac{1}{2}\right) + \boldsymbol{sin^{-1}}\left(-\frac{1}{2}\right)$ is equal to

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

Q14. 2 $\boldsymbol{sin^{-1}}\left(\frac{1}{2}\right) + \boldsymbol{cos^{-1}}\left(\frac{1}{2}\right)$ is equal to

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

Q15. If $\boldsymbol{sin^{-1}x = y}$ then

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

Q16. If $\boldsymbol{cos^{-1}x = y}$ then

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

Q17. If $\boldsymbol{tan^{-1}x = y}$ then

(A) 0$\leq \boldsymbol{y} \leq \boldsymbol{\pi}$ (B) 0$< \boldsymbol{y} < \boldsymbol{\pi}$ (C) $-\frac{\pi}{2} \leq \boldsymbol{y} \leq \frac{\pi}{2}$(D) $-\frac{\pi}{2} < \boldsymbol{y}. < \frac{\pi}{2}$

Q18. The principal value branch of $\boldsymbol{cosec^{-1}x}$ is

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

Q19. The principal value branch of $\boldsymbol{sec}^{-1}\boldsymbol{x}$ is

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

Q20. The principal value branch of $\boldsymbol{cot}^{-1}\boldsymbol{x}$ is

(A) $0\leq \boldsymbol{y}\leq \boldsymbol{\pi}$ (B) $0< \boldsymbol{y}<\boldsymbol{\pi}$ (C) $-\frac{\pi}{2}\leq \boldsymbol{y}\leq \frac{\pi}{2}$ (D) $-\frac{\pi}{2}<\boldsymbol{y}.<\frac{\pi}{2}$

Q21. The domain of $\boldsymbol{sin}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$

Q22. The domain of $\boldsymbol{cos}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$

Q23. The domain of $\boldsymbol{tan}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$

Q24. The domain of $\boldsymbol{cot}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$

Q25. The domain of $\boldsymbol{sec}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$

Q26. The domain of $\boldsymbol{cosec}^{-1}\boldsymbol{x}$ is

(A) R - $(-\mathbf{1},\mathbf{1})$ (B) R (C) $[-\mathbf{1},\mathbf{1}]$ (D) $(-\mathbf{1},\mathbf{1})$.

Q27. The principal value of the expression : $\boldsymbol{cos}^{-1}$[ cos ( - $\mathbf{680}^{\circ}$ ) ] is

(A) $\frac{2\pi}{9}$ (B) $\frac{-2\pi}{9}$ (C) $\frac{34\pi}{9}$ (D) $\frac{\pi}{9}$

Q28. Let $\boldsymbol{\theta}=$ : $\boldsymbol{sin}^{-1}$[ sin ( - $\mathbf{600}^{\circ}$ ) ], then the value of $\boldsymbol{\theta}$ is

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

Q29.The domain of y = $\boldsymbol{cos}^{-1}(\boldsymbol{x}^{2}-\mathbf{4})$ is

(A) [3, 5] (B) [0, $\boldsymbol{\pi}$ ] (C) [ - $\sqrt{\mathbf{5}}$, - $\sqrt{\mathbf{3}}$ ] ∩ [ - $\sqrt{\mathbf{5}}$, $\sqrt{\mathbf{3}}$ ] (D) [ - $\sqrt{\mathbf{5}}$, - $\sqrt{\mathbf{3}}$ ] ∪ [ $\sqrt{\mathbf{3}}$, $\sqrt{\mathbf{5}}$ ]

Q30. The value of sin (2 $\boldsymbol{sin}^{-1}$(.6)) is

(A) 0.48 (B) 0.96(C) $\mathbf{1.2}$ (D) sin ( 1.2)

## Section-B

## (Assertion and Reasoning based MCQs)

Directions: In the following questions, a statement of Assertions (A) is followed by a statement of Reason(s) (R) have been given. Read both the statements carefully and choose the correct alternative from the following:
(A) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
(B) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.
(C) Our Assertion is true but the Reason is false.
(D) The statement of the Assertion is false but the Reason is true.
(E) Both the statements are false.

Q1.A : Value of $sin^{-1}(\sin 10) = 3\pi - 10$

R : $3\pi$ - 10 lies between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$.

Q2.A: Value of $sec^2(tan^{-1} 2) + Cosec^2(cot^{-1} 3) = 15$

R: $sec^2x = 1 + tan^2x$ and $Cosec^2x = 1 + cot^2x$ .

Q3.A : The branch with range ($-\frac{\pi}{2}$ , $\frac{\pi}{2}$) is called the Principal value branch of the function $tan^{-1}$ $i.e.$ $tan^{-1}: R \to \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.

R: $tan^{-1}$ is a function whose domain is R and range could be any of the intervals $(-\pi, 0), (0, \pi), (\pi, 2\pi)$etc.Tangent function remains bijective in these intervals.

Q4.A : The branch with range $(0, \pi)$ is called the Principal value branch of the function $cot^{-1}$ $i.e.$ $cot^{-1}: R \to (0, \pi)$ .

R: $cot^{-1}$ is a function whose domain is R and range could be any of the intervals $(-\pi, 0), (0, \pi), (\pi, 2\pi)$etc.Cotangent function remains bijective in these intervals.

Q5.A : The branch with range ($-\frac{\pi}{2}$ , $\frac{\pi}{2}$ ) is called the Principal value branch of the function $sin^{-1}$ $i.e.$ $sin^{-1}: [-1, 1] \to (-\frac{\pi}{2}, \frac{\pi}{2})$.

R: $sin^{-1}$ is a function whose domain is: $[-1, 1]$ and range could be any of the intervals $(-\pi, 0), (0, \pi), (\pi, 2\pi)$etc.Sine function remains bijective in these intervals.

Q6.A :The branch with range $(-\frac{\pi}{2}, \frac{\pi}{2})$ is called the Principal value branch of the function $cos^{-1}$ $i.e.$ $cos^{-1}: [-1, 1] \rightarrow (-\frac{\pi}{2}, \frac{\pi}{2})$.

R: $cos^{-1}$ is a function whose domain is : $[-1, 1]$ and range could be any of the intervals $[-\pi, 0,]$,$[0, \pi]$, $[\pi, 2\pi]$etc.Cosine function remains bijective in these intervals.

Q7.A : The branch with range (- $\frac{\pi}{2}$ , $\frac{\pi}{2}$) is called the Principal value branch of the function $sec^{-1}$ $i.e.$ $sec^{-1}: R - (-1, 1) \rightarrow [0, \pi] - \{\frac{\pi}{2}\}$.

R: $sec^{-1}$ is a function whose domain is R and range could be any of the intervals $(-\pi, 0), (0, \pi), (\pi, 2\pi)$etc.Secant function remains bijective in these intervals.

Q8.A : The branch with range $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$ is called the Principal value branch of the function $cosec^{-1}$ $i.e.$ $cosec^{-1}: R - (-1, 1) \rightarrow \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$.

R: $cosec^{-1}$ is a function whose domain is $R - (-1, 1)$ and range could be any of the intervals $\left[-\frac{3\pi}{2}, \frac{-\pi}{2}\right] - \{-\pi\}$, $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$, $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right] - \{\pi\}$etc. Cosecant functionremains bijective in these intervals.

Q9. A: Principal value of$tan^{-1}(1)$ + $cos^{-1}\left(-\frac{1}{2}\right)$ is $\frac{11\pi}{12}$

R: Range of $sin^{-1}$x is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

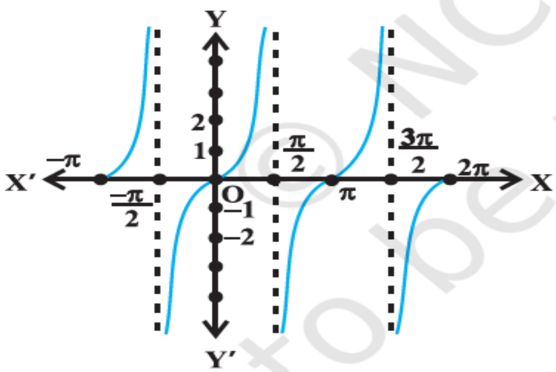
Q10. A: Domain of f (x)= $sin^{-1}(2x - 3)$ is [1,2]

R: Domain of $sin^{-1}$x is $[-1, 1]$.

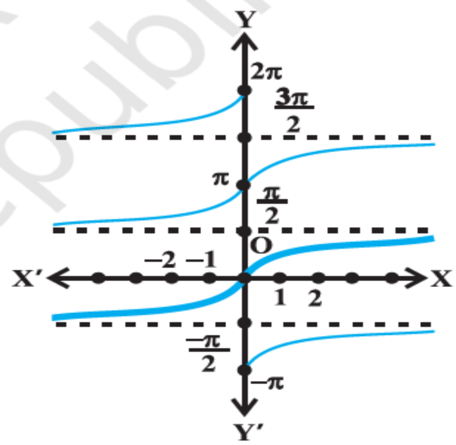
# Section-C

## (Case Study Based MCQs)

**CASE STUDY 1** : The graphs of two trigonometric function tanx and $\boldsymbol{tan}^{-1}$x are given below.On the basis of the information given in the graphs and the learning outcomes achieved from the topic answer the following questions.




$y = \tan x$




$y = \tan^{-1}x$

1.The function f(x) = tanx is given by

(A) f : R - $\left\{\boldsymbol{x}: \boldsymbol{x} = (\mathbf{2}\boldsymbol{n} + \mathbf{1})\frac{\pi}{2}, \boldsymbol{n} \in \boldsymbol{Z}\right\} \rightarrow \boldsymbol{R}$

(B) f : R - $\{\boldsymbol{x}: \boldsymbol{x} = \boldsymbol{n\pi} \in, \boldsymbol{n} \in \boldsymbol{Z}\} \rightarrow \boldsymbol{R}$

(C) f : R - $\left\{(\mathbf{2}\boldsymbol{n} + \mathbf{1})\frac{\pi}{2} : \boldsymbol{n} \in \boldsymbol{Z}\right\} \rightarrow \boldsymbol{R} - (-1,1)$

(D) none of the above

2. The function f(x) = $\boldsymbol{tan}^{-1}$ is given by

(A) f : $\boldsymbol{tan}^{-1}: \boldsymbol{R} \rightarrow \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(B) f: $\boldsymbol{tan}^{-1}: \boldsymbol{R} \rightarrow \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(C) f : $\boldsymbol{tan}^{-1}: \boldsymbol{R} \rightarrow [\mathbf{0}, \boldsymbol{\pi}]$

(D) none of the above

3.If we compare tan 1 and $\boldsymbol{tan^{-1}1}$,we observe

(A) tan 1 <$\boldsymbol{tan^{-1}1}$

(B) tan 1 >$\boldsymbol{tan^{-1}1}$

(C) tan 1 = $\boldsymbol{tan^{-1}1}$

(D) none of the above

4.The minimum value of n for which $\boldsymbol{tan^{-1}}(\frac{\boldsymbol{n}}{\boldsymbol{\pi}})>\frac{\boldsymbol{\pi}}{\boldsymbol{4}}$ , $\boldsymbol{n} \in \boldsymbol{N}$

(A) 0

(B) 1

(C) -4

(D) 4

5.Value of $\boldsymbol{tan^{-1}\{2\sin\ (4\ cos^{-1}\frac{\sqrt{3}}{2})\}}$is

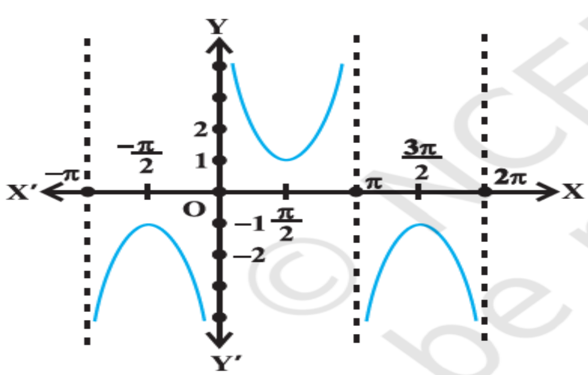
(A)$\boldsymbol{\pi}$

(B) $\frac{\boldsymbol{\pi}}{\boldsymbol{4}}$

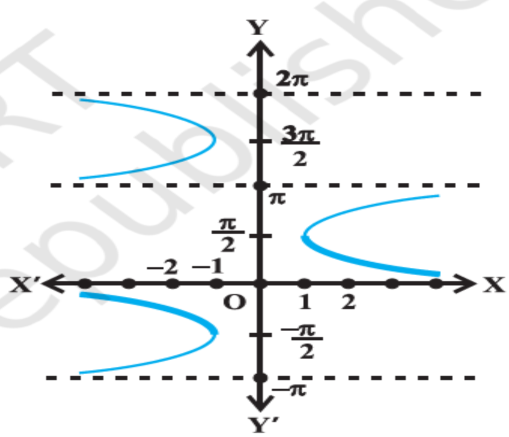
(C ) $\frac{\boldsymbol{\pi}}{\boldsymbol{2}}$

(D) $\frac{\boldsymbol{\pi}}{\boldsymbol{3}}$

CASE STUDY 2 :The graphs of two trigonometric function cose x and $\boldsymbol{cosec^{-1}}$x are given below.On the basis of the information given in the graphs and the learning outcomes achieved from the topic answer the following questions.




$y = \text{cosec}\ x$




$y = \text{cosec}^{-1}x$

1.The function f(x) = cosecx is given by

(A) f : R - $\left\{\boldsymbol{x}: \boldsymbol{x} = (\mathbf{2}\boldsymbol{n}+\mathbf{1})\frac{\boldsymbol{\pi}}{\mathbf{2}}, \boldsymbol{n} \in \boldsymbol{Z}\right\} \rightarrow \boldsymbol{R}$

(B) f : R - $\{\boldsymbol{x}: \boldsymbol{x} = \boldsymbol{n\pi} \in, \boldsymbol{n} \in \boldsymbol{Z}\} \rightarrow \boldsymbol{R}$

(C) f :$\mathbf{R} - \{\boldsymbol{x}: \boldsymbol{x} = \boldsymbol{n\pi} \in, \boldsymbol{n} \in \boldsymbol{Z}\} \rightarrow \boldsymbol{R} - (-\mathbf{1}, \mathbf{1})$.

