041/1/6 **16-NOV-2021**

PREBOARD EXAMINATION (2021-22)
TERM I -SET A

Subject: MATHEMATICS **Max. Marks: 40**
Grade: 12 **Time: 90 minutes**
Name: **Section:** **Roll No:**

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

25 M

1. $Let\ f : R \to R\ defined\ as\ f(x) = 3x, choose\ the\ correct\ answer$

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

2. Objective function of an LPP is

a. A constraint
b A function to be optimized
c. A relation between the variables
d. None of these

3. Which of the following is the principal value branch of cos $^{-1}$ x

a. $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$
b. $\left[0, \frac{\pi}{2}\right]$
c. $[0, \pi]$
d. $(0, \pi) - \left\{\frac{\pi}{2}\right\}$

4. $If \begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}\ then\ the\ value\ of\ x\ and\ y$

a. x =3, y =1
b. x = 2 , y = 3
c. x = 2 , y = 4
d. x = 3 , y = 3

5. Let R be the relation defined on the set of N natural numbers by the rule xRy iff x + 2y = 8 , then the domain of R is

a. {2,4,8}
b. {2,4,6}
c. { 2,4,6,8}
d. { 1,2,3,4}

6. $What\ is\ the\ value\ of\ Sec^2 (tan^{-1}2)$

a. 1
b. 4
c. 5
d. 3

7. Which of the following is true for the function f (x) = 9x – 5

a. f(x) is strictly increasing on R
b. f(x) is strictly decreasing on R
c. Both(a)and (b) are false
d. f (x) is decreasing on R

8. If A = $\begin{bmatrix} 1 & 2 \\ 4 & 1 \\ 5 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 2 \\ 6 & 4 \\ 7 & 3 \end{bmatrix}$, then $(A-B)^T$

a. $\begin{bmatrix} 0 & 0 \\ -2 & -3 \\ -2 & 3 \end{bmatrix}$
b. $\begin{bmatrix} 0 & -2 & -2 \\ 0 & -3 & 3 \end{bmatrix}$
c. $\begin{bmatrix} -2 & 3 & -3 \\ 0 & 0 & 2 \end{bmatrix}$
d. None of these

9 $Consider\ the\ matriices\ A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & -2 & 1 \\ -1 & 0 & 1 \end{bmatrix}\ and\ B = \begin{bmatrix} 1 & -2 \\ 2 & 1 \\ 4 & 3 \end{bmatrix}$

$and\ C = [1 \quad 2 \quad 6]\ then\ which\ of\ the\ following\ is\ not\ defined$

a. CA
b. BA
c. AB
d. CB

10. $If \begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0, then\ the\ value\ of\ x$

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

11. $f(x) = x + |x|$ is continuous for

a. $x \in (-\infty, \infty)$
b. $x \in (-\infty, \infty) - \{0\}$
c. Only x > 0
d. No value of x

12. If $\Delta = \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix}$, then the minor M_{31} is

a. -c($a^2 - b^2$)
b. c($b^2 - a^2$)
c. c($b^2 + a^2$)
d. c($a^2 - b^2$)

13. $For\ the\ curve\ \sqrt{x} + \sqrt{y} = 1\ find\ ,\frac{dy}{dx}\ at\ \left(\frac{1}{4}, \frac{1}{4}\right)$

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

14. $The\ function\ f: Z \to Z\ defined\ by\ f\ (x) = x^2$

a. Neither injective nor surjective
b. Injective
c. Surjective
d. Bijective

15. $If\ y = log\ (cos\ e^x) then \frac{dy}{dx} is$

a. $\cos e^{x-1}$
b. $e^{-x} \cos e^x$
c. $e^x \sin e^x$
d. $-e^x tane^x$

16 The corner points of the feasible region of a LPP are (0,0), (0, 8) ,(0,8) ,(2, 7) , (5,4) and (6, 0) The maximum profit Z = 3x + 2y occurs at the point

a. (0,8) b. (2, 7)

c. (5, 4) d. (6, 0)

