SAMPLE QUESTION PAPER-1 (TERM 1) 2021-22

SUBJECT : MATHEMATICS

CLASS : XII

Time : 90 minutes **Marks : 40**

General Instructions:

1. ***This question paper contains three sections – A, B and C. Each part is compulsory.***
2. ***Section - A has 20 MCQs, attempt any 16 out of 20.***
3. ***Section - B has 20 MCQs, attempt any 16 out of 20***
4. ***Section - C has 10 MCQs, attempt any 8 out of 10.***
5. ***There is no negative marking.***

All questions carry equal marks.

SECTION – A

In this section, attempt any 16 questions out of Questions 1 – 20. Each Question is of 1 mark weightage.

1. The domain of the function : $\cos^{-1}(2x-1)$

   a) [0,1] (b) [-1,1]

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

2. The function f, where f is defined by 1

$$f(x)=\begin{cases}-2, & if\ x\le -1\\ 2x, & if\ -1<x<\infty\end{cases}$$ is

   (a) not continuous at x=1

(b) not continuous at x=-1

(c) not continuous at R

(d) continuous at R

3. Value of k, for which A= $\begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ is a singular matrix is : 1

a) 4 b) -4

b) ±4 d) 0

4. If A= $\begin{bmatrix} \frac{2}{3} & 1 & \frac{5}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3} \\ \frac{7}{3} & 2 & \frac{2}{3} \end{bmatrix}$ and B= $\begin{bmatrix} \frac{2}{5} & \frac{3}{5} & 1 \\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5} \\ \frac{7}{5} & \frac{6}{5} & \frac{2}{5} \end{bmatrix}$ then 3A-5B is :

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

c) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

5. On using elementary column operations $C_2 \rightarrow C_2 - 2C_1$ in the following matrix equation $\begin{bmatrix} 1 & -3 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$, we have

(a) $\begin{bmatrix} 1 & -5 \\ 0 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ -2 & 2 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ 2 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & -5 \\ 0 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ 0 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -3 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ -2 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ 2 & 0 \end{bmatrix}$

6. The function given by f(x)=3-7x is strictly decreasing on R.

a) True b) False
c) Can't say d) Partially true

7. The relation R defined in the set A={1,2,3,4,5,6,7} by R={(a,b) both a and b are either odd or even}. Then, R is

a) Symmetric b) transitive
c) an equivalence relation d) reflexive

8. Suppose 2 x 2 matrix A= $\left[a_{ij}\right]$, whose elements are given by $a_{ij} = \frac{i}{j}$, then matrix A is

a) $\begin{bmatrix} 1 & 1/2 \\ 2 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 2 \\ 1/2 & 1 \end{bmatrix}$

c) $\begin{bmatrix} 1/2 & 1 \\ 2 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1/2 & 1 \\ 1 & 2 \end{bmatrix}$

9. The slope of normal to the following : 1

curve $y = \sin^2 x \, at \, x = \frac{\pi}{4} is$

a) 1 b) -1

c) 0 d) $\sqrt{2}$

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

a) [1,2] b) [2,1]

c) [-1,1] d) [0,1]

11. Let A={a,b,c} and the relation R be defined on A as R={a,a), (b,c), (a,b)}. Then, find minimum number of ordered pairs to be added in R to make R reflexive and transitive. 1

a) 3 b) 4

c) 2 d) 1

12. If y= log x^x, then the value of $\frac{dy}{dx} is$

a) $x^x(1+\log x)$ b) log(ex)

c) log $\frac{e}{x}$ d) log $\left(\frac{x}{e}\right)$

13. Two matrices A=$\left[a_{ij}\right] and\ B=\left[b_{ij}\right]$ are said to be equal, if they are of same order and for all i and j, their elements are

a) $a_{ij}=b_{ij}$ b) $a_{ij}=b_{ij}$

c) $a_{ij}=-b_{ij}$ d) $a_{ij}+b_{ij}=0$

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

a) $\frac{\cos x}{2y+1}$

b) $\frac{\cos x}{2y-1}$

c) $\frac{\sin x}{2y-1}$

d) None of these

15. If A=$\begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, $B=\begin{bmatrix} 1 & 3 & 2 \\ 4 & 3 & 1 \end{bmatrix}$, $C=\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and D=$\begin{bmatrix} 4 & 6 & 8 \\ 5 & 7 & 9 \end{bmatrix}$, then which of the following is defined ?

a) A+B   b) B+C

c) C+D   d) B+D

16. The equation of the tangent to the curve $y=\sqrt{3x-2,}$ which is parallel to the line 4x-2y+5=0, is 1

a) 48x-2y=23   b) 48x+2y=24

c) 48x+23y=24   d) 48x-24y=23

17. If A=$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, than A^2 is equal to 1

a) 0

b) –A

c) 1

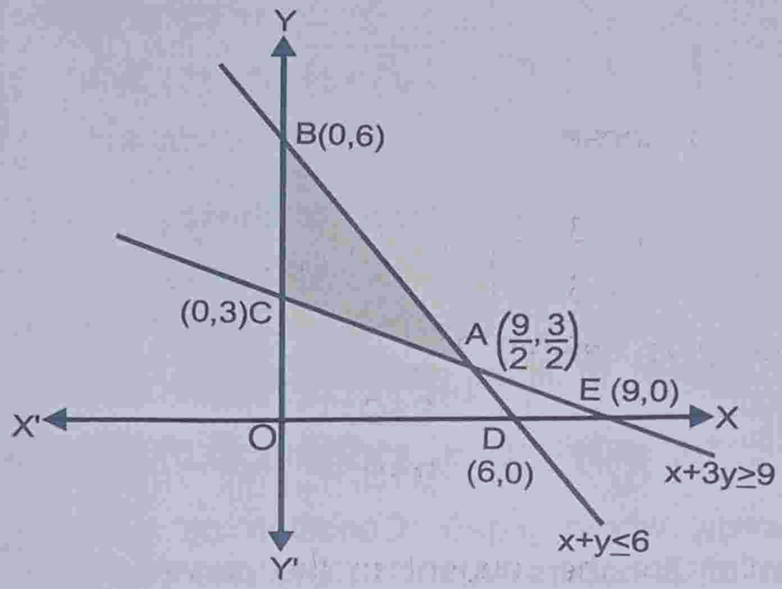
d) 2A

18. If y=$\sec \tan^{-1} x$, then $\frac{dy}{dx}$ is equal to 1

a) xy/(1+x)   b) xy$\sqrt{(1+x^2)}$

c) y/$\sqrt{(1+x^2)}$ d) xy/(1+x$^{2)}$

19. The linear inequality in the graph is shown below : 1



The feasible region is ....

a) OCAD b) ADE

c) ABC d) None of these

20. The minimum value of the function $f(x)=2x^3-3x^2$ exists at x equals to 1

a) 0 b) 2

c) -1 d) 1

SECTION-B

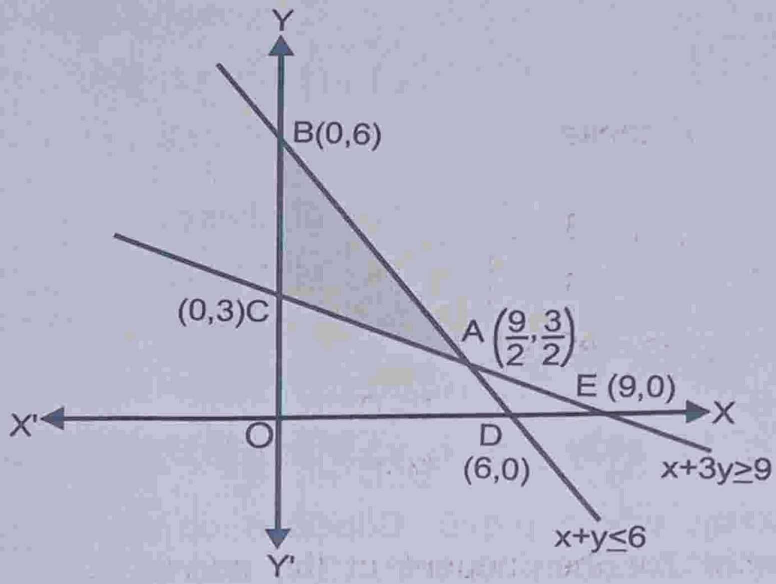
In this section, attempt any 16 questions out of the Questions 21 - 40. Each Question is of 1 mark weightage.