(D)f :$\boldsymbol{R} - (-\mathbf{1}, \mathbf{1}) \rightarrow \left[-\frac{\boldsymbol{\pi}}{\mathbf{2}}, \frac{\boldsymbol{\pi}}{\mathbf{2}}\right] - \{\mathbf{0}\}$

2. The function f(x) = $\boldsymbol{cosec}^{-\mathbf{1}}$ is given by

(A) f :$\boldsymbol{cosec}^{-\mathbf{1}}: \boldsymbol{R} \rightarrow \left(-\frac{\boldsymbol{\pi}}{\mathbf{2}}, \frac{\boldsymbol{\pi}}{\mathbf{2}}\right)$

(B) f :$\boldsymbol{cosec}^{-\mathbf{1}}: \boldsymbol{R} - (-\mathbf{1}, \mathbf{1}) \rightarrow \left[-\frac{\boldsymbol{\pi}}{\mathbf{2}}, \frac{\boldsymbol{\pi}}{\mathbf{2}}\right] - \{\mathbf{0}\}$

(C) f :$\boldsymbol{cosec}^{-\mathbf{1}}: \boldsymbol{R} \rightarrow [\mathbf{0}, \boldsymbol{\pi}]$

(D) none of the above

3. Value of $\boldsymbol{sin}^{-\mathbf{1}}$ [ $\mathbf{cos}$ { $\mathbf{2}\,\boldsymbol{cosec}^{-\mathbf{1}}(-\mathbf{2})$}] is

(A) $\boldsymbol{\pi}$

(B) $\frac{\boldsymbol{\pi}}{\mathbf{4}}$

(C ) $\frac{\boldsymbol{\pi}}{\mathbf{2}}$

(D) $\frac{\boldsymbol{\pi}}{\mathbf{6}}$

4. We restrict the domain of cosec function to any of the intervals $\left[-\frac{\mathbf{3}\boldsymbol{\pi}}{\mathbf{2}}, \frac{-\boldsymbol{\pi}}{\mathbf{2}}\right] - \{-\boldsymbol{\pi}\}$, $\left[-\frac{\boldsymbol{\pi}}{\mathbf{2}}, \frac{\boldsymbol{\pi}}{\mathbf{2}}\right] - \{\mathbf{0}\}$, $\left[\frac{\boldsymbol{\pi}}{\mathbf{2}}, \frac{\mathbf{3}\boldsymbol{\pi}}{\mathbf{2}}\right] - \{\boldsymbol{\pi}\}$etc to make it

(A) $\boldsymbol{one\ one}$

(B) onto

(C ) $\boldsymbol{bijective}$

(D) $\boldsymbol{none}$

5.Value of $\boldsymbol{cosec}^{-\mathbf{1}}$[ $\mathbf{2}\,\mathbf{tan}(\frac{\mathbf{11}\boldsymbol{\pi}}{\mathbf{6}})$]

(A) - $\frac{\boldsymbol{\pi}}{\mathbf{3}}$

(B) $\frac{\boldsymbol{\pi}}{\mathbf{4}}$

(C ) $\frac{\boldsymbol{\pi}}{\mathbf{2}}$

(D) $\frac{\boldsymbol{\pi}}{\mathbf{6}}$

# Chapter 3: Matrices

## Section-A

## (Multiple Choice Questions)

**Q1**. If A and B matrices are of same order and A + B = B + A, this law is known as:

A. Distributive law
B Commutative law
C. Associative law
D. Cramer's law

**Q2** If determinant of a matrix is equal to zero, then it is said to be:

A. square matrix
B. singular matrix
C. non-singular matrix
D. identical matrix

**Q3**. If a matrix ‘A’ has ‘m’ number of columns and ‘n’ number of rows then $m \times n$ is said to be:

A. transpose of a matrix
B. order of a matrix
C. determinant of a matrix
D. equality of a matrix

**Q4**. If A and B are 2 matrices such that AB = B and BA = A, then A ^ 2 + B ^ 2 is:

i) 2AB
ii) 2BA
iii) A+B
iv) AB

**Q5**. If A and B are symmetric matrices of the same order, then (AB’–BA’) is a

a. Skew symmetric matrix
b. Symmetric matrix
c. Both
d. None of the above

**Q6**. If A is a 3x3 matrix, $|A| \neq 0$ and $|3A| = 3k|A|$, Then find the value of k.

A. 3
B. 9
C. 27
D. none of these

**Q7**. The solutions of system of linear equations x + y + z = 6, y + 3z = 11, x – 2y + z = 0. Are:

a. X=1, y=2, z=3
b. X=1, y=2, z= -3
c. X=2, y=3, z=1
d. X=3, z=2, y=1

**Q8**. If A=$\begin{bmatrix} \mathbf{1} & \mathbf{0} \\ \mathbf{-1} & \mathbf{7} \end{bmatrix}$ and A2=8A+kI, Then find the value of k

a. 7
B.-7
c. 6
d. -6

**Q9**. If A=$\begin{bmatrix} \mathbf{1} & \mathbf{-1} \\ \mathbf{2} & \mathbf{-1} \end{bmatrix}$, B=$\begin{bmatrix} \boldsymbol{a} & \mathbf{1} \\ \boldsymbol{b} & \mathbf{-1} \end{bmatrix}$ and $(A+B)^2=A^2+B^2$, then what is the value of a and b.

A. a=1, b=4
B. a=2, b=3
C. a=4, b=3
D. a=3, b=7

**Q10**. If A=$\begin{bmatrix} \mathbf{3} & \boldsymbol{x-1} \\ \boldsymbol{2x+3} & \boldsymbol{x+2} \end{bmatrix}$ is a symmetric matrix, then x=?

A. 4
B. 3
C. -4
D. -3

**Q11**. If A=$\begin{bmatrix} \mathbf{1} & \mathbf{3} \\ \mathbf{3} & \mathbf{4} \end{bmatrix}$, $A^2$-kA-5I= O, Then K=?

A. 5
B. 3
C. 7
D. none of these

**Q12**. For any square matrix A, $AA^T$ is a:

(a) Unit matrix (b) symmetric matrix
(c) skew-symmetric matrix (d) diagonal matrix

**Q13**. If a matrix A is both symmetric and skew-symmetric, then

(A) A is a diagonal matrix
(b) A is a zero matrix

(c) A is a scalar matrix

(d) A is a square matrix

**Q14**. If A is a square matrix such that $A^2 = I$, then $(A - I)^3 + (A + I)^3 - 7A$ is equal to

(a) A

(b) I – A

(c) I + A

(d) 3A

**Q15**. If A = $\begin{matrix} \mathbf{2} & \mathbf{2} & \mathbf{1} \\ \mathbf{1} & \mathbf{3} & \mathbf{1} \\ \mathbf{1} & \mathbf{2} & \mathbf{2} \end{matrix}$ then $A^4 - 2^4 (A - I) =$

(a) 5I + A

(b) 5I – A

(c) 5I

(d) 6I

**Q16**. If A is a matrix of order m × n and B is a matrix such that AB' and B'A are both defined, then the order of matrix B is

(a) m × m

(b) n × n

(c) n × m

(d) m × n

**Q17**. Total number of possible matrices of order 3 × 3 with each entry 2 or 0 is

(A) 9 (b)27 (c) 81 (d) 512

**Q18**. If AB = C, then matrices A, B, C are

(a) $A_{2\times3}$, $B_{3\times2}$, $C_{2\times3}$

(b) $A_{3\times2}$, $B_{2\times3}$, $C_{3\times2}$

(c) $A_{3\times3}$, $B_{2\times3}$, $C_{3\times3}$

(d) $A_{3\times2}$, $B_{2\times3}$, $C_{3\times3}$

**Q19**. If A, B are square matrices of order 3, A is non- singular and AB = O, then *B* is a

(a) Null matrix (b) Singular matrix

(c) Unit matrix (d) Non- singular matrix

**Q20**.Let A=$\begin{bmatrix} \mathbf{1} & \mathbf{2} \\ \mathbf{-5} & \mathbf{1} \end{bmatrix}$, and $A^{-1}$=xA+ yI , then the value of x & y respectively are:

A) -1/11, 2/11 B) 1/11, 2/11

C) -1/11, -2/11 D) 1/11, -2/11

**Q21**.If A = $\begin{bmatrix} \boldsymbol{2x} & \mathbf{0} \\ \boldsymbol{x} & \boldsymbol{x} \end{bmatrix}$ and $A^{-1}$= $\begin{bmatrix} \mathbf{1} & \mathbf{0} \\ \mathbf{-1} & \mathbf{2} \end{bmatrix}$ , then value of x is :

a. 2

b. 1

c. 1/2
d. -1/2

## Section-B ( Case Study Based MCQs)

**Q1**. A manufacture produces three stationery products Pencil, Eraser and Sharpener which he sells in two markets. Annual sales are indicated below

| Markets | Products ( numbers ) | | |
|---|---|---|---|
| | Pencils | Erasers | Sharpeners |
| A | 10000 | 2000 | 18000 |
| B | 6000 | 20000 | 8000 |

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. 20,000)
5. Gross profit in both market
a. Rs.23,000 b. Rs. 20,300
c. Rs. 32,000 d. Rs. 30,200

**Q2**. Three schools DPS, CVC and DAV 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 articles | DPS | CVC | DAV |
|---|---|---|---|
| Handmade fans | 40 | 25 | 35 |
| Mats | 50 | 40 | 50 |
| Plates | 20 | 30 | 40 |

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

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

a. 700

b. 7,000

c. 6125

d. 7875

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

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 DPS, CVC and DAV?

a. Rs. 15,775

b. Rs. 14,000

c. Rs. 21,000

d. Rs. 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. Rs. 18,000

b. Rs. 6,750

c. Rs. 5,000

d. Rs. 21,250

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

a. 230

b. 130

c. 430

d. 330

## Section-C

## (Assertion and Reasoning based MCQs)

Directions : In the following Questions from 1 to 10 the Assertions (A) and Reason(s) (R) statements have been given . Read both the statements carefully and choose the correct alternative from the following:

(A) Both the Statements A and R are correct and the R is the correct explanation of the A

(B) Both the Statements A and R are correct and the R is not the correct explanation of the A

(C) The Statement A is true but the Statement R is false.

(D) The Statement A is false but the statement R is true.

(E) Both the statements are false.

**Q1** Statement A : $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is an identity matrix.

Statement R :A matrix $A= [a_{ij}]$ is an identity matrix of $a_{ij}= \begin{cases} 1 \ if \ i = j \\ 0 \ if i \neq j \end{cases}$

**Q2**. Statement A : Matrix $\begin{bmatrix} 1 \\ 5 \\ 2 \end{bmatrix}$ is a column matrix

Statement R :A matrix of order mx1is called a column matrix where $m \geq 1$.

**Q3**. Statement A : Matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix.

Statement R :Every scalar matrix is a diagonal matrix

**Q4**. Statement A :Two matrices $A_{2} \times_{3}$ and $B_{3} \times_{2}$ can be multiplied and their product will be a matrix of order $2 \times 2$

Statement R :Two matrices can be multiplied if number of columns in pre-factor(first matrix) is equal to the number of rows in post- factor(second matrix).

**Q5**. Statement A : If $\begin{bmatrix} x & 3 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} 5 & 3 \\ 2 & y \end{bmatrix}$ then x=5 and y= -1

Statement R :Two matrices are equal if their order is same.

**Q6**. Statement A : A square matrix can not be written as the sum of a symmetric matrix and a skew symmetric matrix

Statement R : For a square matrix A with real number entries , $A + A'$ is a symmetric matrix and $A – A'$ is a skew symmetric matrix.

**Q7**. Statement A :For two matrices $A=\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$ and $B=\begin{bmatrix} 5 & 0 \\ 0 & 0 \end{bmatrix}$, $(A+B)^2 =A^2+2AB+B^2$

Statement R : For given two matrices A and B,AB=BA

**Q8**. Statement A :Matrix $\begin{bmatrix} 0 & 3 & 2 \\ -3 & 3 & -5 \\ -2 & 5 & 0 \end{bmatrix}$ is a skew symmetric matrix.

Statement R :A matrix A is skew symmetric matrix if $A' = A$.

# Chapter 4: Determinants

## Section-A

## (Multiple Choice Questions)

1. Determinant is:
   a. Real number associated to a square matrix.
   b. Complex matrix associated to a square matrix.
   c. Real or complex number associated to a square matrix.
   d. Real or complex number associated to a matrix.

2. Value of determinant of A = $\begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix}$ is
   a. 2
   b. -2
   c. 5
   d. None of these.

3. Determinant of matrix P = $\begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \end{bmatrix}$ is
   a. 2
   b. 3
   c. 4
   d. None of these.

4. Value of $\begin{vmatrix} cos15^0 & sin15^0 \\ sin15^0 & cos15^0 \end{vmatrix}$ is :
   a. 1
   b. ½
   c. √3/2
   d. None of these

5. The value of $\begin{vmatrix} 5^2 & 5^3 & 5^4 \\ 5^3 & 5^4 & 5 \\ 5^4 & 5^5 & 5^6 \end{vmatrix}$ is:
   a. $5^2$
   b. 0
   c. $5^{13}$
   d. $5^9$

6. Value of $\begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix}$ is:
   a. 2
   b. 6
   c. 24
   d. 120

7. If $\begin{vmatrix} 1-x & 2 & 3 \\ 0 & x & 0 \\ 0 & 0 & x \end{vmatrix} = 0$, then its roots are :
   a. 1 only
   b. 0,1
   c. 0 only
   d. -1,0 & 1

8. Which of the following is correct
   a. Determinant is a square matrix.
   b. Determinant is a number associated to a matrix.
   c. Determinant is a number associated to a square matrix.
   d. None of these.

9. Value of $\begin{vmatrix} a+ib & c+id \\ -c+id & a-ib \end{vmatrix}$ is:
   a. $a^2 + b^2 - c^2 - d^2$
   b. $a^2 - b^2 + c^2 - d^2$
   c. $a^2 + b^2 + c^2 + d^2$
   d. None of these.

10. If $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, then
   a. $\Delta_1 + \Delta_2 = 0$
   b. $\Delta_1 + 2\Delta_2 = 0$
   c. $\Delta_1 = \Delta_2$
   d. None of these

11. Value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$ is:

a. x + y

b. x – y

c. xy

d. None of these

12. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to:

a. 6

b. ±6

c. -6

d. 0

13. Find the value of x if $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$,

a. ±2

b. -2

c. 2

d. 0

14. Let A be a square matrix of order 3x3, then $|\lambda A|$is equal to

a. $\lambda|A|$

b. $\lambda^2|A|$

c. $\lambda^3|A|$

d. $3\lambda|A|$

15. The value of $\begin{vmatrix} \cos(\theta+\emptyset) & -sin(\theta+\emptyset) & cos2\emptyset \\ sin\theta & cos\theta & sin\emptyset \\ -cos\theta & sin\theta & cos\emptyset \end{vmatrix}$ is :

a. Independent of $\theta$ only.

b. Independent of $\emptyset$ only.

c. Independent of both $\theta$ and $\emptyset$.

d. Dependent of both $\theta$ and $\emptyset$.

16. Area of the triangle whose vertices are A(3,8), B(-4,2) and C(5,1) is

a. $\frac{1}{2}\begin{vmatrix} 3 & 8 & 1 \\ -4 & 2 & 1 \\ 5 & 1 & 1 \end{vmatrix}$

b. $\begin{vmatrix} 3 & 8 & 1 \\ -4 & 2 & 1 \\ 5 & 1 & 1 \end{vmatrix}$

c. $2\begin{vmatrix} 3 & 8 & 1 \\ -4 & 2 & 1 \\ 5 & 1 & 1 \end{vmatrix}$

d. None of these.