17 Derivative of $\sqrt{\tan\sqrt{x}}$ with respect to x is

a. $\frac{sec^2\sqrt{x}}{4\sqrt{xtan\sqrt{x}}}$ b. $\frac{sec^2\sqrt{x}}{2\sqrt{xtan\sqrt{x}}}$

c. $\frac{secx}{4\sqrt{xtan\sqrt{x}}}$ d. None of these

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

a. $2\sqrt{ab}$ b. $\sqrt{ab}$

c. $\sqrt{\frac{a}{b}}$ d. $2\sqrt{\frac{a}{b}}$

19 The absolute maximum value of a function f given by

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

a. 18 b. 16

c. 14 d. 12

20 The tangent to the curve $y = e^{2x}$ at the point (0,1) meets x- axis at

a. (0,1) b. (- 1/ 2 , 0)

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

Section B

In this section, attempt any 16 questions out of the questions 21 – 40.

Each Question is of 1 mark weightage

21 Let N be the set of natural numbers and the function $f: N \to N$ be defined by f (x) = 2x + 3 $for\ evry\ x \in N. Then\ f\ is$

a. Surjective b. Injective

c. Bijective d. None of these

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

a. -1 b. 0

c. 1 d. 2

23 $If\ y = sin^{-1}x + sin^{-1}\sqrt{1-x^2},\ x < 1\ then$ $\frac{dy}{dx} =$

a. 0 b. 1

c. 2 d. 3

24 $Find\ x\ if\ A = \begin{bmatrix} 1 & 2 & x \\ 1 & 1 & 1 \\ 2 & 1 & -1 \end{bmatrix} is\ singular$

a. 1 b. 2

c. 3 d. 4

25 Which of the following is correct for the function f (x) = $x^3\ sin\ x$

a. It has local maximum at x= 0 b. It has local minimum at x = 0

c. It is neither maximum nor minimum at x = 0 d. It has maximum value as 1

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

a. 90° b. $tan^{-1}\frac{3}{4}$

c. $tan^{-1}\frac{4}{3}$ d. 45°

27 The equation of normal to the curve $3x^2 - y^2 = 8$ which is parallel to the line x + 3y = 8 , is

a. 3x-y = 8 b. 3x+y + 8 =0

c. $3x + 3y \pm 8 = 0$ d. x + 3y = 0

28 It is given that at x = 1 the function $f(x) = x^4 - 62x^2 + ax + 9$ attains its maximum value , on the interval [0, 2]..Find the value of a

a. 20 b. -120

c. 120 d 52

29 The normal to the curve $x^2 = 4y$ passing (1,2) is

a. x +y = 3 b. x-y =3

c. x + y =1 d. x-y = 1

30 The greatest integer function $f: R \to R$ is given by f (x) = [x] where [x] denotes the greatest integer less than or equal to x

a. One-one b. Onto

c. Both one -one and onto d. Neither one-one nor onto

31 $Find\ the\ value\ of\ \text{Sin}\left[\frac{\pi}{3} - sin^{-1}\left(\frac{-1}{2}\right)\right]$

a. 1/2 b. 1/3

c. 1/4 d 1

32 If $f(x) = \begin{cases} \text{mx} + 1\text{ }, for\ x < \frac{\pi}{2} \\ \text{sinx} + \text{n}, for\ \ x > \frac{\pi}{2} \end{cases}$

is continues at x = $\frac{\pi}{2}$ then

a. m=1, n=0 b. m =$\frac{n\pi}{2} + 1$

c. $n = \frac{m\pi}{2}$ d. $m = n = \frac{\pi}{2}$

33 $If\ A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}\ then\ det\ (adjA) =$

a. a^{27} b. a^9

c. a^6 d. a^2

34 $Derivative\ of\ \cot^{-1}\left[\frac{\sqrt{1+\text{sinx}}+\sqrt{1-sinx}}{\sqrt{1+\text{sinx}}-\sqrt{1-sinx}}\right], 0 < x < \frac{\pi}{2}$

a. 1/2 b. 1

c. 2 d. None of these

35 Differentiate $\frac{x^3}{1-x^3}$ with respect to x^3

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

c. $\frac{1}{(1-x^3)^2}$ d $\frac{1}{(1-x^3)^3}$

36 $If\ f\ x)\ =\ x^x\ then\ find\ the\ value\ of\ \frac{d^2y}{dx^2}$

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

c. 0 d. $x^x\left\{(1-\ logx)^2-\frac{1}{x}\right\}$

37 If A and B are two matrices such that AB = B and BA =A, then $A^2+B^2=$

a. 2BA b. 2AB

c. A+B d. AB

38 If A is a square matrix , then which of the following matrices is not symmetric

a. A + A' b. AA'