21. Let A={1,2,3}. Then, number of relations containing (1,2) and (1,3), which are reflexive and symmetric but not transitive, is 1

a) 1 b) 2

c) 3 d) 4

19. The linear inequality in the graph is shown below : 1



The feasible region is ....

a) OCAD b) ADE

c) ABC d) None of these

20. The minimum value of the function $f(x)=2x^3-3x^2$ exists at x equals to 1

a) 0 b) 2

c) -1 d) 1

SECTION-B

In this section, attempt any 16 questions out of the Questions 21 - 40. Each Question is of 1 mark weightage.

21. Let A={1,2,3}. Then, number of relations containing (1,2) and (1,3), which are reflexive and symmetric but not transitive, is 1

a) 1 b) 2

c) 3 d) 4

22. If f(x)= |cosx-sin x|, then $f'(\frac{\pi}{3})$ is equal to 1

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

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

23. The corner points of the feasible region determined by the following system of linear inequalities

$2x + y \le 10$, $x+3y \le 15$, x, $y \ge 0$ 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

24. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right), then \frac{dy}{dx}$ is equal to 1

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

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

25. Find the value of x and y are respectively, if $\begin{bmatrix} x & y \\ 3y & x \end{bmatrix}\begin{bmatrix} 1 \\ 2 \end{bmatrix}=\begin{bmatrix} 3 \\ 5 \end{bmatrix}$ 1

a) 1,1

b) 2,1

c) 4,3

26. For $x \in R$, the function f(x)=$x^3 - 6x^2 + 12x - 18$ is 1

a) an increasing function

b) decreasing function

c) both (a) and (b) are true

d) None of the above

27. The value of $\tan^{-1}\left[2\sin\left(2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)\right]$ is 1

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

c) $-\frac{\pi}{3}$ d) $\frac{\pi}{6}$

28. The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ is a 1

a) identity matrix b) symmetric matrix

c) skew-symmetric matrix d) None of these

29. Find the slope of the normal to the curve $x = a\cos^3\theta \, and \, y = a\sin^3\theta$ at $\theta = \frac{\pi}{4}$. 1

a) 1 b) -1

c) $\frac{1}{2}$ d) $-\frac{1}{2}$

30. The domain of function $f : R \to R$ defined by $f(x) = \sqrt{x^2 - 3x + 2}$ is

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

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

31. The function defined by $g(x)=x-[x]$ is discontinuous at 1

a) all rational points b) all irrational points

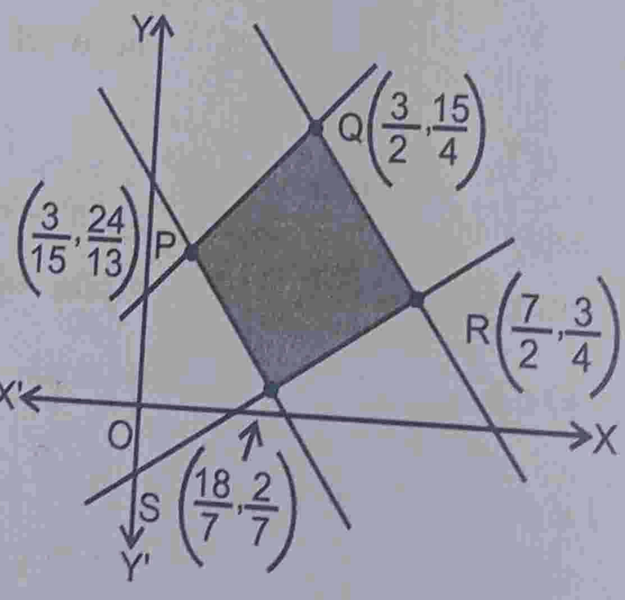
c) all integer points d) None of the above

32. Let $A=\begin{bmatrix}0 & 1\\ 1 & 2\end{bmatrix}$ and $f(x)=x^2+x-1,$ then find f(A). 1

a) $\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$ b) $\begin{bmatrix}0 & 3\\ 3 & 6\end{bmatrix}$

c) $\begin{bmatrix}3 & 0\\ 4 & 5\end{bmatrix}$ c) $\begin{bmatrix}4 & 1\\ 5 & 6\end{bmatrix}$

33. In the given figure, the feasible region for a LPP is shown. Find the maximum and minimum value of Z=x+2y. 1



a) 8,3,2 b) 9,3,14

c) 9,4 d) None of these

34. The maximum and minimum values of the function $2x^3-15x^2+36x+11$ are respectively 1

a) 39,18 b) 39,35

c) 39,38 d) ...

XII

35. If A=$\left[a_{ij}\right]_{mxn,}$ $then\ A'$ is equal to 1

a) $\left[a_{ji}\right]_{nxm}$

b) $\left[a_{ij}\right]_{mxn}$

c) $\left[a_{ji}\right]_{mxn}$

d) $\left[a_{ij}\right]_{nxm}$

36. The inverse of cosine function is defined in the intervals 1

a) $\left[-\pi,0\right]$

b) $\left[\frac{-\pi}{2},0\right]$

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

d) $\left[\frac{\pi}{2},\pi\right]$

37. The function $f:R\to R$ defined by $f(x)=x^2+x$ is 1

a) one-one

b) onto

c) many-one

d) None of these

38. A=$\begin{bmatrix}1 & 2\\ 1 & 1\end{bmatrix}$ $and\ B=\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}, then$ 1

AB ....

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

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

c) $\begin{bmatrix}3 & 1\\ 1 & 0\end{bmatrix}$

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

39. The equation of normal point t to the curves $x=at^2, y=2at$ is 1

a) x-ty+at^2=0

b) $ty+y-at\left(2+t^2\right)=0$

c) $x+ty+at^2=0$

d) $ty+y+at\left(2+t^2\right)=0$

40. If $A=\begin{bmatrix}-2\\4\\5\end{bmatrix}$ $and\ B=\begin{bmatrix}1 & 3 & -6\end{bmatrix}$, then $(AB)'$ is equal to 1

a) B'A'
b) A'B'
c) AB'
d) BA'

SECTION-C

In this section, attempt any 8 questions. Each question is of 1-mark weightage. Questions 41-45 are based on a Assertion-Reasoning. Questions 46-50 are based on a Case-Study.

Assertion-Reasoning MCQs

Directions (Q.Nos. 41-45 each of these questions contains two statements : Assertion (A) and Reason(R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

a) A is true, R is true; R is a correct explanation for A.

b) A is true, R is true; R is not a correct explanation for A.

c) A is true; R is false.

d) A is false; R is true.

41. Assertion (A) For an objective function Z=15x+20y, corner points are (0,0), (10,0), (0,15) and (5,5). Then optimal values are 300 and 0 respectively. 1

Reason (R) The maximum or minimum value of an objective function is known as optimal value of LPP. These values are obtained at corner points.

42. Assertion (A) The equation of all lines having slope 0 which are tangents to the curve $y=\frac{1}{x^2-2x+3}, is\ y=\frac{1}{2}.$ 1

Reason (R) : The point at which tangent to the given curve having slope 0, is $\left(1, \frac{1}{2}\right)$.

43. Assertion (A) The absolute maximum value of the function $2x^3 - 24x$ in the interval [1,3] is 89. 1

Reason (R) The absolute maximum value of the function can be obtained from the value of the function at critical points and at boundary points.

44. Assertion (A) Maximum value of Z=3x+2y, subject to the constraints $x + 2y \leq 2; x \geq 0; y \geq 0$ will be obtained at point (2,0). 1

Reason (R) In a bounded feasible region, it always exist a maximum and minimum value.