17. If A(3,4) , B(-7,2) & C(x, y) are collinear, then:

a. $x - 5y + 17 = 0$

b. $x + 5y + 17 = 0$

c. $x + 5y + 13 = 0$

d. $x - 5y + 13 = 0$

18. The value of $\Delta = a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ is ( Where $a_{ij}$ represents element of $i^{th}$ row & $j^{th}$ column of determinant $\Delta$ and $A_{ij}$ is cofactor of $a_{ij}$):

a. $-\Delta$

b. 0

c. 1

d. None of these.

19. If $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and $A_{ij}$ is cofactor of $a_{ij}$ , then value of $\Delta$ is given by

a. $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33}$

b. $a_{11}A_{11} + a_{12}A_{21} + a_{13}A_{31}$

c. $a_{21}A_{11} + a_{22}A_{12} + a_{23}A_{13}$

d. $a_{11}A_{11} + a_{21}A_{21} + a_{31}A_{31}$

20. Adjoint of $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is

a. $\begin{bmatrix} 4 & -3 \\ -2 & 1 \end{bmatrix}$

b. $\begin{bmatrix} -4 & 3 \\ 2 & -1 \end{bmatrix}$

c. $\begin{bmatrix} 4 & -3 \\ 2 & 1 \end{bmatrix}$

d. $\begin{bmatrix} 4 & 3 \\ -2 & 1 \end{bmatrix}$

21. Let A be a non-singular matrix of order 3x3. Then $|adjA|$is equal to :

a. $|A|$
b. $|A|^2$
c. $|A|^3$
d. $3|A|$

22. If A = $\begin{bmatrix} -x & -y \\ z & t \end{bmatrix}$, then transpose of adjA is:

a. $\begin{bmatrix} 1 & z \\ -y & -x \end{bmatrix}$
b. $\begin{bmatrix} t & y \\ -z & -x \end{bmatrix}$
c. $\begin{bmatrix} t & -z \\ y & -x \end{bmatrix}$
d. None of these

23. Adjoint of matrix X = $\begin{bmatrix} -4 & -3 & -3 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$ is:

a. X
b. 2X
c. –X
d. None of these

24. Cofactor and minor of 2 in $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$ is

a. 5&5
b. 5 & -5
c. -5 & 5
d. -5 & -5

25. Value of $|A(adjA)|$ is

a. $|A|$
b. $[A]^2$
c. $[A]^3$
d. $[A]^4$

26. If A = $\begin{bmatrix} cosx & sinx \\ -sinx & cosx \end{bmatrix}$, then A(adjA) =

a. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

b. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

d. $\begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$

27. If A = $\begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix}$ and A(adjA) = $\begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix}$, then k is equal to:

a. 0

b. 1

c. Sinθ.Cosθ

d. Cos2θ

28. For any 2x2 matrix A if A(adjA) = $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is

a. 0

b. 10

c. 20

d. 100

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

a. O

b. A

c. 2A

d. A+1

30. If A is a singular matrix, then adjA is :

a. Singular Matrix

b. Nonsingular Matrix

c. Symmetric matrix

d. Not defined

31. If A is a skew symmetric matrix, then $A^T$ is

a. A

b. –A

c. O

d. Diagonal Matrix

32. 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

33. The matrix $\begin{bmatrix} \lambda & -1 & 4 \\ -3 & 0 & 1 \\ -1 & 1 & 2 \end{bmatrix}$ is invertible, if

a. $\lambda \neq$ -15

b. $\lambda \neq$ -16

c. $\lambda \neq$ -17

d. $\lambda \neq$ -18

34. The matrix $\begin{bmatrix} 1 & a & 2 \\ 1 & 2 & 5 \\ 2 & 1 & 1 \end{bmatrix}$ is not invertible, if 'a' has the value:

a. 2

b. 1

c. 0

d. -1

35. If $I_3$ is the identity matrix of order 3, then $I_3^{-1}$ is:

a. O

b. $I_3$

c. $I_1$

d. Does not exist

## Section-B( Case Study Based MCQs)

36. CASE STUDY1:

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 50m, then its area will remain same, but if length is decreased by10mand breadth is decreasedby20m, then its area will decreaseby5300m$^2$. Length AB of the rectangular plot ABCD is denoted by x and breadth BC by y.

D C


A B

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

A. The equations 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. $x + y = 50$ ; $2x + y = 550$
B. Which of the following matrix equation is represented by the given information:
   a. $\begin{bmatrix} \mathbf{1} & \mathbf{-1} \\ \mathbf{2} & \mathbf{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{bmatrix} = \begin{bmatrix} \mathbf{50} \\ \mathbf{550} \end{bmatrix}$
   b. $\begin{bmatrix} \mathbf{1} & \mathbf{1} \\ \mathbf{2} & \mathbf{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{bmatrix} = \begin{bmatrix} \mathbf{50} \\ \mathbf{550} \end{bmatrix}$
   c. $\begin{bmatrix} \mathbf{1} & \mathbf{1} \\ \mathbf{2} & \mathbf{-1} \end{bmatrix} \begin{bmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{bmatrix} = \begin{bmatrix} \mathbf{50} \\ \mathbf{550} \end{bmatrix}$
   d. $\begin{bmatrix} \mathbf{1} & \mathbf{1} \\ \mathbf{2} & \mathbf{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{bmatrix} = \begin{bmatrix} \mathbf{-50} \\ \mathbf{-550} \end{bmatrix}$
C. The value of x ( length of rectangular field) is:
   a. 150m
   b. 400m
   c. 200m
   d. 320m
D. The value of y ( breadth of rectangular field) is:
   a. 150m
   b. 200m
   c. 430m
   d. 350m

E. How much is the area of rectangular field?

a. $60000m^2$.

b. $30000m^2$.

c. $25000m^2$

d. $20000\ m^2$

37. CASE STUDY 2:

Each triangular face of the Pyramid of Peace in Kazakhstan is made up of 25 smaller equilateral triangles as shown in the figure.

Using above information, answer the following:

A. If the vertices of one of the smaller equilateral triangle are (0,0) , (3, √3) and (3, -√3) then area of such triangle is :

a. $\frac{1}{2}\begin{bmatrix} 0 & 0 & 0 \\ 3 & 3 & 3 \\ \sqrt{3} & -\sqrt{3} & 1 \end{bmatrix}$

b. $\frac{1}{2}\begin{bmatrix} 0 & 0 & 1 \\ 3 & \sqrt{3} & 1 \\ 3 & -\sqrt{3} & 1 \end{bmatrix}$

c. $\frac{1}{2}\begin{bmatrix} 1 & 1 & 0 \\ 3 & 3 & 3 \\ \sqrt{3} & -\sqrt{3} & 1 \end{bmatrix}$

d. $\begin{bmatrix} 0 & 0 & 0 \\ 3 & 3 & 3 \\ \sqrt{3} & -\sqrt{3} & 1 \end{bmatrix}$

B. The area of a face of pyramid is:

a. $25\sqrt{3}$ Sq. unit

b. $50\sqrt{3}$ Sq. unit

c. $75\sqrt{3}$ Sq. unit

d. None of these.

C. The length of a altitude of a smaller equilateral triangle is:

a. 2 units

b. 3 units

c. $\sqrt{3}$units

d. **4** units

D. If (2, 4) &(2, 6) are two vertices of a smaller equilateral triangle, then the third vertex will lie on the line represented by :

a. x + y = 5

b. 2x + y =5

c. $x = 1 + \sqrt{3}$

d. $x = 2 + \sqrt{3}$

E. 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 right angled triangle.

c. Collinear points.

d. Vertices of an isosceles triangle.

38. <u>CASE STUDY 3:</u>
Three shopkeepers Satyender Chauhan, Vijay Verma and Subramanian Ayer are using polythene bags, handmade bags (prepared by prisoners) and newspaper's envelope (prepared by a ladies group) as carry bags. It is found that the shopkeepers Satyender Chauhan, Vijay Verma and Subramanian Ayer are using (40, 60, 80), (60, 80, 40) and (80, 40, 60) polythene bags, handmade bags and newspaper's envelopes respectively. The shopkeepers Satyender Chauhan, Vijay Verma and Subramanian Ayer spent Rs.500, Rs.540 and Rs.400 on these carry bags respectively. Consider the cost of one polythene bag as Rs. x, one hand made bag y and cost of one newspaper carry bag is z.

Using the concept of matrices and determinants for above information, answer the following questions.

A. Which of the following matrix equation is represented by the given information:

a. $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 2 \\ 4 & 2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 25 \\ 27 \\ 20 \end{bmatrix}$

b. $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 2 \\ 4 & 2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 27 \\ 25 \\ 20 \end{bmatrix}$

c. $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 2 \\ 4 & 2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 20 \\ 25 \\ 27 \end{bmatrix}$

d. None of these

B. The equations terms of x ,y and z are:

a. $2x + 3y + 4z = 20$, $3x + 4y + 2z = 27$, & $4x + 2y + 3z = 50$.

b. $2x + 3y + 4z = 25$, $3x + 4y + 2z = 27$, & $4x + 2y + 3z = 20$.

c. $2x + 3y + 4z = 25$, $3x + 4y + 2z = 20$, & $4x + 2y + 3z = 20$.

d. None of these.

C. What is cost of one polythene bag?

a. Rs1

b. Rs2

c. Rs5

d. Rs7

D. Which carry bag is costly?

a. Polythene Bag
b. Handmade bag
c. Newspaper Carry bag
d. Almost all have same cost.

E. Keeping in mind the environmental condition, which shopkeeper is better?

a. Satyender Chauhan.
b. Vijay Verma
c. Subramanian Ayer
d. None of these.

## Section-C

## (Assertion and Reasoning based MCQs)

In the following questions a statement of assertion is followed by a statement of reason. Pick the correct option for all the questions given below (Q.39 – 48).

a. Assertion (A) and reason(R) both are correct and reason (R) is correct explanation of assertion (A).
b. Assertion (A) and reason(R) both are correct but reason (R) is not correct explanation of assertion (A).
c. Assertion (A) is wrong and reason ( R) is correct
d. Reason (R) is wrong and assertion (A) is correct.

39. Assertion: The determinant of a skew symmetric matrix of even order is perfect square.
Reason: The determinant of skew symmetric matrix of odd order is zero
40. Assertion: If a matrix A = $[a_{ij}]$ of order 3 and det (adjA) = 49, then det (A) = ±7.
Reason: For a square matrix A of order n , $|\boldsymbol{adjA}| = |\boldsymbol{A}|^{\boldsymbol{n-1}}$
41. Assertion: Value of x for which matrix $\begin{bmatrix} \mathbf{2} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{2} \\ \mathbf{1} & \mathbf{-2} & \boldsymbol{x} \end{bmatrix}$ is singular is -5.
Reason: Matrix is singular if $|\boldsymbol{A}| \neq 0$
42. Assertion: For a square matrix A = $\begin{bmatrix} \mathbf{2} & \mathbf{3} \\ \mathbf{4} & \mathbf{5} \end{bmatrix}$, A (adjA) = $\begin{bmatrix} \mathbf{-2} & \mathbf{0} \\ \mathbf{0} & \mathbf{-2} \end{bmatrix}$.
Reason: for any square matrix A, A (adjA) = (adjA) A = $|\boldsymbol{A}|$I
43. Assertion: All the matrices are invertible.
Reason: A square matrix is invertible if it is non-singular.

44. Assertion: If $|\boldsymbol{A}|$ = 7, then $|\boldsymbol{4A}|$ = 448

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

45. Assertion: Cofactor of -3 in $\begin{vmatrix} \mathbf{3} & \mathbf{8} & \mathbf{1} \\ \mathbf{4} & \mathbf{-3} & \mathbf{2} \\ \mathbf{5} & \mathbf{-2} & \mathbf{1} \end{vmatrix}$ is -2

Reason: Cofactor of element $a_{ij}$ is defined as $A_{ij} = (1)^{i+j}M_{ij};$ $M_{ij}$ represents minor of element $a_{ij}$

46. Assertion : Cofactor of element $a_{ij}$ is defined as $A_{ij} = (-1)^{i+j}M_{ij}$; $M_{ij}$ represents minor of element $a_{ij}$

Reason: Therefore cofactors and minors are same.

47. Assertion: If $\begin{vmatrix} \boldsymbol{x} & \mathbf{2} \\ \mathbf{18} & \boldsymbol{x} \end{vmatrix} = \begin{vmatrix} \mathbf{6} & \mathbf{2} \\ \mathbf{18} & \mathbf{6} \end{vmatrix}$ then x is equal to 6.

Reason: Two determinants are equal if they have same value. Like matrices corresponding entries or elements cannot be equated.

48. Assertion: Minor $M_{23}$ of an element $a_{23}$ of $\begin{vmatrix} \mathbf{1} & \mathbf{2} & \mathbf{3} \\ \mathbf{2} & \mathbf{3} & \mathbf{4} \\ \mathbf{3} & \mathbf{4} & \mathbf{5} \end{vmatrix}$ is $\begin{vmatrix} \mathbf{1} & \mathbf{2} \\ \mathbf{3} & \mathbf{4} \end{vmatrix}$ = -2.

