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# Grade: 12 Term- I Date : 10.10.2022

# Marks: 80 MATHEMATICS Time : 3 hrs

**General Instructions:**

 1. This question paper contains two parts A and B. Each part is compulsory. Part A carries 24 marks and Part B carries 56 marks

2. Part-A has Objective Type Questions and Part -B has Descriptive Type

Questions

3. Both Part A and Part B have choices.

**Part – A:**

1. It consists of two sections- I and II.

 2. Section I comprises of 16 very short answer type questions.

 3. Section II contains 2 case studies. Each case study comprises of 4 case-based MCQs.

**Part – B:**

1. It consists of three sections- III, IV and V.

2. Section III comprises of 10 questions of 2 marks each.

3. Section IV comprises of 7 questions of 3 marks each.

4. Section V comprises of 3 questions of 5 marks each.

**PART A**

**Section I**

1. A relation R in 𝑆 = {1,2,3} is defined as 𝑅 = {(1, 1), (1, 2), (2, 2), (3, 3)}. Which element(s) of relation R be removed to make R an equivalence relation?

2. If A and B are matrices of order 3 × 𝑛 and 𝑚 × 5 respectively, then find the order of matrix 5A – 3B, given that it is defined.

3. Find the value of , where A is a 2×2 matrix whose elements are given by

𝑎𝑖𝑗 = $\left\{\begin{array}{c}1 if i\ne j\\0 if i=j\end{array}\right.$

**OR**

Given that A is a square matrix of order 3×3 and |A| = - 4. Find |adj A|

4. Using principal values, evaluate sin-1 sin (5)+ cos-1 cos(5)

5. Find order of the resultant matrix for : $\left(\begin{matrix}1&2\\0&1\end{matrix}\right)\left(\begin{matrix}0&0&1\\0&-1&5\end{matrix}\right)$

6. If M = $\left(\begin{matrix}1&3\\2&-1\end{matrix}\right)$ and B = $\left(\begin{matrix}1&3\\-1&1\end{matrix}\right)$ , write the value of |BM|

7. Write the value of expression tan $\left(\frac{sin^{-1}x+cos^{-1}x}{2}\right) when x= \frac{\sqrt{3}}{2}$

8. f(x) = ex is a strictly \_\_\_\_\_\_\_ function , for all values of x.

9. Find the second derivative of x cosx

10. Find the rate of change of the area of a circle ( in terms of $π$) with respect to its radius r when r =3cm.

11. Find the value of y if sin-1x = y , then

a) 0$\leq y\leq π$ b) $\frac{-π}{2}\leq y\leq \frac{π}{2}$ c) 0<y<$ π$ d) $\frac{-π}{2}<y<\frac{π}{2}$

12. Determine the principal value of cos-1 ( -1/2).

13. Show that the function f(x)=cos2x is a decreasing function on (0,$\frac{π}{2}$ )

14. Find $\frac{dx}{dθ}$ if x= cos2 $θ$ + sin2 $θ$

15. If $\left|\begin{matrix}3x&7\\-2&4\end{matrix}\right|$ = $\left|\begin{matrix}8&7\\6&4\end{matrix}\right|$ , then find the value of x.

16. **Assertion and Reasoning MCQs**

The following question has four alternative choices, any one of which is the correct answer. You have to select one the codes (a), (b), (c) , (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.

Assertion (A) Let a relation R defined from set B to B such that B= { 1,2,3,4} and R = { (,1) , (2,2) , (3,3) , (1,3) , (3,1) } , then R is transitive.

Reason( R ) A relation R in set A is called transitive , if (a,b)$\in $ R and (b,c) $\in $ R $\rightarrow $ (a,c)$ \in $ R, for all a,b,c$\in $A.

**Case study**

17. The relation between the height of the plant ( y in cm) with respect to exposure to sunlight if governed by the following equation y = 4x- $\frac{1}{2}$x2 where x is the number of days exposed to sunlight.

i) The rate of growth of the plant with respect to sunlight is

a) 4x - $\frac{1}{2}$x2 b) 4-x c) x-4 d) x- $\frac{1}{2}$x2

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) 12cm b) 10cm c) 8cm d) 6cm

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

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

18. Students of grade 12 , planned to plant saplings along straight lines , parallel to each other to one side of the playground ensuring that they had enough play area. Let us assume that they planted one of the rows of the saplings along the line y = x-4. Let L be the set of all lines which are parallel on the ground and R be a relation on L .

i) Let relation R be defined by R = { (L1 , L2) : L1 is parallel to L2 where L1 , L2$ϵ$L } then R is \_\_\_\_ relation

a) equivalence b) only reflexive c) not reflexive d)symmetric but not transitive

ii) Let R = { (L1 , L2) : L1 is perpendicular to L2 where L1 , L2$ϵ$L } which of the following is true ?