45. Assertion (A) Scalar matrix

$A = \left[a_{ij}\right] = \begin{cases} k, i = j, \\ 0; \ i \neq j \end{cases}$ where k is a scalar, is an identity matrix when

k=1.

Reason (R) Every identity matrix is not a scalar matrix.

Vinay wants to construct a rectangular plastic tank for his house that can hold $100\,ft^3$ of water. The top of the tank is open. The width of tank will be 10 ft but the length and heights are variables. Building the tank cost Rs 30 per sq foot for the base and Rs 20 per sq foot for the side.

Based on the above information, answer the following questions.

46. In order to make a least expensive water tank, Vinay need to minimise its 1

a) Volume
b) Base
c) Curved surface area
d) Cost

47. Total cost of tank as a function b can be represented as 1

a) $C(b) = 400b + 100 + \frac{2000}{b}$
b) $C(b) = 400b - 400 + \frac{2000}{b}$
c) $C(b) = 100b + 400 + \frac{2000}{b}$
d) $C(b) = 400b + 400 + \frac{2000}{b}$

48. Range of b is 1

a) (3,5)
b) $(0, \infty)$
c) (0,8)
d) (0,3)

49. Value of b at which C(b) is minimum 1

a) 4
b) $\sqrt{5}$
c) $\sqrt{6}$
d) 6.7

50. The cost of least expensive tank is Rs 1

a) $400(1+2\sqrt{5})$
b) $400(2+\sqrt{5})$
c) $800(1+2\sqrt{5})$
d) $400(1-2\sqrt{5})$

SAMPLE QUESTION PAPER-2 (TERM 1) 2021-22

SUBJECT : MATHEMATICS

CLASS : XII

Time : 90 minutes **Marks : 40**

General Instructions:

1. This question paper contain three section – A,B and C . Each section is compulsory.
2. Section A has 20 MCQs, attempt any 16 out of 20
3. Section B has 20 MCQs, attempt any 16 out of 20
4. Section C has 10 MCQs, attempt any 8 out of 10.
5. There is no negative marking.
6. All question carry equal marks

SECTION A

In this section attempt any 16 questions out of Question 1-20.

Each Question is of 1 mark weightage.

1. If A is a matrix of order m X n and B is a matrix such that AB^t and BA^t are both defined, the order of the matrix B is

a) m × m b) n × n

c) n × m d) m × n

2. The value of $\begin{vmatrix} 0 & a-b & a-c \\ b-a & 0 & b-c \\ c-a & c-b & 0 \end{vmatrix}$ is:

(a) a

(b) b

(c) 0

(d) none of these

3. The value of the expression 2 $\sec^{-1} 2 + \sin^{-1} (1/2)$ is

a) $\frac{\pi}{6}$ b) $\frac{5\pi}{6}$

c) $\frac{7\pi}{6}$ d) 1

4. The function $f(x) = |x| + |x-2|$ is

a) differentiable at x=0 and at x=2

b) differentiable at x=0 but not at x=2

c) not differentiable at x=0 and at x=2

d) none of these

5. $f(x) = x^x$ has a stationary point at

a) x =e

b) x= 1/e

c) x=1

d) x= $\sqrt{e}$

6. If $A^2-A+I=0$, then the inverse of A is

a) A^{-2} b) I-A

c) 0 d) A

7. If the function f:R$\rightarrow$R nad g: R$\Rightarrow$R are defined as

$$f(x) = \begin{cases} 0, x \in \text{rational} \\ x, x \in \text{irrational} \end{cases} \text{ and } g(x) = \begin{cases} x, x \in \text{rational} \\ 0, x \in \text{irrational} \end{cases}$$

a) one-one onto

b) many- one onto

c) one –one but not onto

d) neither one-one nor onto

8. If $A=\begin{bmatrix}0 & 2\\ 3 & -4\end{bmatrix}$ $and\ kA=\begin{bmatrix}0 & 3a\\ 2b & 24\end{bmatrix}$, then find the values of k, a and b

a) -6, -12,-18
b) -6, 4, 9
c) -6, -4 ,-9
d) -6, 12 , 18

9. The values of a for which y = x^2+ax+25 touches x- axis are

a) 0
b) ±10
c) 4, -6
d) ±5

10. If $\cos^{-1}\alpha$ $+\cos^{-1}\beta$ $+\cos^{-1}\gamma = 3\pi$, then $\alpha(\beta+\gamma)+\beta(y+\alpha)+\gamma(\alpha+\beta)$ equals

a) 0
b) 1
c) 6
d) 12

11. If a relation R on the set {1 , 2 , 3}be defined by R ={(1,2)} then R is

a) Reflexive
b) Transitive
c) Symmetric
d) none of these

12. If $u=\sin^{-1}\left(\frac{2x}{1+x^2}\right) and\ \upsilon=\tan^{-1}\left(\frac{2x}{1-x^2}\right) then \frac{du}{dv}$ is

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

13. If A and B are two matrices of the order 3 x m and 3 x n respectively and m=n , then the order of matrix (5A-2B) is

a) m x 3
b) 3 x 3
c) m x n
d) 3 x n

14. If y = x^x find $\frac{d^2y}{dx^2}$

a) $x^x\left\{(1+\log x)^2-\frac{1}{x}\right\}$

b) $x^x\left\{(1+\log x)^2+\frac{1}{x}\right\}$

c) 0

d) $x^x\left\{(1-\log x)^2+\frac{1}{x}\right\}$

15. If A = $\begin{bmatrix}-2 & 0 & 0\\ 0 & -2 & 0\\ 0 & 0 & -2\end{bmatrix}$, then the value of |adj A| is

a) 64
b) 16
c) 0
d) -8

16. Let the f: R→R be defined by f(x)=2x +cosx , then f

a) has a maximum , at x=0

b) has a minimum ,at x=π

c) is an increasing function

d) is a decreasing function

17. If A is a 3 x 3 non-singular matrix such that AA'=A'A and B= $A^{-1}A'$, then BB' is equal to

a) I+B

b) I

c) B^{-1}

d) $(B^{-1})'$

18. If $x^y = y^x$, find dy/dx

a) x log x

b) $\frac{y}{x}\left(\frac{x\log y - y}{y\log x - x}\right)$

c) 0

d) none of these

19 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

20. The least value of the function f(x) =ax+b/x (a>0, b>0, x>0) is

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

c) 0 d) none of these

SECTION B

In this section attempt any 16 questions out of Question 21-40.

Each Question is of 1 mark weightage.

21. Let f: (-1,1)→B , be a function defined by f(x)= $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$,then f is both one-one and onto when B is the interval

a) $[0, \pi/2)$ b) $(0, \pi/2)$

c) $(-\pi/2, \pi/2)$ d) $[-\pi/2, \pi/2]$

22. Find $\frac{d^2y}{dx^2}$, if x= at^2 , y =2at

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

c) $\frac{-1}{2at^2}$ d) 0

23. By graphical method solution of LPP maximize

Z=x+y, $x+y\leq 2$, $x;y\geq 0$ obtained at

a) only one point

b) only two points

c) at infinitely many points

d) none of these

24. If $x=\sqrt{a^{\sin-1t}}, y=\sqrt{a^{\cos-1t}}$, a> 0 and -1 < t < 1 then dy/dx is:

a) y/x b) x/y

c) -y /x d) none of these

25. If $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 2\\ 3 & -1 & 9\end{bmatrix}$, then the value of det (adj (adjA)) equals

a) 11 b) 121

c) 1331 d) 14641

26. If $f(x)=\frac{x}{\sin x}$ *and* $g(x)=\frac{x}{\tan x}$ *where* $0<x\leq 1$, then in the interval

a) both f(x) and g(x) are increasing functions

b) both f(x) and g(x) are decreasing functions

c) f(x) is an increasing function

d) g(x) is an increasing function

27. If $A=\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ then A^{-1} is

a) $\begin{bmatrix} 2 & -3 \\ 5 & 2 \end{bmatrix}$ b) $\begin{bmatrix} -2 & 4 \\ 3 & 5 \end{bmatrix}$

c) $\frac{1}{19}\begin{bmatrix} 3 & -2 \\ 5 & 3 \end{bmatrix}$ d) $\frac{1}{19}A$