Reason: Minor $M_{ij}$ of an element $a_{ij}$ of a determinant is the determinant obtained by deleting its $i^{th}$ row and $j^{th}$ column in which element $a_{ij}$ lies

# Chapter 5:Continuity and Differentiability

## Section-A (Multiple Choice Questions)

Q.1 Let f(x) = $\begin{cases} x+a & x<1 \\ ax^2+1 & x \geq 1 \end{cases}$ , then f(x) is continuous at x=1 for

a) a = 0 b) a = 1 c) all a ∈ R d) none of these

Q.2 If f(x) = $x^2 \sin\frac{1}{x}$ , where x ≠ 0 , then value of the function f at x = 0 , so that the function is continuous at x = 0 is

a) 0 b) 1 c) - 1 d) none of these

Q.3 The function f(x) = tan x is discontinuous on the set

a) { n$\pi$ : n ∈ Z } b) { 2n$\pi$: n ∈ Z } c) { (2n + 1)$\frac{\pi}{2}$ : n ∈ Z } d) { $\frac{n\pi}{2}$ : n ∈ Z }

Q.4 The function f(x) = [ x ] , where [x] denotes the greatest integer function is continuous at

a) 4 b) – 2 c) 1 d) 1.5

Q.5 The function $e^{|x|}$ is

a) Continuous everywhere but not differential at x = 0.
b) Continuous and differentiable everywhere
c) Not continuous at x = 0.
d) None of these

Q.6 The set of points, where the function f given by f(x) = $|x-1|$ is differentiable is

a) R b) R – {1} c) ( 0 , ∞ ) d) none of these

Q.7 A function f(x) is said to be continuous for x∈ R , if

a) f(x) is continuous at x = 0.
b) f(x) is differentiable at x = 0.
c) f(x) is continuous at two points.
d) f(x) is differentiable for x ∈ R

Q.8 If y = $\sqrt{\sin x + y}$ , then $\frac{dy}{dx}$ is equal to

a) $\frac{\cos x}{2y-1}$ b) $\frac{\cos x}{1-2y}$ c) $\frac{\sin x}{1-2y}$ d) $\frac{\sin x}{2y-1}$

Q.9 If x$\sqrt{1+y}$ + y $\sqrt{1+x}$ = 0 , then $\frac{dy}{dx}$

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

Q.10 If x sin (a + y) = sin y then $\frac{dy}{dx}$ is equal to

a) $\frac{\sin^2(a+y)}{\sin a}$ b) $\frac{\sin a}{\sin^2(a+y)}$ c) $\frac{\sin(a+y)}{\sin a}$ d) $\frac{\sin a}{\sin(a+y)}$

Q.11 If $ax^2 + 2hxy + by^2 = 1$ then $\frac{dy}{dx}$ equals

a) $\frac{hx+by}{ax+by}$ b) $\frac{ax+by}{hx+by}$ c) $\frac{ax+hy}{hx+by}$ d) - $\frac{ax+hy}{hx+by}$

Q.12 Differential coefficient of sec ( $\tan^{-1} x$ ) w.r.t. x is

a) $\frac{x}{\sqrt{x^2+1}}$ b) $\frac{x}{1+x^2}$ c) x $\sqrt{1+x^2}$ d) $\frac{1}{\sqrt{x^2+1}}$

Q.13 If y = $\sin^{-1}\left(\frac{\sqrt{x}-1}{\sqrt{x}+1}\right)$ + $\sec^{-1}\left(\frac{\sqrt{x}+1}{\sqrt{x}-1}\right)$ , x > 0 then $\frac{dy}{dx}$ is equal to

a) 1 b) 0 c) $\frac{\pi}{2}$ d) none of these

Q.14 If $y = \cos^{-1} x$ then $\frac{d^2y}{dx^2} =$

a) $- cosec^2\, y$ cot y b) $cosec^2\, y$ cot y c) $cot^2\, y$ cosec y d) - $sec^2\, y$ cot y

Q.15 $\frac{d}{dx}$ {log ( x + $\sqrt{x^2+1}$ )} =

a) $\sqrt{x^2+1}$ b) $\frac{x}{\sqrt{x^2+1}}$ c) x $\sqrt{x^2+1}$ d) $\frac{1}{\sqrt{x^2+1}}$

Q.16 The derivative of the function f(x) = $\log_7(\log x)$ , x > 1 is

a) $\frac{1}{x \log x}$ b) $\frac{1}{x \log 7 \log x}$ c) $\frac{1}{\log x}$ d) none of these

Q.17 If y = sin ($x^x$) then $\frac{dy}{dx}$ is

$x^x$ cos ($x^x$) b) $x^x$ cos ($x^x$) [ 1 + logx] c) $x^x$ cos ($x^x$) logx d) None

Q.18 $x^y = e^{x-y}$ then $\frac{dy}{dx}$ is

a) $\frac{1+x}{1+\log x}$ b) $\frac{1-\log x}{1+\log x}$ c) not defined d) $\frac{\log x}{(1+\log x)^2}$

Q.19 If y = $x^x$ then $\frac{dy}{dx}$ at x = e is

a) $e^e$ b) 2 $e^e$ c) -$e^e$ d) $e^{2e}$

Q.20 If x = a (cos$\theta$ + $\theta$ sin$\theta$) , y = a (sin$\theta$ - $\theta$ cos$\theta$ ) , then $\frac{dy}{dx}$ is

a) cot$\theta$ b) tan$\theta$ c) a cot$\theta$ d) a tan$\theta$

Q.21 If x = $e^t$ sin t and y = $e^t$ cos t , where t is a parameter then $\frac{dy}{dx}$ at (1,1) is equal to

a) -$\frac{1}{2}$ b) - $\frac{1}{4}$ c) 0 d) $\frac{1}{2}$

Q.22 If x = $t^2$ , y = $t^3$ , then $\frac{d^2y}{dx^2}$ is

a) $\frac{3}{2}$ b) $\frac{3}{4t}$ c) $\frac{3}{2t}$ d) $\frac{3t}{2}$

Q.23 If x = a sin $\theta$ , y = b cos $\theta$then $\frac{d^2y}{dx^2}$ =

a) $\frac{a}{b^2} sec^2\theta$ b) $\frac{b}{a} sec^2\theta$ c) $\frac{b}{a^2} sec^3\theta$ d) $-\frac{b}{a^2} sec^3\theta$

Q.24 If y = a $e^{mx}$ + b $e^{-mx}$, then $\frac{d^2y}{dx^2}$ =

a)$m^2$ y b) - $m^2$ y c) m y d) – m y

Q.25 If f(x) = $|\cos x|$ then f ′ ($\frac{3\pi}{4}$) =

a) $\sqrt{2}$ b) - $\sqrt{2}$ c) $\frac{1}{\sqrt{2}}$ d) $\frac{-1}{\sqrt{2}}$

Q.26 Derivative of $sin^2$x w.r.t. $e^{\cos x}$

a) - $\frac{2\cos x}{e^{\cos x}}$ b) 2 sin x cos x . $e^{\cos x}$ c) - $\frac{2\sin x}{e^{\cos x}}$ d) - $\frac{2\cos x \sin x}{e^{\cos x}}$

Q.27 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 – $x^2$

Q.28 If y = $\sin^{-1} x$ then ( 1 – $x^2$ )$\frac{d^2y}{dx^2}$ - x $\frac{dy}{dx}$ =

a) 0 b) 1 c) - 1 d) 2

Q.29 If f(x) = x $|x|$ , x < 0 then $\frac{dy}{dx}$ =

a) 2x b) - 2x c) $x^2$ d) none of these

Q.30 If f (x) = $\sqrt{x^2-10x+25}$ then the derivative of f(x) in the interval [0, 7] is a)1 b) – 1 c) 0 d) none of these

Q.31 If $y = a+bx^2$ ,a and b are arbitrary constants then

(a) $\frac{d^2y}{dx^2}$ = 2xy (b) $x\frac{d^2y}{dx^2} = \frac{dy}{dx}$ (c) $x\frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 0$ (d) $x\frac{d^2y}{dx^2}$ = 2xy

## Section-B (Case Study Based MCQs )

32. If a real valued function f (x) is finitely derivable at any point of its domain, it is necessarily continuous at that point. But its converse need not be true.
For example, every polynomial function, constant function are both continuous as well as differentiable and inverse trigonometric functions are continuous and differentiable in its domain etc.
Based on the above information answer the following questions.

(i) If $f(x) = \begin{cases} x, & for\ x \le 0 \\ 0, & for\ x > 0 \end{cases}$ then at x = 0

a) f (x) is continuous and differentiable
b) f (x) is neither continuous nor differentiable
c) f (x) is continuous but not differentiable
d) none of these

(ii) If f (x) = $|x-1|$ , x $\varepsilon$ R, then at x = 1

a) f (x) is not continuous
b) f (x) is continuous but not differentiable
c) f (x) is continuous and differentiable
d) none of these

(iii) f (x) = $x^3$ is

a) continuous but not differentiable at x = 3
b) continuous and differentiable at x = 3
c) neither continuous and nor differentiable at x = 3
d) none of these

(iv) If f (x) = [x] , then which of the following statements is true ?

a) f (x) is continuous and differentiable at x = 0
b) f (x) is discontinuous at x = 0
c) f (x) is continuous but not differentiable at x = 0
d) f (x) is continuous at x = 1

(v) If f (x) = $\sin^{-1} x$ , - 1 ≤ x ≤ 1, then

a) f (x) is both continuous and differentiable
b) f (x) is neither continuous nor differentiable
c) continuous but not differentiable
d) none of these

33. If y = f (u) is a differentiable function of u and u = g (x) is a differentiable function of x, then y = f (g(x)) is a differentiable function of x and $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ . This is known as CHAIN RULE .
Based on the above information find the derivative of functions w.r.t. x in the following equations.

(i) $\cos\sqrt{x}$

a) $\frac{-\sin\sqrt{x}}{2\sqrt{x}}$ b) $\frac{\sin\sqrt{x}}{2\sqrt{x}}$ c) $\sin\sqrt{x}$ d) - $\sin\sqrt{x}$

(ii)

$\mathbf{7^{x+\frac{1}{x}}}$

a) $(\frac{x^2+1}{x^2})\ \mathbf{7^{x+\frac{1}{x}}\log 7}$ b) $(\frac{x^2-1}{x^2})\ \mathbf{7^{x+\frac{1}{x}}\log 7}$ c) $(\frac{x^2+1}{x^2})\ \mathbf{7^{x-\frac{1}{x}}\log 7}$ d) $(\frac{x^2-1}{x^2})\ \mathbf{7^{x-\frac{1}{x}}\log 7}$

(iii) $e^{e^x}$

a) $e^{e^x}$ b) $\frac{e^{e^x}}{e^x}$ c) $e^{e^x}e^x$ d) none of these

(iv) tan ($5x^o$)

a) $sec^2(5x^o)$ b) 5 $sec^2(5x^o)$ c) $\frac{5\pi}{180}sec^2(5x^o)$ d) none of these

(v) $\tan^{-1}(e^{-x})$

a) $\frac{-1}{1+e^{-2x}}$ b) $\frac{1}{1+e^{-2x}}$ c) $\frac{e^{-x}}{1+e^{-2x}}$ d) $\frac{-e^{-x}}{1+e^{-2x}}$

## Section-C

## (Assertion and Reasoning based MCQs)

Q.34 Assertion (A) : The function f(x) = $|x|$ is discontinuous at x =0

Reason ( R ) : The function f(x) = $|x|$ is not differentiable at x =0

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.35 Assertion (A) : The function f (x) = [x], where [x] denotes the greatest integer less than or equal to x , is discontinuous at x = 1.

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

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.36 Assertion (A) : The function f (x) = $|x|$ is continuous at x = 0.

Reason ( R ) : If a function is continuous at a point c then it is also differentiable at that point.

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.37 Assertion (A) : $\frac{d(x^{\sin x})}{dx} = x^{\sin x}\left(\frac{\sin x}{x} + \cos x \log x\right)$

Reason ( R ) : $\frac{dy}{dx} = y\left[\frac{v(x)}{u(x)}u'(x) + v'(x) \cdot \log[u(x)]\right]$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.38 Assertion (A) : If x = a cos$\theta$ , y = a sin$\theta$ then $\frac{dy}{dx}$ = - cot$\theta$

Reason ( R ) :$\frac{dy}{dx} = \frac{(\frac{dy}{d\theta})}{(\frac{dx}{d\theta})}$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.39 Assertion (A) :$\frac{d\ (\log_5 x)}{dx} = \frac{1}{\mathrm{x} \log 5}$

Reason ( R ) :$\frac{d\ (\log x)}{dx} = \frac{1}{x}$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.40 Assertion (A) :$\frac{d\ (x^n)}{dx}$ = n $x^{n-1}$

Reason ( R ) :$\frac{d\ (sin^2 x)}{dx}$ = 2 sin $x$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.41 Assertion (A) :$\frac{d\ (\sin^{-1} x + \cos^{-1} x)}{dx} = 0$

Reason ( R ) :$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ and derivative of constant is zero.

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.42 Assertion (A) :$\frac{d\ |x|}{dx} = \frac{x}{|x|}$, x ≠ 0

Reason ( R ) : because $|x| = \begin{cases} x\ ,\ if\ x > 0 \\ -x\ ,if\ x < 0 \end{cases}$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

Q.43 Assertion (A) :$\frac{d\ (e^{2x})}{dx} = e^{2x}$

Reason ( R ) :$\frac{d\ (e^x)}{dx} = e^x$

a) ( A ) is true but ( R ) is false.
b) ( R ) is true but ( A ) is false
c) Both ( A ) and ( R ) are true but ( R ) the correct explanation of ( A )
d) Both ( A ) and ( R ) are true but ( R ) is not the correct explanation of ( A )

# Chapter 6: Applications of Derivatives

## Section-A

## (Multiple Choice Questions)

Q.1 The equation of the normal to the curve y = Sin x at (0,0) is
a) $x = 0$ b) $y = 0$ c) $x + y = 0$ d) $x - y = 0$

Q.2 The point on the curve where tangent to the curve $y^2 = x$ makes an angle of $45^0$ clockwise with the x-axis is :
a) $(-1/2, 1/4)$ b) $(1/4, -1/2)$ c) $(-2, 4)$ d) $(4, -2)$

Q.3 The line $y = x + 1$ is a tangent to the curve $y^2 = 4x$ at the point
a) $(-1, 2)$ b) $(1, 2)$ c) $(1, -2)$ d) $(2, 1)$

Q.4 The curves $y = ae^{-x}$ and $y = be^{x}$ are orthogonal
a) $a = b$ b) $a = -b$ c) $ab = -1$ d) $ab = 1$

Q.5 If the curves $ay + x^2 = 7$ and $x^3 = y$ cut orthogonally at (1,1) then the value of a is
a) 1 b) 0 c) - 6 d) 6

Q.6 The tangent to the curve $y = e^{2x}$ at the point (0,1) meets x-axis at
a) $(0, 1)$ b) $(2,0)$ c) $(-1/2, 0)$ d) $(-2, 0)$

Q.7 Slope of tangent to the curve $x = 3t^2 + 1$ , $y = t^3 - 1$ at $x = 1$
a) 0 b) 1 c) 2 d) 3

Q.8 The function $f(x) = x^3 - 3x^2 + 3x - 100$ is increasing in
a) R b) N c) W d) I

Q.9 The interval in which $y = x^2 e^{-x}$ is increasing in
a) $(-\infty, \infty)$ b) $(-2,0)$ c) $(2, \infty)$ d) $(0, 2)$

Q.10 The interval for which $f(x) = \cot^{-1} x + x$ increases.
a) $(-1, 1)$ b) $(-\infty, \infty)$ c) $(0, 1)$ d) $(0, \infty)$

Q.11 The function f(x) = sin x is strictly decreasing in
a) $(\pi/2, \pi)$ b) $(0, \pi)$ c) $(-\pi, 0)$ d) $(\pi/2, 3\pi/2)$

Q.12 f(x) is strictly increasing function if $f'(x)$ is
a) positive b) Negative c) zero d) none of these

Q.13 The slope of tangent to the curve $x = a\cos^3 t$ , $y = a\sin^3 t$ at $t = \pi/4$ is
a) 1 b) 2 c) -1 d) none of these

Q.14 The slope of normal to the curve $x = a\cos^3 t$ , $y = a\sin^3 t$ at $t = \pi/4$ is
a) 1 b) -1 c) 3 d) -2

Q.15 The point on the curve $y = x^3 - 11x + 5$ at which the tangents is $y = x - 11$ is
a) (-2,0) b) (3,7) c) (0,2) d) (2,-9)

Q.16 The points on the curve $9y^2 = x^3$ where the normal to the curve makes equal intercepts with the axes are :
a) $(4, \pm 8/3)$ b) $(4, -8/3)$ c) $(4, \pm 3/8)$ d) $(\pm 4, 3/8)$

Q.17 The normal at the point (1,1) on the curve $2y + x^2 = 3$ is :
a) $x + y = 0$ b) $x - y = 0$ c) $x + y + 1 = 0$ d) $x - y = 2$