a) R is symmetric but neither reflexive nor transitive

b) R is reflexive and transitive but not symmetric

c) R is reflexive but neither symmetric not transitive

d) R is an equivalence relation

iii) The function f: R $\rightarrow $R defined by f(x) = x-4. Then the range of f(X) is

a) R b) Z c) W d) Q

iv) Let R = { (L1 , L2) : L1 is parallel to L2 and L1 : y = x- 4 } then which of

 the following can be taken as L2?

a) 2x-2y+5=0 b) 2x+y=5 c) 2x+2y+7=0 d) x+y=7

**Part B**

**Section III**

19. Find the inverse of A = $\left[\begin{matrix}1&-1\\0&2\end{matrix}\right]$, also find the value of AA-1

20. If y = xsinx , find $\frac{dy}{dx}$ .

21. If 3tan-1x = $π$ and cot-1y = $\frac{π}{4}$, find the value of (x+y)2

22. The volume of a cube is increasing at the rate of 8 cm3 /s. How fast is the surface area increasing when the length of its edge is 12 cm?

**(or)**

Show that the function f(x) =tan-1( sinx+cosx) is strictly decreasing for x $ϵ$ ( $\frac{π}{4},\frac{π}{2}$)

23. Find the matrix A , such that $\left[\begin{matrix}2&-1\\1&0\\-3&4\end{matrix}\right]X A=\left[\begin{matrix}-1&-8\\1&-2\\9&22\end{matrix}\right] $

24. Find the value of tan-1($\sqrt{3}$ ) – sec-1( -2)

25. Let N be the set of all natural numbers and let R be a relation in N , defined by R = { (a,b) : a is a multiple of b}. Show that R is reflexive and transitive but not symmetric.

26. Determine the approximate variation in the surface area of a cube of side x meters caused by decreasing the side by 1%

27. Show that the function f(x) = $\left\{ \begin{array}{c}\frac{sinx}{x}+cosx if x\ne 0\\2 if x=0 \end{array}\right.$ is continuous at x=0.

28. Find the derivative of (x2+y2)2 = xy with respect to x

**Section IV**

29. For the matrix A = $\left[\begin{matrix}1&3\\-5&7\end{matrix}\right]$ , prove that A(adj A) =|A| I2. Can you conclude a relation between Det(A) and Det(adjA), here ?

30. If y = cos-1x , find $\frac{d^{2}y}{dx^{2}}$ in terms of y alone.

31. Find the inverse of matrix $\left[\begin{matrix}1&0&0\\0&cosα&sinα\\0&sinα&-cosα\end{matrix}\right]$ ( if exist)

32. If y= tan x + sec x , then show that $\frac{d^{2}y}{dx^{2}}$=$\frac{cosx}{\left(1-sinx\right)^{2}}$

33. Find the value of tan-1(1) +cos-1($\frac{-1}{2})$+sin-1($\frac{-1}{2})$

**(or)**

 Find the local maximum and local minimum values of f(x) =x5-5x4+5x3-1

34. Find the points of absolute maximum and minimum of f(x) = (x-1$)^{\frac{1}{3}}$ (x-2) ,

 1$\leq x\leq 9$

35. If y = log( 1+2t2+t4) and x = tan-1t , find $\frac{d^{2}y}{dx^{2}}$ in terms of x only.

**Section V**

36. a) If A = $\left[\begin{matrix}2&-3&5\\3&2&-4\\1&1&-2\end{matrix}\right]$, then find A-1. Hence , using A-1,solve the system of equations 2x-3y+5z=11, 3x+2y-4z=-5 and x+y-2z=-3.

**(or)**

b) If the sum of the lengths of the hypotenuse and a side of a right triangle is given, then show that the area of the triangle is maximum, when the angle between them is $\frac{π}{3}$

37. a)If x= sint and y = sinpt, then prove that (1-x2)$ \frac{d^{2}y}{dx^{2}}$ - x$\frac{dy}{dx}$+p2y=0.

**(or)**

b) If y = cos(mcos-1x) , prove that (1-x2)$ \frac{d^{2}y}{dx^{2}}$ - x $\frac{dy}{dx}$+m2y =0.

38. a) A cuboidal shaped godown with square base is to be constructed. Three times as much cost per square meter is incurred for constructing the roof as compared to the walls. Find the dimensions of the godown if it is to enclose a given volume and minimize the cost of constructing the roof and walls.

**(or)**

b) Find the value of k for which the given function f(x) is continuous at x= 0,

f(x) = $\left\{\begin{array}{c}\frac{2-2cos2x}{x^{2}} if x<0\\k if x=0\\\frac{\sqrt{x}}{\sqrt{4+\sqrt{x}-2}} if x>0 \end{array}\right.$