28. Simplest form of $\tan^{-1}\left(\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right)$ $\pi < x < 3\pi/2$ is

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

c) $-\frac{x}{2}$ d) $\pi-\frac{x}{2}$

29. A point out of the following points lie in the plane represented by $2x + 3y \leq 12$ is

a) (0,3) b) (3,3)

c) (4,3) d) (0,5)

30. Identity relation R on a set A is

a) Reflexive only b) Symmetric only

c) Transitive only d) Equivalence

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

a) discountinuous at only one point

b) discontinuous at exactly two points

c) discontinuous at exactly three points

d) none of these

32. If $A = \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and A = A^t , then

a) x=0 and y=5
b) x=y
c) x+y=5
d) none of these

33. The graph of the inequality 2x +3y >6 is

a) half plane that contains the origin.
b) half plane that neither contains the origin nor the points of the line 2x+3y=6
c) whole XOY-plane excluding the pointa on the line 2x+3y=6
d) entire XOY-plane

34. The maximum value of $[x(x-1)+1]^{1/3}$, $0 \le x \le 1$ is at

a) $(1/3)^{1/3}$
b) ½
c) 1
d) 0

35. If A and B are aquare matrices of the same order , then the value of (A +B) (A-B) is equal to

a) $A^2 - B^2$
b) $A^2 - BA - AB - B^2$
c) $A^2 - B^2 + BA - AB$
d) $A^2 - BA + B^2 + AB$

36. The value of $\cos^{-1}(2x^2 - 1)$, $0 \le x \le 1$ is equal to

a) $2 \cos^{-1} x$
b) $2 \sin^{-1} x$
c) $\pi - 2 \cos^{-1} x$
d) $\pi + 2 \cos^{-1} x$

37. The angle between the curve $y^2 = x$ and $x^2 = y$ at (1,1) is

a) $\pi/2$
b) $\tan^{-1}(3/4)$
c) $\tan^{-1}(4/3)$
d) $\pi/4$

38. The inverse of the matrix $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$ is

a) $\begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix}$ b) $\begin{bmatrix} \frac{4}{11} & \frac{1}{11} \\ \frac{-3}{11} & \frac{2}{11} \end{bmatrix}$

c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$

39. Let the function f: $R \rightarrow R$ be defined by $f(x) = 2x + \sin x$ for $x \in R$. Then f is

a) one-one but not onto   b) ono but not one –one

c) neither one-one nor onto   d) one-one and onto

40. For the matrix $A = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix}$, find x and y so that $A^2 + xI = yA$

a) (8,8)   b) (-8,0)

c) (-8,-8)   d) none of these

SECTION C

In this section attempt any 8 questions. Each Question is of 1 mark weightage Questions 46-50 are based on a Case study.

41. The maximum value of $Z = x + 3y$ such that $2x + y \leq 20, x + 2y \leq 20$, $x \geq 0,\ y \geq 0$ is

a) 10   b) 30

c) 60   d) 80/3

42. The total revenue received from the sale of x units of a product is given by : $R(x) = 5x^3 - 4x^2$, find the marginal revenue of x=20

a) 5860   b) 5840

c) 5000   d) 5600

43. It is given that at x=1 , the function $f(x) = x^4 - 62x^2 + ax + a$ attains its maximum value , on the interval [0, 2] . The value of a is

a) 20

b) -120

c) 120

d) 52

44. Which of the following statement is true?

a) Every LPP admits an optional selection

b) A LPP admits unique optimal selection

c) If a LPP admits two optimal solutions it has an infinite solution

d) The set of all feasible solutions of a LPP is not a convex set.

45. If x,y $\in$ R , then the determinant $\Delta = \begin{vmatrix} \cos x & -\sin x & 1 \\ \sin x & \cos x & 1 \\ \cos(x+y) & -\sin(x+y) & 0 \end{vmatrix}$

a) $\left[-\sqrt{2}, \sqrt{2}\right]$

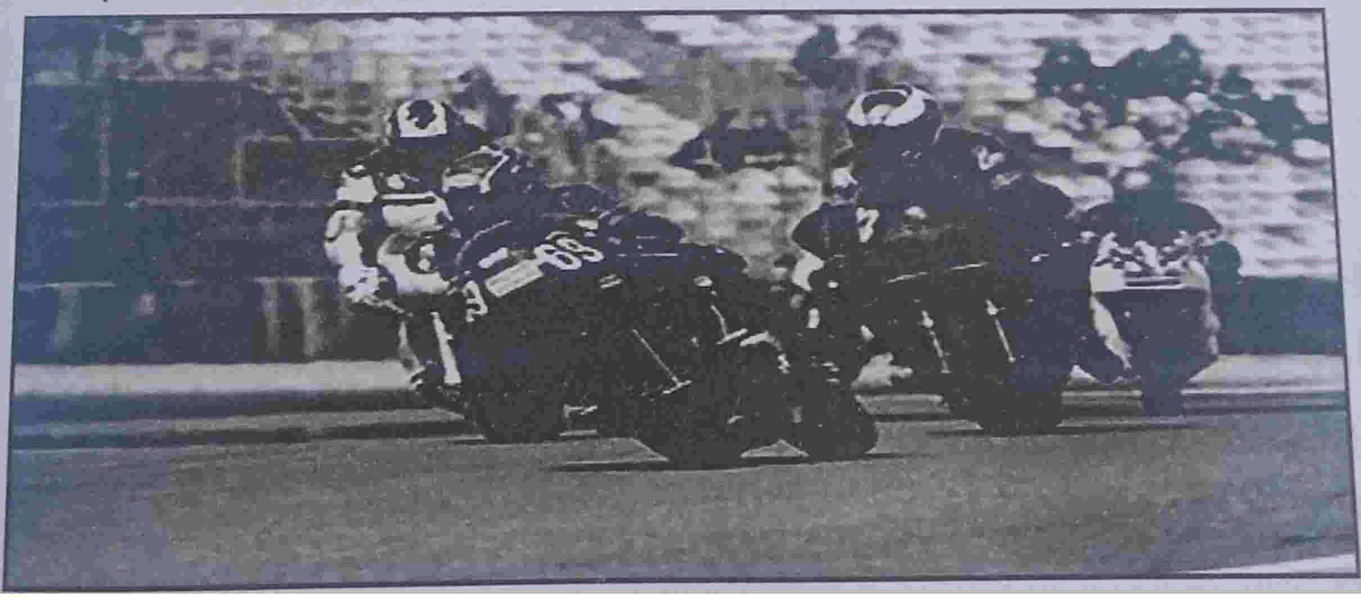
b) [-1 , 1]

c) $\left[-\sqrt{2}, 1\right]$

d) $\left[-1, -\sqrt{2},\right]$

CASE STUDY

An organization conducted bike race under 2 different categories-boys and girls. In all there were 250 participants. Among all of them finally three from category1 and two from category 2 were selected for the final race. Hemant form two sets B and G with these participants for his college project. Let B={b_1, b_2, b_3} and G= {g_1 , g_2}, where B represents set of boys selected and G represent set of girls selected for the final race.



Hemant decided to explore various types of relations and functions for these sets.

Based on the above information answer the following :

46. Hemant wishes to form all the possible relations from B to G . how many such relations are possible?

a) 2^6 b) 2^5

c) 0 d) 2^3

47. let R: B→B be defined by R ={(x,y) : x and y are students of same sex}. Then relation R is

a) Equivalence

b) Reflexive only

c) Reflexive and symmetric but not transitive

d) Reflexive and transitive but not symmetric

48. Hemant want to know among those how many functions can be formed from B to G

a) 2^2 b) 2^{12}

c) 3^2 d) 2^3

49 Let R: B →G be defined by R={(b_1 , g_1) , (b_2 , g_2), (b_3 ,g_1)}, then R is

a) Injective

b) Surjective

c) Neither injective nor Srjective

d) Bijective

50. Hemant wants to find the number of injective functions from B to G. How many such functions are possible?

a) 0 b) 2!

c) 3! d) 0!