Q.18 On which of the following intervals is the function $f(x)= x^{100} + \text{Sin } x - 1$ strictly decreasing ?
a) (0,1) b) $(\pi/2, \pi)$ c) $(0, \pi/2)$ d) none of these

Q.19 The interval for which the function $f(x) = x^2 - 4x - 5$ is strictly increasing is :
a) $(2,\infty)$ b) $(-2,2)$ c) $(-\infty,-2)$ d) $(-2, \infty)$

Q.20 The function log x/x is increasing on the interval
a) (1,2e) b) (0,e) c) (2,2e) d) (1/e,2e)

Q.21 The equation of tangent to the curve $y = x + 4/x^2$ parallel to x-axis is

a) $y = 0$ b) $y = 1$ c) $y = 2$ d) $y = 3$

Q.22 The point on the curve $y = (x - 3)^2$ where tangent is parallel to the chord joining (3,0) and (4,1)

a) (- 7/2,-1/4) b) (5/2,1/4) c) (-5/2,1/4) d) (7/2,1/4)

Q.23 The function $f(x) = 2x^3 - 15x^2 + 36x + 1$ is monotonically decreasing in the interval

a) (2,3) b) $(-\infty,2)$ c) $(3,\infty)$ d) none of these

Q.24 If $y = [x(x-3)]^2$ increases for all values of x lying in the interval

a) $0 < x < 3/2$ b) $0 < x < \infty$ c) $-\infty < x < 0$ d) $1 < x < 3$

Q.25 The absolute maximum value of $y = x^3 - 3x + 2$ in [ 0, 2 ] is

a) 4 b) 6 c) 2 d) 0

Q.26 The minimum value of $x^3 - 3x + 3$ on interval [ -3,3/2 ] is

a) 1 b) 5 c) -15 d) -20

Q.27 The minimum value of $f(x) = x^4 - x^2 - 2x + 6$ is

(a) 6 (b) 4 (c) 8 (d) none of these

Q.28 The maximum value of 3Cosθ + 4Sinθ is

a) 3 b) 4 c) 5 d) none of these

Q.29 The minimum value of 3Cosx + 4Sinx + 5 is

a) 5 b) 9 c) 0 d) 3

Q.30 The function $f(x) = x^x$ has a stationary point at

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

Q.31 The sum of two numbers is 3 then maximum value of product of first and square of second number is

a) 1 b) 3 c) 2 d) 4

Q.32 The maximum area of the rectangle that can be inscribed in a circle of radius r is

a) $\pi r^2$ b) $r^2$ c) $\pi r^2/4$ d) $2r^2$

Q.33 Maximum area of a rectangle of perimeter 176 cm is

a) 1936 $cm^2$ b) 1854 $cm^2$ c) 2110 $cm^2$ d) none of these

Q.34 The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minima at

a) $x = -2$ b) $x = 0$ c) $x = 1$ d) $x = 2$

Q.35 The absolute minimum value of $y = x^2 - 3x$ in [ 0,2 ] is

a) -9/4 b) 2/9 c) -3/4 d) ¾

Q.36 If y = Sin x then the maximum point of y is

a) $\pi/3$ b) $\pi/2$ c) $2\pi$ d) $-\pi/2$

Q.37 The maximum value of Sin x . Cos x is

a) 1/4 b) 1/2 c) $\sqrt{2}$ d) $2\sqrt{2}$

Q.38 At $x = 5\pi/6$, f(x) = 2 Sin3x + 3 Cos3x is

a) maximum b) minimum c) zero d) neither max nor min

Q.39 The point on the curve $x^2 = 2y$ which is nearest to the point ( 0,5 ) is

a) (0,4) b) (1,3) c) $(2\sqrt{2},4)$ d) none of these

Q.40 Minimum value of f(x) = Sin x in $[-\pi/2, \pi/2]$ is

a) -1 b) 0 c) 1 d) -2

## Section-B

## (Assertion and Reasoning based MCQs)

Directions : In the following questions, a statement of assertion (Statement-I) is followed by a statement of reason (Statement-II). Mark the correct choice as :

(a) If both Statement-I and Statement-II are true and Statement-II is the correct explanation of Statement-I.

(b) If both Statement-I and Statement-II are true and Statement-II is not the correct explanation of Statement-I.

(c) If Statement-I is true but Statement-II is false.

(d) If Statement-I is false but Statement-II is true.

Q.1 Statement-I : Points on the curve $y = x^3$ at which the slope of the tangent is equal to the y-coordinate of the point are (0,0) , (3,26).
Statement-II: For the curve $y = 3x^2 + 4x$, slope of the tangent to the curve at the point whose x-coordinate is -2 is -8.

Q.2 Statement-I : Slope of tangent to the curve $y = 2\ \text{Sin}^2(3x)$ at $x = \pi/6$ is 0.
Statement-II: Slope of tangent to the curve $y = 2\ \text{Cos}^2(3x)$ at $x = \pi/6$ is 3.

Q.3 Statement-I : Intervals in which $f(x) = 2x^3 - 9x^2 + 12x + 15$ is strictly increasing is $(-\infty,1) \cup (3, \infty)$.
Statement-II: Let f be continuous on [a,b] and differentiable on the open interval (a,b).Then f is constant function in [a,b] if $f'(x) = 0$ for each $x \in (a,b)$.

Q.4 Statement-I : Intervals in which the function $f(x) = x^2 - 4x + 6$ is strictly increasing is $(2, \infty)$.
Statement-II: Let f be continuous on [a,b] and differentiable on the open interval (a,b).Then f is strictly increasing function in [a,b] if $f'(x) > 0$ for each $x \in (a,b)$.

Q.5 Statement-I : Two positive numbers whose sum is 15 and the sum of whose squares is minimum are $\frac{15}{2}, \frac{15}{2}$.
Statement-II: Let f be a real valued function such that $f''(x_0)$ exists.Then
(i) if $f'(x_0) = 0$ and $f''(x_0) > 0$, then f has local minimum at $x_0$.
(ii) if $f'(x_0) = 0$ and $f''(x_0) < 0$, then f has local maximum at $x_0$.

Q.6 Statement-I : Two positive numbers x and y such that $x + y = 60$ and $xy^3$ is maximum are 15,45.
Statement-II: Let f be a real valued function such that $f''(x_0)$ exists.Then
(i) if $f'(x_0) = 0$ and $f''(x_0) > 0$, then f has local maximum at $x_0$.
(ii) if $f'(x_0) = 0$ and $f''(x_0) < 0$, then f has local minimum at $x_0$.

## Section-C

## (Case Study Based MCQs)

Q.1 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.

Answer the following questions using the above information :

(i) The change of growth of the plant with respect to sunlight is :

(a) $4x - \frac{1}{2}x^2$ (b) $4 - x$ (c) $x - 4$ (d) $x - \frac{1}{2}x^2$

(ii) What is the number of days it will take for the plant to grow to the maximum height ?

(a) 4 (b) 6 (c) 7 (d) 10

(iii) What is the maximum height of the plant ?

(a) 12 cm (b) 10 cm (c) 8 cm (d) 10 cm

(iv) What will be the height of the plant after 2 days ?

a) 4 cm (b) 6 cm (c) 8 cm (d) 10 cm

(v) If the height of the plant is 7/2 cm, the number of days it has been exposed to the sunlight is :

(a) 2 (b) 3 (c) 4 (d) 1

Q.2 $P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.

Answer the following questions using the above information :

(i) What will be the production when the profit is maximum ?

(a) 37500 (b) 12.5 (c) – 12.5 (d) – 37500

(ii) What will be the maximum profit ?

a) Rs 38,28,125 (b) Rs 38281.25 (c) Rs 39,000 (d) None of these

(iii) Check in which interval the profit is strictly increasing.

(a) $(12.5,\infty)$ (b) for all real numbers (c) for all positive real numbers (d) $(0,12.5)$

(iv) When the production is 2 units what will be the profit of the company ?

(a) 37500 (b) 37,730 (c) 37,770 (d) None of these

(v) What will be production of the company when the profit is Rs 38250 ?

(a) 15 (b) 30 (c) 2 (d) data is not sufficient to find.

Q.3 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.

Answer the following questions using the above information :

(i) Which value from the following may be abscissa of critical point ?

(a) $\pm 1/4$ (b) $\pm 1/2$ (c) $\pm 1$ (d) None

(ii) Find the slope of the normal based on the position of the stick.

(a) 360 (b) -360 (c) 1/360 (d) – 1/360

(iii) What will be the equation of the tangent at the point (2,3) ?

(a) $x + 360y = 1082$ (b) $y = 360x - 717$ (c) $x = 717y + 360$ (d) None

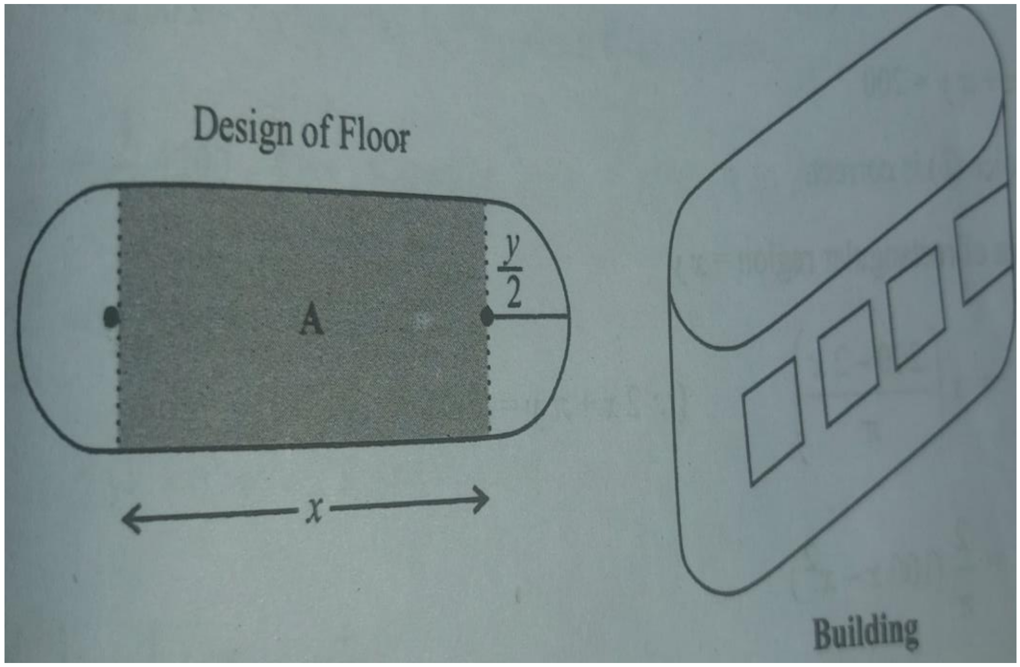
(iv) Find the second order derivative of the function at x = 5.

(a) 598 (b) 1176 (c) 3588 (d) 3312

(v) At which of the following intervals will f(x) be deccreasing ?

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

4 An architect designs a building for a multi-national company.The floor consists of a rectangular region with semicircular ends having a perimeter of 200 m as shown below:




Based on the above information answer the following :

(i) If x and y represent the length and breadth of the rectangular region,then the relation between the variables is

(a) x + лy = 100 (b) 2x + лy = 200 (c) лx + y = 50 (d) x + y = 100

(ii) The area of the rectangular region A expressed as a function of x is

(a) 2/ л $(100x – x^2)$ (b) 1/ л $(100x – x^2)$ (c) x/ л (100 – x) (d) $xy^2$ + 2/ л $(100x – x^2)$

(iii) The maximum value of area A is

(a) л/3200 $m^2$ (b) 3200/ л $m^2$ (c) 5000/ л $m^2$ (d) 1000/ л $m^2$

(iv) 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 the value of x should be

(a) 0 m (b) 30 m (c) 50 m (d) 80 m

(v) The extra area generated if the area of the whole floor is maximized is :

(a) 3000/ л $m^2$ (b) 5000/ л $m^2$ (c) 7000/ л $m^2$ (d) No change both areas are equal.

Q.5 A wire of length 36 cm is cut into two pieces.One of the pieces is turned in the form of a square of side x and the other in the form of an equilateral triangle of side y.

Based on the above information answer the following:

(i) The relation between the variables is

(a) x + y = 36 (b) 2x + 3y = 36 (c) 3x + 4y = 36 (d) 4x + 3y = 36

(ii) The area A of the sum of areas of square and equilateral triangle is

(a) $A = x^2 + (9-x)^2$ (b) $x^2 + 4\sqrt{3}\,(9-x)^2$ (c) $x^2 + 4\sqrt{3}/9\,(9-x)^2$ (d) $x^2 + 1/9\,(9-x)^2$

(iii) Area A is minimum when

(a) $x = 36\sqrt{3}$ cm (b) $x = 36\sqrt{3}/9+4\sqrt{3}$ cm (c) $y = 36\sqrt{3}$ cm (d) $y = 36\sqrt{3}/9+4\sqrt{3}$ cm

(iv) Length of piece required for square

(a) $144\sqrt{3}/9+4\sqrt{3}$ cm (b) $144/9+4\sqrt{3}$ cm (c) $144/9\sqrt{3} + 4$ cm (d) $144\sqrt{3} / 9\sqrt{3} + 4$ cm

(v) Length of piece required for triangle is

(a) $224/9+4\sqrt{3}$ cm (b) $124/9+4\sqrt{3}$ cm (c) $324/9+4\sqrt{3}$ cm (d) $324 / 9\sqrt{3} + 4$ cm

Q.6 A window has the shape of a rectangle of length x metres,breadth y metres surmounted by an equilateral triangle.The perimeter of the window is 12 metre.

Based on the above information answer the following:

(i) The relation between x and y is

(a) $3x + 2y = 12$ (b) $2x + 3y = 12$ (c) $x + 2y = 12$ (d) $2x + y = 12$

(ii) A,the area of window, is given by

(a) $A = xy + ¼ x^2$ (b) $A = xy + \sqrt{3}/4\ x^2$ (c) $A = 2xy + ¼ x^2$ (d) $A = 2xy + \sqrt{3}/4\ x^2$

(iii) Area A is maximum when

(a) $x = 12/5-\sqrt{3}$ (b) $x = 12/6-\sqrt{3}$ (c) ) $y = 12/5-\sqrt{3}$ (d) $x = 12/6-\sqrt{3}$

(iv) Length of rectangle is given by

(a) $6/6 - \sqrt{3}$ (b) $8/6 - \sqrt{3}$ (c) $10/6 - \sqrt{3}$ (d) $12/6 - \sqrt{3}$

(v) Breadth of rectangle is given by :

(a) $18/6 - \sqrt{3}$ (b) $18 + 6\sqrt{3}/6 - \sqrt{3}$ (c) $18 - 6\sqrt{3}/6 - \sqrt{3}$ (d) $6 + 18\sqrt{3}/6 - \sqrt{3}$

Q.7 A window consists of a semi-circle with a rectangle on its diameter.The perimeter of the window is 30 metres.Let x,y be length and breadth of the rectngle.

Based on the above information answer the following:

(i) Relation between the variables is

(a) (л + 2)x + 4y = 60 (b) (л + 2)x - 4y = 60 (c) x + 4y = 60 (d) x - 4y = 60

(ii) Area A of window ,is given by

(a) A = xy + лx²/2 (b) A = xy + лx²/4 (c) A = xy + лx²/8 (d) A = xy + лx²/16

(iii) Area A is maximum when

(a) x = 20/ л + 4 (b) 210/ л + 4 (c) 60/ л + 4 (d) 80/ л + 4

(iv) Area A is maximum when

(a) y = 20/ л + 4 (b) y = 30/ л + 4 (c) y = 15/ л + 4 (d) y = 25/ л + 4

(v) Area is maximum when radius of semi-circle is

(a) 15/ л + 4 (b) 20/ л + 4 (c) 10/ л + 4 (d) 30/ л + 4

Q.8 A particle is moving along the curve $f(x) = (x-1)(x-2)^2$.

Based on the above information ,answer the following questions:

(i) Find the critical points of x which touches the x-axis

(a) 2 , - 4/3 (b) 2 , 4/3 (c) -2 , - 4/3 (d) – 2, 4/3

(ii) Find the intervals where f(x) is strictly increasing

(a) $(-\infty,4/3) \cup (2, \infty)$ (b) $(-\infty,-4/3) \cup (2, \infty)$ (c) $(2, \infty)$ (d) $(-\infty,4/3)$

(iii) Find the intervals where f(x) is strictly decreasing

(a) (4/3 , 2) (b) (-4/3 , 2) (c) (0 , 2) (d) None of these

(iv) What is local minimum value of $f(x) = (x-1)(x-2)^2$ ?

(a) 1 (b) 2 (c) 0 (d) 3

(v) What is the point of local maxima for $f(x) = (x-2)^2$ ?

(a) 2 (b) 4/3 (c) 0 (d) -2

Q.9 A wire of length 28 m is to be cut into two pieces.One of the pieces is to be made into a square and the other into a circle.Let x metres be made into a circle.

Based on the above information answer the following :

(i) Radius of circle is :

(a) x/2 л (b) 2x/ л (c) x/ л (d) 2 л/x

(ii) Derivative of combined area S of two figures is

(a) x/2 л - (4 –x) /8 (b) x/2 л - (28 –x) /8 (c) x/ л - ( 4 –x) /8 (d) x/ л - (28 –x) /8

(iii) S is minimum when

(a) x = л/ л + 4 (b) x = 2л/ л + 4 (c) x = 8л/ л + 4 (d) x = 28л/ л + 4

(iv) Wire is to be cut from one end at a distance of

(a) 28л/ л + 4 (b) 28л$^2$/ л + 4 (c) 14л/ л + 4 (d) 14л$^2$/ л + 4

(v) Side of square, when S is minimum, is

(a) 7- 7л/ л + 4 (b) 7- л/ л + 4 (c) 7- 2л/ л + 4 (d) 7+ л/ л + 4

Q.10 An open box with a square base of side x and height y is to be made out of a given iron sheet of area 36 square metre.

Based on the above information answer the following:

(i) Volume V of box is given by

(a) $xy^2$ (b) $x^2y$ (c) $4xy^2$ (d) $4x^2y$

(ii) Relation between the variables is

(a) $x^2 + 4xy = 36$ (b) $x^2 + 2xy = 36$ (c) $y^2 + 4xy = 36$ (d) $y^2 + 2xy = 36$

(iii) V is given by

(a) ¼ $(36 – x^2)$ (b) ¼ $(36 – x^3)$ (c) ¼ $(36x – x^2)$ (d) ¼ $(36x – x^3)$

(iv) V is maximum when

(a) $x = 2\sqrt{3}$ (b) $x = 3\sqrt{3}$ (c) $x = 4\sqrt{3}$ (d) $x = 5\sqrt{3}$

(v) Maximum value of V is

(a) $12\sqrt{3}$ cubic metres (b) $13\sqrt{3}$ cubic metres (c) 13.5 cubic metres (d) 15 cubic metres

# Chapter 12: Linear Programming

# Section-A

## (Multiple Choice Questions)

Q1: 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 |

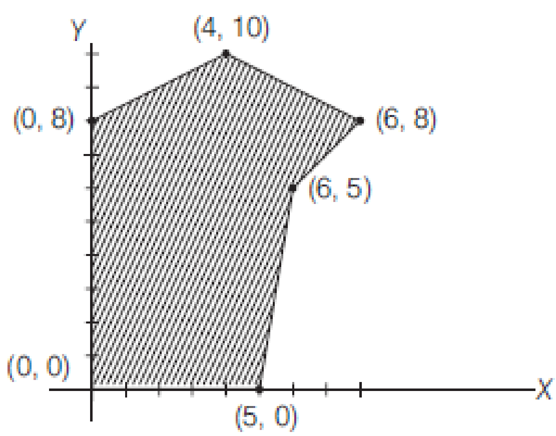
(a) The quantity in column A is greater

(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.

Q2: The feasible solution for a LPP is shown in following figure. Let $Z = 3x - 4y$ be the objective function. Minimum of $Z$ occurs at




(a) (6,5) (b) (0, 8) (c) (5, 0) (d) (4, 10)

Q3:The maximum value of $Z = 11x + 7y$ subject to theconstraints$2x + y \leq 6$, $x \leq 2$ ,$x \geq 0$,

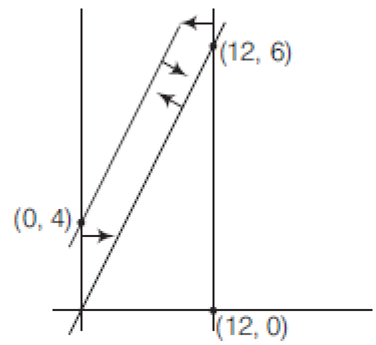
$y \geq 0$.

(a) 32 (b) 24 (c) 42 (d) 10

Q4: Corner points of the feasible region for an LPP are (0, 3), (3, 2) and (0, 5). Find the minimum value of $Z = 11x + 7y$.

(a) 21 (b) 1 (c) -13 (d) -17

Q5: The feasible region for an LPP is shown in the following figure. Let $F = 3x - 4y$ be the objective function. Maximum value of $F$ is




(a) 0 (b) 8 (c) 12 (d) -18

Q6; 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. The minimum value of $F$ occurs at

(a) Only (0, 2)

(b) Only (3, 0)

(c) the mid-point of the line segment joining the points (0, 2) and (3, 0)

(d) any point on the line segment joining the points (0, 2) and (3, 0)

Q7: 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) $p = q$

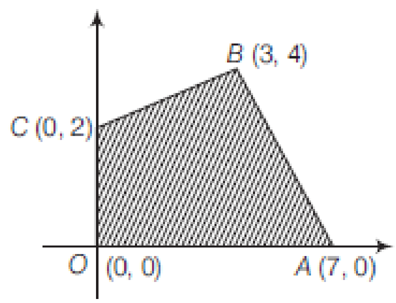
Q8: The optimal value of the objective function is attained at the points
(a) on X-axis
(b) on Y-axis

(c) which are comer points of the feasible region
(d) none of these

Q9: Region represented by $x \geq 0, y \geq 0$ is

(a) First Quadrant (b) Second Quadrant (c) Third Quadrant (d) fourth Quadrant

Q10: Feasible region (shaded) for a LPP is shown in following figure. Maximize $Z = 5x + 7y$.




(a) 60 (b) 48 (c) 42 (d) 43

Q11: Maximize $Z = 11x + 8y$, subject to $x \leq 4$, $y \leq 2$, $x \geq 0$, $y \geq 0$.
(a) 16 at (0 , 2)
(b) 60 at (4, 2)
(c) 62 at (4, 0)
(d) 48 at (4, 2)

Q12: The corner points of the feasible region determined by the following system of linear inequalities: $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are (0, 0), (5, 0), (3, 4) and (0, 5). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the maximum of Z occurs at both (3, 4) and (0, 5) is

(a) $p = q$ (b) $p = 2q$ (c) $p = 3q$ (d) $q = 3p$

Q13:A set of values of decision variables which satisfies the linear constraints and non-negativity conditions of a L.P.P. is called its
(a) Unbounded solution
(b) Optimum solution
(c) Feasible solution
(d) None of these

Q14: Objective function of a linear programming problem is
(a) a constraint
(b) function to be optimized

(c) A relation between the variables
(d) None of these

Q15: 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. The maximum value of $F$ is equal to

(a) 72 (b) 48 (c) 42 (d) 18

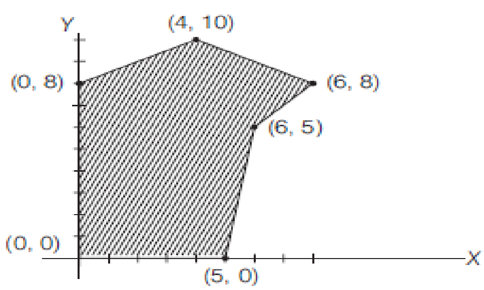
Q16: Maximize $Z = 4x + 6y$, subject to $3x + 2y \leq 12$, $x + y \geq 4$, $x, y \geq 0$.
(a) 16 at (4, 0)
(b) 24 at (0, 4)
(c) 24 at (6, 0)
(d) 36 at (0, 6)

Q17: 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

Q18: The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5), (15, 15), (0, 20). Let $Z = px + qy$, where $p, q > 0$.Condition on p and q so that the maximum of Z occurs at both the points (15, 15) and(0, 20) is

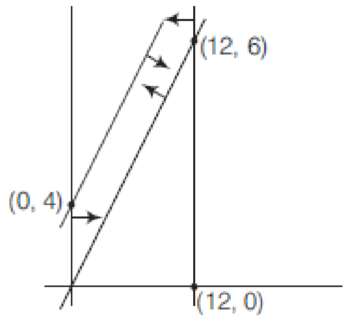
(a) $p = q$ (b) $p = 2q$ (c) $q = 2p$ (d) $q = 3p$

Q19: The feasible solution for a LPP is shown in following figure. Let $Z = 3x - 4y$ be the objective function. Maximum of $Z$ occurs at




(a) (5, 0) (b) (6, 5) (c) (6, 8) (d) (4, 10)

Q20: The feasible region for an LPP is shown in the following figure. Let $F = 3x - 4y$ be the objective function. Minimum value of $F$ is




(a) 0 (b) -16 (c) 12 (d) Does not exist

Q21 Infeasibility means that the number of solutions to the linear programming models that satisfies all constraints is

(a) At least 1

(b) An infinite number

(c) Zero

(d) At least 2

Q22A toy company manufactures two types of toys A and B. Demand for toy B is at most half of that of type A. Write the corresponding constraint if x toys of type A and y toys of type B are manufactured.

(a) $x/2 \leq y$

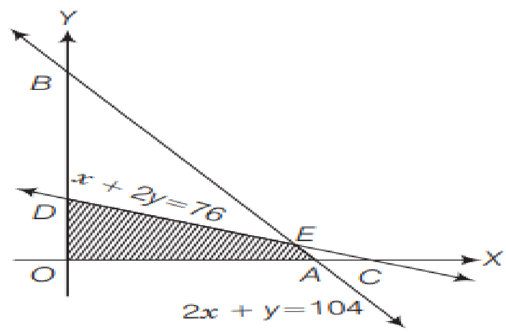
(b) $2y - x \geq 0$

(c) $x - 2y \geq 0$

(d) $x < 2y$

Q23The feasible region for a LPP is shown in following figure. Maximum value of

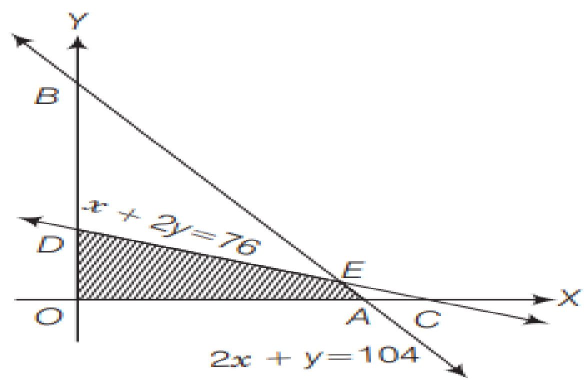
$Z = 3x + 4y$ is




(a) 200 (b) 196 (c) 156 (d) 252

Q24The feasible region for a LPP is shown in following figure. Maximum value of

$Z = 3x + 4y$ occurs at




(a) (44, 16) (b) (52, 0) (c) (0, 38) (d) (0, 0)

Q25Let R be the feasible region for a linear programming problem and let Z = ax + by be the objective function. If R is bounded, then the objective function Z has both a maximum and a minimum value on R and

(a) each of these occurs at a corner point (vertex) of R.

(b) each of these occurs at the mid points of the edges of R

(c) each of these occurs at the centre of R.

(d) each of these occurs at some points except corner points of R.

Q26What is the objective function in linear programming problems?

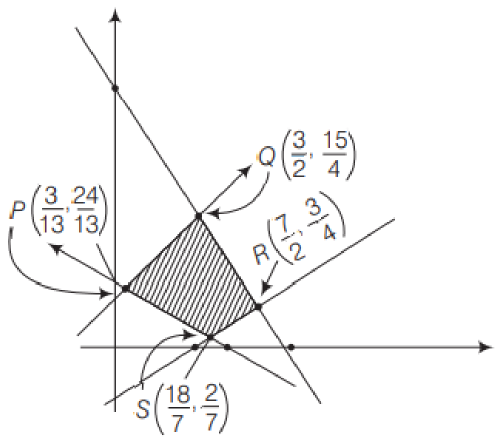
(a) A constraint for available resource

(b) An objective for research and development of a company

(c) A linear function in an optimization problem

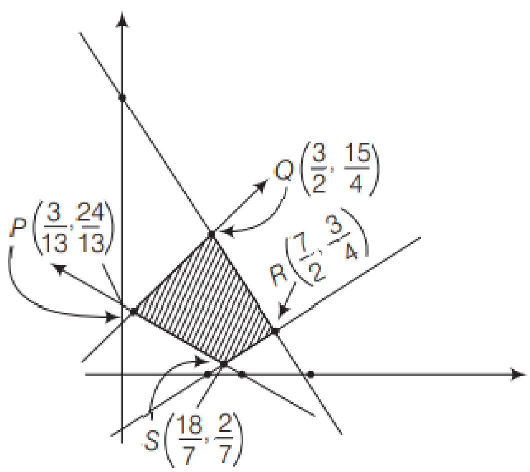
(d) A set of non-negativity conditions

Q27In following figure, the feasible region (shaded) for a LPP is shown. Determine the maximum value of Z = x + 2y




(a) 200 (b) 196 (c) 156 (d) 9

Q28In following figure, the feasible region (shaded) for a LPP is shown. Determine the minimum value of Z = x + 2y




(a) $3\frac{12}{13}$ (b) $3\frac{1}{7}$ (c) $3\frac{2}{7}$ (d) 2

Q29In LPP the condition to be satisfied is

(a) Constraints have to be linear

(b) Objective function has to be linear

(c) none of the above

(d) both a and b

Q30 Shape of the feasible region formed by the following constraints is $x + y \leq 2$, $x + y \geq 5$,

$x \geq 0$, $y \geq 0$

(a) No feasible region

(b) Triangular region

(c) Unbounded solution

(d) Trapezium

## Section-B

## (Assertion and Reasoning based MCQs)

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion(A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of

assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q1 Assertion: In a LPP, the maximum value of the objective function $Z = ax + by$ is always finite.