SAMPLE QUESTION PAPER-3 (TERM 1) 2021-22

SUBJECT : MATHEMATICS

CLASS : XII

Time : 90 minutes **Marks : 40**

General Instructions:

1. *This question paper contains three sections– A, B and C. Each part is compulsory.*
2. *Section - A has 20 MCQs, attempt any 16 out of 20.*
3. *Section - B has 20 MCQs, attempt any 16 out of 20*
4. *Section - C has 10 MCQs, attempt any 8 out of 10.*
5. *There is no negative marking. 6. All questions carry equal marks.*

SECTION–A

In this section, attempt any 16 questions out of Questions 1 – 20. Each Question is of 1 mark weightage

1 $A=\left[a_{ij}\right]_{mxn}$ is a square matrix, if 1

(A) m<n (B) m>n

(C) m=n (D) None of these

2 Find the values of k so that the function f is continuous at x=π

$$f(x)=\begin{cases} kx+1, \ if\ x\le\pi \\ \cos x, \ if\ x>\pi \end{cases}$$

A) π B) $\frac{-2}{\pi}$

C) $\frac{\pi}{3}$ D) none of these1

3 $\tan^{-1}\sqrt{3}-\sec^{-1}(-2)$ 1

(A) π

(B) $-\frac{\pi}{3}$

C) $\frac{\pi}{3}$

D) $\frac{2\pi}{3}$

4 $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix}=\begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$, then x is equal to 1

(A) 6

(B) ± 6

(C) -6

(D) 0

5 The intervals in which the function f given by

$f(x) = 4x^3 - 6x^2 - 72x + 30$ is increasing: 1

A) $(-\infty,-2)\, and\, (3,\infty)$

B) (2,3) and (3, ∞)

C) $(1,\infty)$

D) none of the above

6 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 Cofactors of a_{ij}, then value of Δ is given by 1

(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) $a_{11}A_{11}+a_{21}A_{21}+a_{31}A_{31}$

7 Let A=$\{1,2,3\}$. Then number of equivalence relations containing (1,2) is 1

(A) 1 (B) 2

(C) 3 (D) 4

8 Find X and Y, if X+Y=$\begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and X-Y=$\begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$ 1

A) $X=\begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix} Y=\begin{bmatrix} 1 & 3 \\ 0 & 5 \end{bmatrix}$ B) $X=\begin{bmatrix} 1 & 4 \\ 0 & 3 \end{bmatrix} Y=\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

C) $X=\begin{bmatrix} 4 & 4 \\ 0 & 4 \end{bmatrix} Y=\begin{bmatrix} 1 & -2 \\ 0 & 5 \end{bmatrix}$ D) None of the above

9 The equation of all lines having slope 2 and being tangent to $y+\frac{2}{x-3}=0$ the curve 1

A) $2y - x + 2 = 0$ and $2y - x + 10 = 0$

B) $y - 2x + 2 = 0$ and $y - 2x + 10 = 0$

C) $3y - x + 12 = 0$ and $3y - x + 10 = 0$

D) none of the above

10 Express $\tan^{-1}\frac{\cos x}{1-\sin x}, \frac{-3\pi}{2} < x < \frac{\pi}{2}$ in the simplest form. 1

A) $\frac{\pi}{4}+\frac{x}{2}$ B) $\frac{\pi}{2}$

C) $\frac{\pi}{4}-\frac{x}{2}$ D) $\frac{\pi}{3}+\frac{x}{2}$

11 Let A be a set containing 10 distinct elements, then the total number of distinct functions from A to A is 1

a) 10! b) 10^{10}

c) 2^{10} d) $2^{10}-1$

12 Find $\frac{dy}{dx}$: $xy + y^2 = \tan x + y$ 1

A) $\frac{\sec^2 x + y}{x+2y-1}$ B) $\frac{\sec^2 x - y}{x+2y-1}$

C) $\frac{\operatorname{cosec} x - 2y}{2y-1}$ D) none of the above

13 Construct a matrix

A = [aij]2×2 whose elements aijare given byaij= $e^{2ix}\sin jx$. 1

A) $\begin{bmatrix} e^x \sin 2x & e^x \sin 2x \\ e^x \sin x & e^{4x} \sin 2x \end{bmatrix}$ B) $\begin{bmatrix} e^{2x} \sin 4x & e^x \sin 2x \\ e^{4x} \sin 4x & e^{4x} \sin 2x \end{bmatrix}$

C) $\begin{bmatrix} e^{2x} \sin x & e^{2x} \sin 2x \\ e^{4x} \sin x & e^{4x} \sin 2x \end{bmatrix}$ D) none of these

14 Differentiate the following w.r.t.x : $\sqrt{e^{\sqrt{x}}}, x > 0$

A) $\frac{e^{\sqrt{x}}}{4\sqrt{xe^{\sqrt{x}}}}, x > 0$ B) $\frac{2e^{\sqrt{x}}}{\sqrt{xe^{\sqrt{x}}}}, x > 0$

C) $\frac{-e^{\sqrt{x}}}{\sqrt{e^{\sqrt{x}}}}, x > 0$ D) none of these

15 The area of a triangle with vertices (-3,0),(3,0) and (0,k) is 9 sq. units. The value of k will be 1

(A) 9 (B) 3

(C) -9 (D) 6

16 The point on the curve $y^2 = x$, where the tangent makes an angle of $\frac{\pi}{4}$ with x-axis is: 1

(A) $\left(\frac{1}{2},\frac{1}{4}\right)$ (B) $\left(\frac{1}{4},\frac{1}{2}\right)$

(C) (4,2) (D) (1,1)

17 If A=$\begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A^{-1} exists if 1

(A) $\lambda = 2$ (B) $\lambda \neq 2$

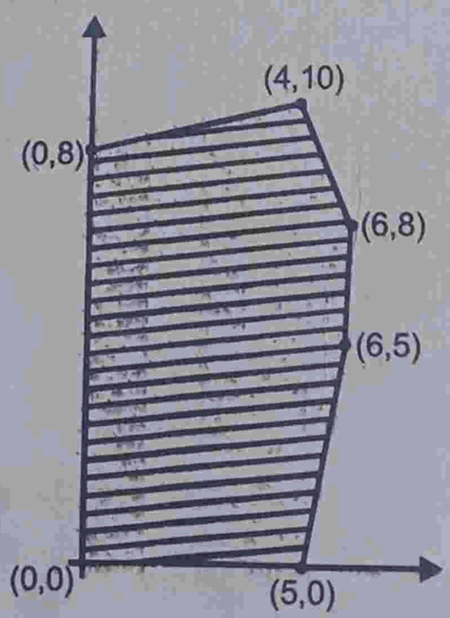
(C) $\lambda \neq -2$ (D) None of these

18 If $e^y(x + 1) = 1$, then $\frac{d^2y}{dx^2} =$ 1

A) $\left(\frac{dy}{dx}\right)$ B) 0

C) $2\left(\frac{dy}{dx}\right)$ D) $\left(\frac{dy}{dx}\right)^2$

19 The feasible solution for a LPP is shown in Figure. Let Z=3x–4y be the objective function. Minimum of Z occurs at: 1



(A) (0, 0)

(B) (0, 8)

(C) (5, 0)

(D) (4, 10)

20 The function $f(x) = 2x^3 - 3x^2 - 12x + 4$, has 1

(A) two points of local maximum

(B) two points of local minimum

(C) one maxima and one minima

(D) no maxima or minima

SECTION – B

In this section, attempt any 16 questions out of Questions 21 – 40. Each Question is of 1 mark weightage

21 If A = {*a*, *b*, *c*, *d*} and *f* = {*a*, *b*), (*b*, *d*), (*c*, *a*), (*d*, *c*)}, then *f* is:1

A) one one and onto from A to A.