Reason: A Linear Programming Problem is one that is concerned with finding the optimal value (maximum or minimum value) of a linear function (called objective function) of several variables (say $x$ and $y$).

Q2 Assertion: In a LPP, the minimum value of the objective function $Z = ax + by$ is always 0, if origin is one of the corner point of the feasible region.

Reason: The linear inequalities or equations or restrictions on the variables of a linear programming problem are called constraints.

Q3 Assertion: If the feasible region for a LPP is bounded, maximum or minimum of the objective function $Z = ax + by$ may or may not exist.

Reason: The common region determined by all the constraints including non-negative constraints $x, y \geq 0$ of a linear programming problem is called the feasible region (or solution region)

Q4 Assertion: Maximum value of the objective function $Z = ax + by$ in a LPP not always occurs at only one corner point of the feasible region.

Reason: The common region determined by all the constraints including non-negative constraints $x, y \geq 0$ of a linear programming problem is called the feasible region (or solution region).

Q5 Assertion: A linear programming problem is one that is concerned with finding the optimal value of a linear function.

Reason: A linear programming problem is one that is concerned with finding the maximum or minimum of a linear function of several variables subject to the conditions that the variables are non-negative and satisfy a set of linear inequalities. Variables are sometimes called decision variables and are non-negative.

Q6 Assertion: Minimum of Z = 200 $x$ + 500 $y$ subject to the constraints :$x + 2y \geq 10$,

$3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$ is 2300.

Reason: minimum value of Z is attained at the point (9, 1)

Q7 Assertion: If a L.P.P admits two optimal solution then it has infinitely many optimal solutions.

Reason: If the value of the objective function of L.P.P is same at two corner points then it is same at every point on the line joining two corner points.

Q8 Assertion: feasible region is the set of points which satisfy all of the given constraints and objective function too.

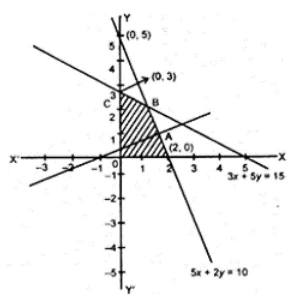
Reason: The optimal value of the objective function is attained at the point on x-axis only.

Q9 Assertion: For the constraints of a L.P.P $Z = x + y$, given by $x + y \leq 1$, $3x + y \geq 1$, there is a feasible region.

Reason:$Z = 7x + y$, subject to $5x + y \leq 5$, $x + y \geq 3$, $x \geq 0$, $y \geq 0$. Out of the corner points of feasible region (0, 3), (0, 5) and $\left(\frac{1}{2}, \frac{5}{2}\right)$ the maximum value of Z occurs at. $\left(\frac{1}{2}, \frac{5}{2}\right)$

Q10 Assertion : Maximise Z = 5$x$ + 3$y$ subject to 3$x$ + 5$y$ ≤ 15, 5$x$ + 2$y$ ≤ 10, $x$ ≥ 0, $y$ ≥ 0.

Reason:




From the graph, it is clear that Z is maximum at point $\left(\frac{20}{19}, \frac{45}{19}\right)$.

## Section-C

## (Case Study Based MCQs)

## Case Study 1

Let R be the feasible region (convex polygon) for a linear programming problem and let $Z = ax + by$ be the objective function. When Z has an optimal value (maximum or minimum), where the variables x and y are subject to, constraints described by linear inequalities, this optimal value must occur at a corner point (vertex) of the feasible region.

Based on the above information, answer the following questions.

(1) The optimal value of the objective function is attained at the points
(a) on X-axis
(b) on Y-axis
(c) which are corner points of the feasible region
(d) none of these

(2) The graph of the inequality $3x + 4y < 12$ is

(a) half plane that contains the origin
(b) half plane that neither contains the origin nor the points of the line $3x + 4y =12$.
(c) whole XOY-plane excluding the points on line $3x + 4y = 12$
(d) none of these

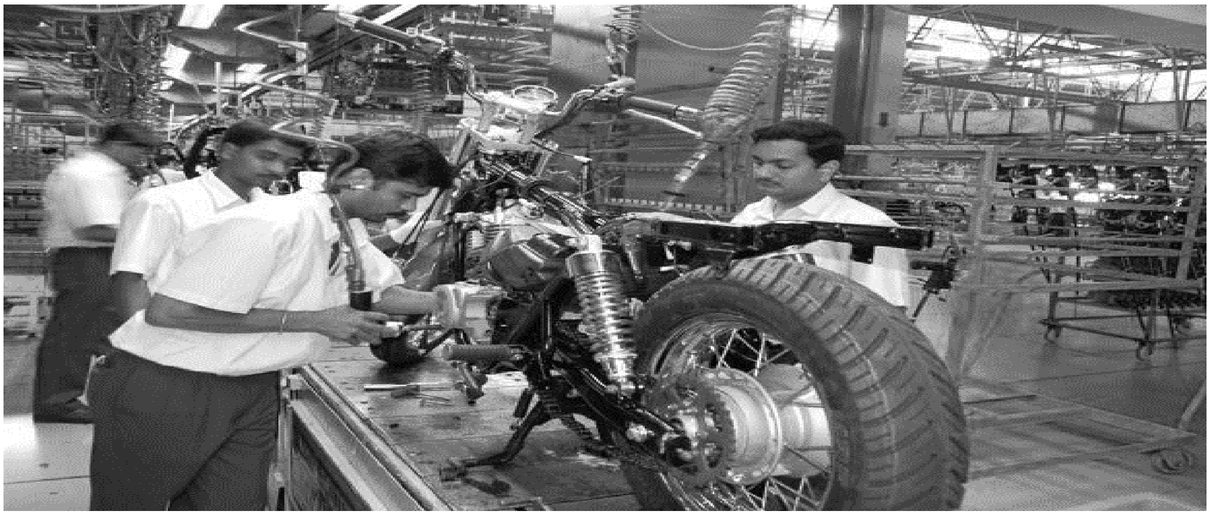
(3) Objective function of a L.P.P. is
(a) a constant
(b) a function to be optimized
(c) a relation between the variables
(d) none of these

(4) Which of the following statement is correct?
(a) Every LPP has at least one optimal solution.
(b) Every LPP has a unique optimal solution.
(c) If an LPP has two optimal solutions, then it has infinitely many solutions
(d) none of these

(5) In solving the LPP:Minimize $f = 6x + 10y$ subject to constraints $x \geq 6$, $Y \geq 2$, $2x + y \geq 10$, $x \geq 0, y \geq 0$ then redundant constraints are
(a) $x \geq 6, y \geq 2$ (b) $2x + y \geq 10, x \geq 0, y \geq 0$ (c) $x \geq 6$ (d) none of these

## Case Study 2

A manufacturer produces two models of bikes-model *X* and model *Y*.Model *X* takes 6 man-hours to make per unit, while model *Y* takes10 man-hours per unit. There is a total of 450 man-hour available per week. Handling and marketing costs are Rs.2000 per unit and Rs. 1000 per unit for models *X* and *Y*, respectively. The total funds available for these purposes are Rs. 80000 per week. Profits per unit for models *X* and *Y* are Rs. 1000 and Rs. 500, respectively.
Assume the manufacturer produces *x* units of model X and *y* units of model Y bikes.



Based on the above information, answer the following questions.

(1) The objective function of the above LPP is

(a) Z = 500 x + y

(b) Z = 1000 x + 500 y

(c) Z = 6x + 10y

(d) none of these

(2) How many bikes of model *X* should the manufacturer produce to yield a maximum profit

(a) 25 (b) 50 (c) 100 (d) 40

(3) How many bikes of model *Y* should the manufacturer produce to yield a maximum profit

(a) 25 (b) 50 (c) 30 (d) 60

(4) The maximum profit of the above LPP is

(a) 25000 (b) 40000 (c) 30000 (d) 60000

(5) Corner points of the feasible region of the above LPP are

(a) (0, 0), (30, 0), (25, 30) and (0, 45)

(b) (0, 0), (75, 0), (25, 30) and (0, 45)

(c) (0, 0), (40, 0), (25, 30) and (0, 80)

(d) (0, 0), (40, 0), (25, 30) and (0, 45)

## Case Study 3

A cooperative society of farmers has 50 hectare of land to grow two crops X and Y. The profit from crops X and Y per hectare are estimated as Rs 10,500 and Rs 9,000 respectively. To control weeds, a liquid herbicide has to be used for crops X and Y at rates of 20 litres and 10 litres per hectare. Further, no more than 800 litres of herbicide should be used in order to protect fish and wild life using a pond which collects drainage from this land.

Assume that the land allotted to crop X and Y is $x$ hectare and $y$ hectare.

Based on the above information, answer the following questions.

Q1 The objective function is

(a) Maximise Z = $9000x + 10500y$

(b) Minimise Z = $9000x + 10500y$

(c) Minimise Z = $10500x + 9000y$

(d) Maximise Z = $10500x + 9000y$

Q2 Which of the following is not a constraint.

(a) $2x + y \geq 80$

(b) $2x + y \leq 80$

(c) $x + y \leq 50$

(d) $x, y \geq 0$

Q3 How much land should be allocated to each crop so as to maximise the total profit of the society?

(a) 20 hectares for crop X and 30 hectares for crop Y

(b) 30 hectares for crop X and 20 hectares for crop Y

(c) 40 hectares for crop X and 10 hectares for crop Y

(d) 25 hectares for crop X and 25 hectares for crop Y

Q4 The maximum profit of the society is _____.

(a) 595000

(b) 494000

(c) 495000

(d) 420000

Q5 The profit when x = 40 and y = 0 is _____.

(a) 487500

(b) 494000

(c) 495000

(d) 420000

## Case Study 4

A manufacturer of electronic circuits has a stock of 200 resistors, 120 transistors and 150 capacitors and is required to produce two types of circuits *A* and *B*. Type *A* requires 20 resistors, 10 transistors and 10 capacitors. Type *B* requires 10 resistors, 20 transistors and 30 capacitors. The profit on type *A* circuit is Rs. 50 and that on type *B* circuit is Rs. 60,

Assume the manufacturer produces $x$ units of type *A* circuits and $y$ units of type *B* circuits.

Based on the above information, answer the following questions.

Q1 The objective function so that the manufacturer can maximise his profit.

(a) Maximise $Z = 50x + 60y$

(b) Maximise $Z = 60x + 50y$

(c) Maximise $Z = 120x + 150y$

(d) Maximise $Z = 200x + 120y$

Q2 How many of circuits of type *A* should be produced by the manufacturer, so as to maximise his profit?

(a) 0

(b) 3

(c) 5

(d) 6

Q3 How many of circuits of type *B*,should be produced by the manufacturer, so as to maximise his profit?

(a) 0

(b) 3

(c) 5

(d) 6

Q4 The maximum profit the manufacturer of electronic components get is ______.

(a) 595

(b) 494

(c) 480

(d) 420

Q5 The profit when x = 3 and y = 5 is ______.

(a) 487

(b) 450

(c) 495

(d) 420

## Case Study 5

A fruit grower can use two types of fertilizer in his garden, brand P and brand Q. The amounts (in kg) of nitrogen, phosphoric acid, potash and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine.

| kg per bag | | |
|---|---|---|
| | Brand P | Brand Q |
| Nitrogen | 3 | 3.5 |
| Phosphoric acid | 1 | 2 |
| Potash | 3 | 1.5 |
| Chlorine | 1.5 | 2 |

Assume amount of Brand P of fertilizer = x bags and amount of Brand Q of fertilizer = y bags

Based on the above information, answer the following questions.

Q1 The objective function so that the manufacturer can minimise amount of Nitrogen.

(a) Minimise Z = $1.5x + 2y$

(b) Minimise Z = $2x + 1.5y$

(c) Minimise Z = $3.5x + 3y$

(d) Minimise Z = $3x + 3.5y$

Q2 What is the minimum amount of nitrogen added in the garden?

(a) 460

(b) 470

(c) 385

(d) 395

Q3 If the grower wants to minimize the amount of nitrogen added to the garden ,how many bags of brand P should be used

(a) 40 (b) 30 (c) 35 (d) 50

Q4 If the grower wants to minimize the amount of nitrogen added to the garden, how many bags of brand Q should be used

(a) 90

(b) 120

(c) 100

(d) 110

Q5 What is the maximum amount of nitrogen added in the garden?

(a) 687

(b) 550

(c) 595

(d) 520

## Case Study 6

A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 hours of machine time and 3 hours of craft man's time in its making while a cricket bat takes 3 hour of machine time and 1 hour of craftman's time. In a day, the factory has the availability of not more than 42 hours of machine time and 24 hours of craftsman's time.

Assume number of rackets = $x$ and number of bats = $y$

Based on the above information, answer the following questions.

Q1 What number of rackets must be made if the factory is to work at full capacity?

(a) 4

(b) 8

(c) 12

(d) 0

Q2 What number of bats must be made if the factory is to work at full capacity?

(a) 4

(b) 12

(c) 8

(d) 0

Q3 If the profit on a racket and on a bat is Rs 20 and Rs 10 respectively, find the maximum profit of the factory when it works at full capacity.

(a) 500

(b) 400

(c) 200

(d) 100

Q4 The corner points of feasible region are

(a) (0, 0), (8, 0), (4, 12) and (0, 24)

(b) (0, 0), (28, 0), (4, 12) and (0, 14)

(c) (0, 0), (28, 0), (4, 12) and (0, 24)

(d) (0, 0), (8, 0), (4, 12) and (0, 14)

Q5 What is the gross production (piece) of the factory in a day when it works at full capacity?

(a) 16 piece

(b) 14 piece

(c) 24 piece

(d) 28 piece

## Case Study 7

A manufacturer has three machines I, II and III installed in his factory. Machines I and II are capable of being operated for at most 12 hours whereas machine III must be operated for atleast 5 hours a day. She produces only two items M and N each requiring the use of all the three machines. The number of hours required for producing 1 unit of each of M and N on the three machines are given in the following table:

| Items | Number of hours required on machines | | |
|---|---|---|---|
| | I | II | III |
| M | 1 | 2 | 1 |
| N | 2 | 1 | 1.25 |

She makes a profit of Rs 600 and Rs 400 on items M and N respectively.

Assume x and y be the number of items M and N respectively.

Based on the above information, answer the following questions.

Q1 How many of item M should she produce so as to maximise her profit assuming that she can sell all the items that she produced?

(a) 5 (b) 4 (c) 6 (d) 3

Q2 How many of item N should she produce so as to maximise her profit assuming that she can sell all the items that she produced?

(a) 2

(b) 3

(c) 4

(d) 5

Q3 The objective function so that the manufacturer can maximise his profit.

(a) Z = 600 $x$ + 400 $y$

(b) Z = 400 $x$ + 600 $y$

(c) Z = 500 $x$ + 400 $y$

(d) None of the above

Q4 What will be the maximum profit?

(a) 3000

(b) 4000

(c) 3600

(d) 5000

Q5 The corner points of feasible region are

(a) (5, 0) (6, 0), (4, 4), (0, 6) and (0, 4)

(b) (5, 0) (6, 0), (4, 4), (0, 6) and (0, 4)

(c) (5, 0) (6, 0), (4, 4), (0, 6) and (0, 4)

(d) (5, 0) (6, 0), (4, 4), (0, 6) and (0, 4)

## Case Study 8

There are two factories located one at place P and the other at place Q. From these locations, a certain commodity is to be delivered to each of the three depots situated at A, B and C. The weekly requirements of the depots are respectively 5, 5 and 4 units of the commodity while the production capacity of the factories at P and Q are respectively 8 and 6 units. The cost of transportation per unit is given below:

| From/to | Cost (in Rs) | | |
|---|---|---|---|
| | A | B | C |
| P | 160 | 100 | 150 |
| Q | 100 | 120 | 100 |

Assume x units and y units of the commodity be transported from the factory at P to the depots at A and B respectively.

Based on the above information, answer the following questions.

Q1 The objective function so that the transportation cost will be minimum?

(a) $Z = 10\,(7x - y + 160)$

(b) $Z = 10\,(x - 7y + 160)$

(c) $Z = 10\,(x - 7y + 190)$

(d) $Z = 10\,(7x - y + 190)$

Q2 How many units should be transported from factory P to depot A in order that the transportation cost is minimum.
(a) 0

(b) 4

(c) 6

(d) 3

Q3 How many units should be transported from factory Q to depot B in order that the transportation cost is minimum.
(a) 5

(b) 0

(c) 6

(d) 3

Q4 How many units should be transported from P factory to depot C in order that the transportation cost is minimum.
(a) 5

(b) 4

(c) 6

(d) 3

Q5 What will be the minimum transportation cost?

(a) Rs 1350

(b) Rs 1440

(c) Rs 1550

(d) Rs 1400

## Case Study 9

An aero plane carries a maximum of 200 passengers. A profit of Rs. 1000 is made on each executive class ticket and a profit of Rs. 600 is made on each economy class ticket. The airline reserves at least 20 seats for executive class. How ever at least 4 times as many passengers prefer to travel by economy class than by the executive class.

Assume number of tickets of executive class sold = $x$ and number of tickets of economy class sold = $y$

Based on the above information, answer the following questions.

Q1 Which of the following is not a constraint

(a) $x, y \geq 0$

(b) $x \geq 20$

(c) $x + y \leq 200$

(d) $2x + y \geq 200$

Q2 How many executive class ticket must be sold in order to maximize the profit for the airline?

(a) 40 (b) 45 (c) 60 (d) 30

Q3 How many economy class tickets must be sold in order to maximize the profit for the airline?

(a) 150

(b) 160

(c) 165

(d) 135

Q4 The profit when x = 20 and y = 80 is ______.

(a) 48000

(b) 59000

(c) 68000

(d) 42000

Q5 What is the maximum profit?

(a) 136000

(b) 59000

(c) 68000

(d) 42000

## Case Study 10

An oil company has two depots A and B with capacities of 7000 L and 4000 L respectively. The company is to supply oil to three petrol pumps. D, E and F whose requirements are 4500 L, 3000 L and 3500 L respectively. Assuming that the transportation cost of 10 liters of oil is Re. 1 per km. The distances (in km) between the depots and the petrol pumps is given in the following table:

| Distance in km. | | |
|---|---|---|
| From/To | A | B |
| D | 7 | 3 |
| E | 6 | 4 |
| F | 3 | 2 |


Assume x and y liters of oil is supplied from depot A to petrol pump D and E respectively.

Q1The objective function so that the transportation cost will be minimum?

(a) $Z = 0.3x + y + 3950$

(b) $Z = 0.3x + 0.1y + 3590$

(c) $Z = 0.3x + 0.1y + 3950$

(d) $Z = 0.1x + 0.3y + 3590$

Q2What is the minimum transportation cost?

(a) 4400

(b) 4200

(c) 4000

(d) 3500

Q3What is the maximum transportation cost?

(a) 5450

(b) 5550

(c) 5560

(d) 5650

Q4 How should the delivery be scheduled from Depot A to petrol pump D, E and F respectively in order that the transportation cost is minimum?

(a) 3000, 500, 3500

(b) 3500, 3000, 500

(c) 500, 3000, 3500

(d) None of the above

Q5 How should the delivery be scheduled from Depot B to petrol pump D, E and F respectively in order that the transportation cost is minimum?

(a) 0, 0, 4000

(b) 4000, 500, 0

(c) 0, 4000, 500

(d) 4000, 0, 0

# ANSWER KEY

## Chapter 01 : Relations and Functions

### Section A ( Multiple Choice Questions )

Q 1. ( a ) Q 2 . ( c ) Q 3. ( d ) Q 4 . ( b ) Q 5. ( d )

Q 6. ( d ) Q 7. ( d ) Q 8. ( d ) Q 9. ( c ) Q 10 ( a )

Q 11. ( c ) Q 12 . ( d ) Q 13. ( b ) Q 14 . ( a ) Q 15. ( d )

Q 16. ( b ) Q 17. ( a ) Q 18. ( d ) Q 19. ( c ) Q 20 ( b )

Q 21. ( b ) Q 22 . ( c ) Q 23. ( c ) Q 24 . ( c ) Q 25. ( b )

Q 26. ( c ) Q 27. ( c ) Q 28. ( d ) Q 29. ( d ) Q 30 ( a )

### Section-B (Assertion Reasoning based MCQs)

Q 1. ( A ) Q 2. ( c ) Q 3. ( A ) Q 4. ( E ) Q 5 . ( D )

Q 6. ( A ) Q 7. ( D ) Q 8. ( A ) Q 9. ( B ) Q 10. ( A )

### Section-C

### ( Case Study Based MCQs)

Q 1 ( i ) ( c ) Q 1 ( ii ) ( c ) Q1 ( iii ) ( b ) Q 1 ( iv ) ( d ) Q 1 ( v ) (b )

Q 2 ( i ) ( d ) Q 2 ( ii ) ( b ) Q2 ( iii ) ( b ) Q 2 ( iv ) ( c ) Q 2 ( v ) ( a )

# ANSWER KEY: Chapter 2 Inverse Trigonometric Functions

## Section-A

## (Multiple Choice Questions)

Q1 (D)

Q2 (C)

Q3 (D)

Q4 (B)

Q5 (C)

Q6 (A)

Q7 (B)

Q8 (C)

Q9 (D)

Q10 (A)

Q11 (B)

Q12 (B)

Q13 (B)

Q14 (A)

Q15 (C)

Q16 (A)

Q17 (D)

Q18 (D)

Q19 (B)

Q20 (B)

Q21 (C)

Q22 (C)

Q23 (B)

Q24 (B)

Q25 (A)

Q26 (A)

Q27 (A)

Q28 (A)

Q29 (D)s

Q30 (B)

## Section- B

## (Assertion Reasoning based MCQs)

Q1 (A)

Q2 (A)

Q3 (C)

Q4 (A)

Q5 (E)

Q6 (D)

Q7 (C)

Q8 (A)

Q9 (B)

Q10 (A)

## Section-C

## ( Case Study Based MCQs)

CASE STUDY 1

1 (A) 2 (A) 3 (B) 4 (D) 5 (D)

CASE STUDY 2

1 (C) 2 (B) 3 (D) 4 (C) 5 (A)

# ANSWER KEY: Chapter 3 Matrices

## Section-A

## (Multiple Choice Questions)

1. B
2.B
3. B
4. A
5.A
6. B
7. A
8. A
9.A
10. C
11. A
12. B
13. B
14 A
15 B
16. D
17. D
18. D
19. D
20. A
21. C

## Section-B

## ( Case Study Based MCQs)

Q1

ANS: 1. Rs. 46,000

2. Rs. 53,000

3. RS.31,000

4. (Rs.15, 000, Rs.17, 000)

5. Rs. 32,000

Q2 ANS;

1. (b) 7000

2. (a) 14000

3. (c) Rs.21000

4. (d) 21250 5. (d) 33

## Section-C

### ANSWER: (Assertion Reasoning based MCQs)

Q 1. ( D)    Q 2. ( A )    Q 3. ( D )    Q 4. ( B)    Q 5 . ( C )

Q 6. ( D )    Q 7. ( A)    Q 8. ( C )

## Answers:

## Chapter 4 Determinants

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q. No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Answer | c | b | d | c | b | C | b | c | C | a | c | b | c | c | a |
| Q. No. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Answer | a | a | b | d | a | B | c | a | A | c | a | b | b | b | a |
| Q. No. | 31 | 32 | 33 | 34 | 35 | 36A | 36B | 36C | 36D | 36E | 37A | 37B | 37C | 37D | 37E |
| Answer | b | b | c | b | b | C | a | c | A | b | b | c | b | d | c |
| Q. No. | 38A | 38B | 38C | 38D | 38E | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| Answer | a | b | a | b | a | C | a | d | A | c | a | d | d | c | a |

## Answers Chapter 5: Continuity and Differentiability

### Section-A
### (Multiple Choice Questions)

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

Ans.14 A
Ans.15 D
Ans.16 B
Ans.17 B
Ans.18 D
Ans.19 B
Ans.20 B
Ans.21 C
Ans.22 B
Ans.23 D
Ans.24 A
Ans.25 C
Ans.26 A
Ans.27 A
Ans.28 A
Ans.29 B
Ans.30 D
Ans.31 B

## Section-B
## ( Case Study Based MCQs)

| | | |
|---|---|---|
| Ans.32 | (i) | C |
| | (ii) | b |
| | (iii) | b |
| | (iv) | b |
| | (v) | a |
| Ans.33 | (i) | a |
| | (ii) | b |
| | (iii) | c |
| | (iv) | c |
| | (v) | d |

## Section-C
## (Assertion Reasoning based MCQs)

Ans.34 B
Ans.35 C
Ans.36 A
Ans.37 C
Ans.38 C
Ans.39 D
Ans.40 A
Ans.41 C
Ans.42 C
Ans.43 B

## ANSWERS Chapter 6:Applications of Derivatives

## Section-A

## (Multiple Choice Questions)

| | |
|---|---|
| Q-1 (c) | Q-21 (d) |
| Q-2 (b) | Q-22 (d) |
| Q-3 (b) | Q-23 (a) |
| Q-4 (d) | Q-24 (a) |
| Q-5 (d) | Q-25 (a) |
| Q-6 (c) | Q-26 (c) |
| Q-7 (a) | Q-27 (b) |
| Q-8 (a) | Q-28 (c) |
| Q-9 (d) | Q-29 (c) |
| Q-10 (b) | Q-30 (b) |
| Q-11 (d) | Q-31 (d) |
| Q-12 (a) | Q-32 (d) |
| Q-13 (c) | Q-33 (a) |
| Q-14 (a) | Q-34 (d) |
| Q-15 (d) | Q-35 (a) |
| Q-16 (a) | Q-36 (b) |
| Q-17 (b) | Q-37 (b) |
| Q-18 (d) | Q-38 (d) |
| Q-19 (a) | Q-39 (c) |
| Q-20 (b) | Q-40 (a) |

# ANSWER KEY

## Section-B

## (Assertion Reasoning based MCQs)

Q-1 (d)

Q-2 (c)

Q-3 (d)

Q-4 (a)

Q-5 (a)

Q-6 (c)

## Section-C

## ( Case Study Based MCQs)

Q-1 (i) (b)
(ii) (a)
(iii) (c)
(iv) (b)
(v) (d)

Q-2 (i) (b)
(ii) (b)
(iii) (d)
(iv) (b)
(v) (a)

Q-3 (i) (b)
(ii) (d)
(iii) (b)
(iv) (c)
(v) (d)

Q-7 (i) (a)
(ii) (c)
(iii) (c)
(iv) (b)
(v) (a)

Q-8 (i) (b)
(ii) (a)
(iii) (a)
(iv) (c)
(v) (b)

Q-9 (i) (a)
(ii) (b)
(iii) (d)
(iv) (a)
(v) (a)

Q-4 (i) (b)
(ii) (a)
(iii) (c)
(iv) (a)
(v) (d)

Q-5 (i) (d)
(ii) (c)
(iii) (b)
(iv) (a)
(v) (c)

Q-6 (i) (a)
(ii) (b)
(iii) (b)
(iv) (d)
(v) (c

Q-10 (i) (b)
(ii) (a)
(iii) (d)
(iv) (a)
(v) (a)

# Answer Key Chapter 12 Linear Programming

## Section-A

## (Multiple Choice Questions)

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

## Section-B

## ANSWER (Assertion and Reasoning based MCQs)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (a) | 2 (d) | 3 (d) | 4 (b) | 5 (a) | 6 (c) | 7 (a) | 8 (c) | 9 (b) | 10 (a) |

## Section-C
## ( Case Study Based MCQs)

### ANSWER CASE STUDY 1

| | | | | |
|---|---|---|---|---|
| 1 (c) | 2 (a) | 3 (b) | 4 (c) | 5 (b) |

### ANSWER CASE STUDY 2

| | | | | |
|---|---|---|---|---|
| 1 (b) | 2 (a) | 3 (c) | 4 (b) | 5 (d) |

### ANSWER CASE STUDY 3

| | | | | |
|---|---|---|---|---|
| 1 (d) | 2 (a) | 3 (b) | 4 (c) | 5 (d) |

### ANSWER CASE STUDY 4

| | | | | |
|---|---|---|---|---|
| 1 (a) | 2 (d) | 3 (b) | 4 (c) | 5 (b) |

### ANSWER CASE STUDY 5

| | | | | |
|---|---|---|---|---|
| 1 (d) | 2 (b) | 3 (a) | 4 (c) | 5 (c) |

### ANSWER CASE STUDY 6

| | | | | |
|---|---|---|---|---|
| 1 (a) | 2 (b) | 3 (c) | 4 (d) | 5 (a) |

### ANSWER CASE STUDY 7

| | | | | |
|---|---|---|---|---|
| 1 (b) | 2 (c) | 3 (a) | 4 (b) | 5 (d) |

### ANSWER CASE STUDY 8

| | | | | |
|---|---|---|---|---|
| 1 (c) | 2 (a) | 3 (b) | 4 (d) | 5 (c) |

### ANSWER CASE STUDY 9

| | | | | |
|---|---|---|---|---|
| 1 (d) | 2 (a) | 3 (b) | 4 (c) | 5 (a) |

### ANSWER CASE STUDY 10

| | | | | |
|---|---|---|---|---|
| 1 (c) | 2 (a) | 3 (b) | 4 (c) | 5 (d) |