B) one one from A to A

C) neither one one nor onto from A to A

D) none of these 1

22 The function given by *f* (*x*) = tan*x* is discontinuous on the set 1

(A) $\{n\pi : n \in Z\}$

(B) $\{2n\pi : n \in Z\}$

(C) $\left\{(2n+1)\frac{\pi}{2} : n \in Z\right\}$

(D) $\left\{\frac{n\pi}{2} : n \in Z\right\}$

23 The corner points of the feasible region determined by the following system o. linear inequalities : 1

$2x + y \leq 10, x + 3y \leq 15, x, y \geq 0\, are\, (0,0), (5,0), (3,4)\, and\, (0,5). Let$
$Z = px + qy, where\ p, q > 0.$

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

24. If $u=\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $v=\tan^{-1}\left(\frac{2x}{1-x^2}\right)$, then $\frac{du}{dv}$ is 1

(A) $\frac{1}{2}$ (B) x

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

25 If $A^3 - 6A^2 + 9A - 4I = O$ and 1

$$A=\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

Then $\mathbf{A}^{-1}$ =

A) $\frac{1}{4}\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ B) $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$

C) $\frac{-1}{4}\begin{bmatrix} 1 & 3 & -1 \\ 1 & 1 & -3 \\ -1 & 1 & 3 \end{bmatrix}$ D) none of these 1

26 At $x=\frac{5\pi}{6}, f(x)=2\sin 3x+3\cos 3x$ is: 1

(A) maximum (B) minimum

(C) Zero (D) neither maximum nor minimum

27 The value of the following is : $\tan^{-1}(1)+\cos^{-1}-\frac{1}{2}+\sin^{-1}\ -\frac{1}{2}$

A) $\frac{-\pi}{4}$ B) $\frac{7\pi}{4}$

C) $\frac{3\pi}{4}$ D) $\frac{7\pi}{12}$ 1

28 If $\begin{bmatrix}2x & 3\end{bmatrix}\begin{bmatrix}1 & 2\\ -3 & 0\end{bmatrix}\begin{bmatrix}x\\ 8\end{bmatrix}$=O, find the value of x. 1

A) x=0,x = $\frac{-23}{2}$ B) x=1,x = $\frac{5}{2}$

C) x=0,x = $\frac{-2}{3}$ D) none of these

29 The interval in which $y=x^2 e^{-x}$ is increasing is 1

A) $(-\infty,\infty)$ B) (-2,0)

C) $(2,\infty)$ D) (0,2)

30 For the set A = {1, 2, 3}, define a relation R in the set A as follows:R = {(1, 1), (2, 2), (3, 3), (1, 3)}. 1

Which of the following ordered pairs should be added to R to make it the smallest equivalence relation:

A) (2,3) B) (3,1)

C) (3,2) D) (1,3)

31 Let f (x)=|cosx|. Then, 1

A) f is everywhere differentiable.

B) f is everywhere continuous but ont differentiable at n=nπ, z∈Z.

C) f is everywhere continuous but not differentiable at $x=(2n+1)\frac{\pi}{2}$, $n \in Z$.

D) None of these.

32 The matrix $\begin{bmatrix} 0 & -5 & 8 \\ 5 & 0 & 12 \\ -8 & -12 & 0 \end{bmatrix}$ is a 1

A) diagonal matrix

B) symmetric matrix

C) skew symmetric matrix

D) scalar matrix

33 Maximize $Z = 11x + 8y$ subject to $x \leq 4$, $y \leq 6$, $x + y \leq 6$, $x \geq 0$, $y \geq 0$. 1

A) 44 at (4, 2)

B) 60 at (4, 2)

C) 62 at (4, 0)

D) none of these

34 Find two positive numbers x and y such that $x + y = 60$ and xy^3 is maximum. 1

A) (20,40)

B) (15,45)

C) (50,10)

D) none of these

35 If A is matrix of order mxn and B is a matrix such that AB' and B'A are both defined, then order of matrix B is 1

A) $m \times m$

B) n × n

C) n × m

D) m × n

36 Find the value of $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$

A) $\frac{2\pi}{6}$ B) $\frac{\pi}{6}$

C) $\frac{\pi}{3}$ D) none of these

37 A relation R in Z given by R={(*a*, *b*):3 divides *a*– *b*} is equivalence. The equivalence class [0] for the given relation R will be: 1

A) {..., – 4, – 1, 2, 5, 8, ...}

B) {..., – 5, – 2, 1, 4, 7, ...}

C) {..., – 6, – 3, 0, 3, 6, ...}

D) none of these

38 If A is a square matrix such that $A^2=1$, then $(A-1)^3+(A+1)^3-7A$ is equal to 1

A) A B) I–A

C) I+A D) 3A

39 The two curves $x^3-3xy^2+2=0$ and $3x^2y-y^3=2$ 1

A) touch each other B) cut at right angle

C) cut at an angle $\frac{\pi}{3}$ D) cut at an angle $\frac{\pi}{4}$

40 Total number of possible matrices of order 3×3 with each entry 2 or 0 is 1

A) 9 B) 27

C) 81 D) 512

SECTION–C

In this section, attempt any 8 questions out of Questions 41–50. Each Question is of 1 mark weightage

41 In a LPP, the linear function which has to be maximized or minimized iscalled a linear __________ function. 1

A) constraints B) feasible

C) objective D) none of these

42 Find a point on the curve $y=(x-2)^2$ at which the tangent is parallel to the chord joining the points (2,0) and (4,4). 1

A) (3,1) B) (1,1)

C) (0,1) D) (2,3)

43 Find absolute maximum value of a function f given by 1

$$f(x) = 12x^{\frac{4}{3}} - 6x^{\frac{1}{3}}, x \in [-1, 1]$$

A) absolute maximum value of f is 3 that occurs at $x = 0$

B) absolute maximum value of f is 18 that occurs at $x = -1$

C) absolute maximum value of f is 20 that occurs at $x = 2$

D) none of these

44 Calculate: $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ 1

A) x^2-2

B) $-x^3-x$

C) $-x^3$

D) none of these

45 If A(3,4), B (–7,2), C(x,y) are collinear, then: 1

(a) $x+5y+17=0$

(b) $x+5y+13=0$

(c) $x-5y+17=0$

(d) none of these

A telephone company in a town has 500 subscribers on its list and collectsfixed charges of Rs 300/- per subscriber per year. The company proposes toincrease the annual subscription and it is believed that for every increase of Re 1/- one subscriber will discontinue the service. Consider that company increases the annual subscription by Rs. x

46 If the company increases the annual subscription by Rs. x, how many subscribers will it loose? 1

A) 1

B) 2x

C) x^2

D) x

47 If the company increases the annual subscription by Rs. x, then calculate the total revenue; 1

A) $R(x) = 150x+100000$

B) $R(x)=-x^2+200x+150000$

C) $R(x) = x^2-20x+15000$

D) none of the above

48 Value of $R'(x)=$ 1

A) $-2x-20$

B) $-2x+200$

C) $-20x+150$

D) none of these

49 Find what increase will bring maximum profit? 1

A) x = 200

B) x = 150

C) x = 100

D) none of these

50 What is the maximum revenue that the company will have? 1

A)160000

B)150000

C)100000

D) none of these

****

MARKING SCHEME

(SAMPLE QUESTION PAPER-I) 2021-2022

CLASS XII

SUBJECT : MATHEMATICS

SECTION-A

1	A	2	D
3	C	4	B
5	D	6	A
7	C	8	A
9	B	10	A
11	B	12	B
13	B	14	B
15	D	16	D
17	C	18	D
19	C	20	B

SECTION-B

21	A	22	C
23	D	24	B
25	A	26	A
27	A	28	B
29	B	30	C
31	C	32	B
33	B	34	C
35	A	36	A

37 C

38 D

39 B

40 A

SECTION-C

41 A

42 B

43 D

44 B

45 C

46 D

47 D

48 B

49 B

50 A

MARKING SCHEME

(SAMPLE QUESTION PAPER-2) 2021-2022

CLASS XII

SUBJECT : MATHEMATICS

1. (d)

Let B is of order k x p

Then the order of B^t is p x k

Therefore, AB^t is defined if n= p

And B^tA is defined if m=k

Therefore (d) is the correct option.

2. (c)

$$\Delta = \begin{vmatrix} 0 & a-b & a-c \\ b-a & 0 & b-c \\ c-a & c-b & 0 \end{vmatrix} = \begin{vmatrix} 0 & a-b & a-c \\ -(a-b) & 0 & b-c \\ -(a-c) & -(b-c) & 0 \end{vmatrix} = 0$$

As $\begin{bmatrix} 0 & a-b & a-c \\ -(a-b) & 0 & b-c \\ -(a-c) & -(b-c) & 0 \end{bmatrix}$ is skew symmetric matrix so its determinant is zero.

3. (b)

$2\sec^{-1} 2 + \sin^{-1}(1/2) = 2\sec^{-1}(\sec(\frac{\pi}{3})) + \sin^{-1}(\sin(\frac{\pi}{6}))$

$$= 2\times\frac{\pi}{3}+\frac{\pi}{6}=\frac{2\pi}{3}+\frac{\pi}{6}=\frac{5\pi}{6}$$

(c)

LHD (at x=0) $\neq$ RHD (at x=0)

Also LHD (at x=2) ≠ RHD (at x=2)

Therefore f(x) = |x|+|x-2| is not differentaiable at x=0 and x=2

5. (b)

$Y=x^x$

Log y = xlogx

$$\frac{1}{y}\frac{dy}{dx} = x\frac{1}{x} + \log x$$

$$\Rightarrow \frac{dy}{dx} = x(1+\log x)x^x$$

$$\because \frac{dy}{dx} = 0 \Rightarrow (1+\log x)x^x = 0$$

$x^x \neq 0$ so lox x= $-1 \Rightarrow$ x= e^{-1} = 1/e

6. (b)

A^2-A+I=0

Multiplying both sides by A^{-1}

$A-I+A^{-1}=0 \Rightarrow A^{-1} = I-A$

7. (a)

f-g:R→R such that (f–g) (x) = $\begin{cases} -x, x \in \textit{rational} \\ x, x \in \textit{irrational} \end{cases}$

it is obvious that each rational number of domain of (f-g)(x) associates to its negative number in its codomain/range and each irrational number of domain of (f-g)(x) associates to same irrational number in its codomain/range.

Therefore, for each x∈ Domain of (f-g)(x), there is only one value in codomain/ range of (f-g)(x). Hence f-g is one-one onto.

8. (c)

$$A=\begin{bmatrix}0 & 2\\3 & -4\end{bmatrix} \text{ and } kA = A=\begin{bmatrix}0 & 3a\\2b & 24\end{bmatrix}$$

$$\Rightarrow\begin{bmatrix}0 & 2k\\3k & -4k\end{bmatrix}=\begin{bmatrix}0 & 3a\\2b & 24\end{bmatrix}$$

Therefore, $-4\ k=24 \Rightarrow k = -6$

$2k = 3a \Rightarrow a = -4$

$3k = 2b \Rightarrow b = -9$

9. (b)

$y = x^2+ax+25$

$dy/dx=2x +a$

the curve touches x axis means $dy/dx = 0$

or $2x+a=0 \Rightarrow x=-a/2$

The co-ordinates of the meeting point are (-a/2,0), therefore it satisfies the curve

$$\Rightarrow\left(\frac{-a}{2}\right)^2+a\left(\frac{-a}{2}\right)+25=0$$

$$\Rightarrow\frac{a2}{4}+a\left(-\frac{a}{2}\right)+25=0$$

$$\Rightarrow -a^2+100=0\Rightarrow a=\pm 10$$

10. (c)

We have, $\cos^{-1}\alpha+\cos^{-1}\beta+\cos^{-1}\gamma=3\pi$

$0\le\cos^{-1}x\le\pi$

$\cos^{-1}\alpha\ +\cos^{-1}\beta\ +\cos^{-1}\gamma=3\pi$

if and only if $\cos^{-1}\alpha = \cos^{-1}\beta = \cos^{-1}\gamma = \pi$

$\cos\ \pi = \alpha = \beta = \gamma \quad \Rightarrow\ -1 = \alpha = \beta = \gamma \quad$ or $\quad \alpha = \beta = \gamma = -1$

$\alpha(\beta+\gamma)+\beta(\gamma+\alpha)+\gamma(\alpha+\beta) = -1(-1-1)-1(-1-1)-1\ (-1-1) = 2+2+2 = 6$

11. (b)

R={(1,2)}, A{1,2,3}

Clearly R is neither reflexive nor symmetric.

As $(1,2) \in R$, but $\nexists\ (2,b) \in R$ for $b \in A$ such that $(1,b) \notin R$

Hence R is transitive relation on A

12. (d)

$$u = \sin^{-1}\left(\frac{2x}{1+x^2}\right) = 2\tan^{-1}x \Rightarrow \frac{du}{dx} = \frac{2}{1+x^2}$$

and $v = \tan^{-1}\left(\frac{2x}{1-x^2}\right) = 2\tan^{-1}x \Rightarrow \frac{du}{dx} = \frac{2}{1+x^2}$

$$\therefore \frac{dy}{dx} = \frac{du/dx}{dv/dx} = 1$$

13. (d)

A_{3xm} and B_{3xn} are two matrices. If m=n, then A and B as 3xn each, so the order of 5A-2B should be same as 3 x n

14. (b)

$y = x^x = e^{x\ \log x}$

$$\therefore \frac{dy}{dx} = e^{x\log x}(1+\log x)$$

$$\frac{d^2y}{dx^2} = e^{x\log x}\left(\frac{1}{x}\right) + (1+\log x)e^{x\log x}(1+\log x)$$

$$= x^x\left(\frac{1}{x}\right) + x^x(1+\log x)^2 \quad \{\text{since } x^x = e^{x\log x}\}$$

15. (a)

$$A = \begin{bmatrix} -2 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -2 \end{bmatrix} \Rightarrow |A| = -2((-2)(-2)-0)$$

$$\Rightarrow |A| = -8$$

$$\Rightarrow |\text{adj}A| = |A|^{n-1} = (-8)^2 = 64$$

16. (c)

f(x)=2x+cosx

df/dx=2–sinx>0 for all $x \in R$

hence f is increasing

17. (b)

AA'=A'A and B= $A^{-1}A'$

BB'=$(A^{-1}A')(A^{-1}A')' = A^{-1}A'(A')'(A^{-1})' = A^{-1}A'A(A^{-1})' = I$

18. (b)

$x^y = y^x \Rightarrow y\log x = x \log y$

$$\frac{dy}{dx}\log x + \frac{y}{x} = \log y + \frac{x}{y}\frac{dy}{dx}$$

$$\frac{dy}{dx} = \frac{y}{x}\left\{\frac{x\log y - y}{y\log x - x}\right\}$$

19. (b)

Given Z = 3x -4y

Putting corner points, we have $Z_{min} = -32$ at (0,8)

20. (b)

21. (c)

22. (a)

$x = at^2 \quad \Rightarrow \frac{dx}{dt} = 2at,$

$y = 2at \quad \Rightarrow \frac{dy}{at} = 2a$

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{1}{t}$$

$$\frac{d^2y}{dx^2} = -\frac{1}{t^2} \times \frac{dt}{dx} = -\frac{1}{2at^3}$$

23. (c)

24. (c)

$$x = \sqrt{a^{\sin^{-1}t}} \Rightarrow \log x = \frac{1}{2}\sin^{-1} x \log a$$

$$\frac{1}{x}\frac{dx}{dt} = \frac{1}{2}\log a \frac{1}{\sqrt{1-t^2}}$$

$$\frac{dx}{dt} = \frac{x}{2}\log a \times \frac{1}{\sqrt{1-t^2}}$$

$$\frac{dy}{dx} = \frac{y}{2}\log a \times \frac{(-1)}{\sqrt{1-t^2}}$$

$$\frac{dy}{dx} = -\frac{y}{x}$$

25 (d)

Adj(adjA) $=|A|^{n-2}$ A where n is the order of matrix.

Therefore det (adj (adjA))= |adj(adjA)| = $|A|^{n-2}$ A|

$=|A|^4=11^4=14641|$

26. (c) $f'(x) = \frac{\sin x - x\cos x}{\sin^2 x}$ and $g'(x) = \frac{\tan x - x\sec^2 x}{\tan^2 x}$

As $\frac{d(\sin x - x\cos x)}{dx}$ = cosx + x sinx − cosx = x sinx > 0 for $0 \le x \le 1$

Therefore sinx − x cosx is an increasing function.

But at x = 0 x sinx − x cosx > 0 therefore f'(x) > 0 for 0< x ≤1

So f (x) is increasing function in the interval 0 < x ≤ 1

$$\frac{d(\tan x - x\sec^2 x)}{dx} = -2x\sec^2 x\tan x < 0 \text{ for } 0 \le x \le 1$$

Therefore g(x) is decreasing in 0 < x ≤ 1

27. (d) $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}, \text{adj} A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$

| A | = − 19

$$A^{-1} = \frac{\text{adj}(A)}{|A|} \frac{1}{19} A$$

28. (a) $\tan^{-1}\left(\dfrac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right)=\tan^{-1}\left(\tan\left(\dfrac{\pi}{4}-\dfrac{x}{2}\right)\right)=\dfrac{\pi}{4}-\dfrac{x}{2}$

29. (A) (0, 3) satisfy the equation $2x+3y\leq 12$

$2\times 0+3\times 3\leq 12$ or $9\leq 12$

30. (d)

31. (c) $f(x)=\dfrac{4-x^2}{4x-x^3}$

f (x) is discontinuous where $4x - x^3 = 0 \Rightarrow x = 0, 2, -2$ there are three points of discountinuity

32. (b)

$A = A^t \Rightarrow \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix} = \begin{bmatrix} 5 & y \\ x & 0 \end{bmatrix} \Rightarrow x = y$

33. (b)

Check $2x + 3x > 6$ for (0, 0)

$2 \times 0 + 3 \times 0 > 6$ or $0 > 6$ is not true

34. (b)

35. (c) $(A + B)(A - B) = A(A-B) + B(A-B) = A^2+AB+BA-B^2$

36. (a) $\cos^{-1}(2x^2 - 1)$

Put $x=\cos\alpha \Rightarrow \alpha=\cos^{-1}x$

Therefore,

$\cos^{-1}(2x^2-1)=\cos^{-1}(2\cos^2\alpha-1)\cos^{-1}\cos 2\alpha=2\alpha=2\cos^{-1}x$

28. (a) $\tan^{-1}\left(\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right)=\tan^{-1}(\tan\left(\frac{\pi}{4}-\frac{x}{2}\right)=\frac{\pi}{4}-\frac{x}{2}$

29. (A) (0, 3) satisfy the equation $2x+3y\leq 12$

$2\times 0+3\times 3\leq 12$ or $9\leq 12$

30. (d)

31. (c) $f(x)=\frac{4-x^2}{4x-x^3}$

f (x) is discontinuous where $4x - x^3 = 0 \Rightarrow x = 0, 2, -2$ there are three points of discountinuity

32. (b)

$A = A^t \Rightarrow \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix} = \begin{bmatrix} 5 & y \\ x & 0 \end{bmatrix} \Rightarrow x = y$

33. (b)

Check 2x + 3x > 6 for (0, 0)

2 × 0 + 3 × 0 > 6 or 0 > 6 is not true

34. (b)

35. (c) (A + B) (A – B) = A (A–B) + B (A–B) = $A^2+AB+BA-B^2$

36. (a). $\cos^{-1}(2x^2-1)$

Put $x=\cos\alpha \Rightarrow \alpha=\cos^{-1}x$

Therefore,

$\cos^{-1}(2x^2-1)=\cos^{-1}(2\cos^2\alpha-1)\cos^{-1}\cos 2\alpha=2\alpha=2\cos^{-1}x$

37. (b)

38. (b) | A | = 11

$$\text{Adj } A = \begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix} \text{ so inverse of } A = \begin{bmatrix} \frac{4}{11} & \frac{1}{11} \\ -\frac{3}{11} & \frac{2}{11} \end{bmatrix}$$

39. (d)

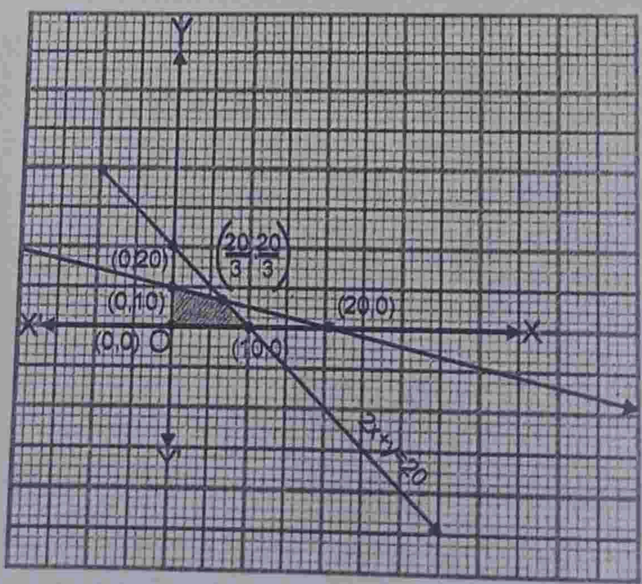
40. (a) $A=\begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix}, A^2 = \begin{bmatrix} 16 & 8 \\ 56 & 32 \end{bmatrix}$, $A^2 + xI = yA$

$$\begin{bmatrix} 16+x & 8 \\ 56 & 32-x \end{bmatrix} = \begin{bmatrix} 3y & y \\ 7y & 5y \end{bmatrix}$$

So, we have y = 8; 16 + x = 3y, > x = 8

41. (b)

Feasible region is shaded region which is shown in the figure with corner points (0, 0), (10, 0), (20/3), 20/3) and (10, 10)



Z (0, 0) = 0

Z (20/3, 20/3) 80/3

Z (0, 10) = 30,

Therefore, Max Z = 30 is obtained at (10, 0)

42. (b)

43. (c) $F'(x) = 4x^3 - 124x + a$

A function attains maximum at $x = 1 \in (0, 2)$

$F'(1) = 0$

So we have a = 120

44. (c)

45. (a)

Case Study

We have $B = \{b_1, b_2, b_3\}$ and $G = \{g_1, g_2\}$ .n(B)=3 and n(G) = 2

46. (a)

Number of all the possible relations from B to G = $2^{3\times3} = 2^6$.

47. (a)

R = {(x, y) : x and y are students of same sex} on set B.

$B = \{b_1, b_2, b_3\}$, all boys. Therefore R is an equivalence relation

48. (d) .n (B) = 3 and n (G) = 2

Total number of functions from B to G = 2^3.

49. (b) $R : B \to G$ be defined by $R = \{b_1, g_1), (b_2, g_2), (b_3, g_1)\}$

It is not injective because b_1 and b_3 have same image g_1.

It is surjective because its Co-domain-Range

50. (a) Because R is not injective, so number or injective functions =0

MARKING SCHEME

(SAMPLE QUESTION PAPER-3) 2021-2022

CLASS XII

SUBJECT : MATHEMATICS

MARKING SCHEME

SL.NO.	ANSWER	MARKS
	SECTION-A	
1	C	1
2	B $-\frac{2}{\pi}$	1
3	B	1
4	B	1
5	A	1
6	D	1
7	B	1
8	C	1
9	B	1
10	A	1
11	B	1
12	B	1
13	C	1
14	A	1

15	B	1
16	B	1
17	D	1
18	D	1
19	B	1
20	C	1

SECTION-B

21	A	1
22	C	1
23	D	1
24	D	1
25	A	1
26	D	1
27	C	1
28	A	1
29	D	1
30	B	1
31	C	1
32	C	1
33	B	1
34	B	1
35	C	1

36	B	1
37	C	1
38	A	1
39	B	1
40	D	1

SECTION-C

41	C	1
42	A	1
43	B	1
44	C	1
45	C	1
46	D	1
47	B	1
48	B	1
49	C	1
50	A	1