c. $A'A$ d. $A-A'$

39 If $\alpha=\tan^{-1}\left\{\tan\left(\frac{5\pi}{4}\right)\right\}$ and $\beta=\ \tan^{-1}\left\{-\tan\left(\frac{2\pi}{3}\right)\right\}$ then

a. $4\alpha=\ 3\beta$ b. $3\alpha=\ 4\beta$

c. $\alpha=\ \beta$ d. None of these

40 The value of $\sin^{-1}\left[-\left(\frac{1}{2}\right)\right]+\cos^{-1}\left[-\left(\frac{1}{2}\right)\right]+\cot^{-1}(-\sqrt{3})+\operatorname{cosec}^{-1}(\sqrt{2})+\tan^{-1}(-1)$

a. $\frac{5\pi}{3}$ b. $\frac{4\pi}{3}$

c. $\frac{\pi}{3}$ d. $\frac{-4\pi}{3}$

Section C

In this section, attempt any 8 questions out of the questions.

Each Question is of 1 mark weightage.

Questions 46- 50 are based on case study

41 Find the non zero values of x, satisfying the matrix eqaution

$$x\begin{bmatrix}2x & 2\\ 3 & x\end{bmatrix}+2\begin{bmatrix}8 & 5x\\ 4 & 4x\end{bmatrix}=2\begin{bmatrix}x^2+8 & 24\\ 10 & 6x\end{bmatrix}$$

a. x = 2 b. x = 4

c. x = 7 d. None of these

42 $The\ function\ f\ (x)\ =\ \frac{4-\ x^2}{4x-\ x^3} is$

a. Discontinuous at only one point

b. Discontinuous at exactly two points

c. Discontinuous at exactly three points

d. None of these

43 $The\ value\ of\ tan\ \left[\frac{1}{2}\ cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right]$

a. $\frac{3+\sqrt{5}}{2}$

b. $\frac{3-\sqrt{5}}{2}$

c. $\frac{-3+\sqrt{5}}{2}$

d. $\frac{-3-\sqrt{5}}{2}$

44 

The feasible region for an LPP is shown in the figure. Then the maximum value of Z = 0.7x + y

a. 45

b. 40

c. 50

d. 41

45 Which of the following is an equivalence relation

a. R = { (a,b); 2 divides a-b, a, b belongs to Z}

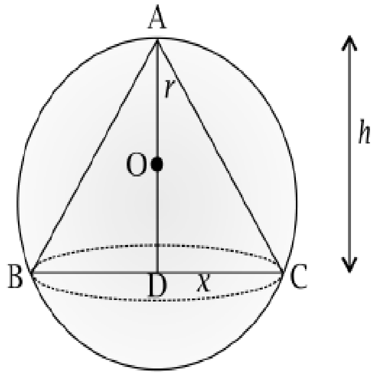
b. $R\ =\ \{(a,b): a \leq b, where\ a, b \in \boldsymbol{R}\}$

c. R = { (x,y) : y = x+5 and x <4, x, y belongs to N }

d. $R\ =\ \{(a,b): 3a - b\ =\ 0\ \}$
Where R is defined on the set {1,2,3,…14}

Case Study

Ram is stunt driver. He is showing stunt by driving in a globe of metallic sphere .One day he planned to install a metallic conical shape inside the metallic sphere .He was thinking about a right circular cone of maximum volume that can be inscribed in a sphere of radius r. Based on the above information answer the following questions



46 What is the volume of the cone V

a. $\frac{1}{3}\pi(-h^3 + 2h^2r)$
b. $\frac{1}{2}\pi(-h^3 + 2h^2r)$
c. $\frac{1}{4}\pi(-h^3 + 2h^2r)$
d. $\frac{1}{5}\pi(-h^3 + 2h^2r)$

47 $Find\ \frac{dv}{dh}$

a. $\frac{1}{2}\pi(-3h^2 + 4hr)$
b. $\frac{1}{5}\pi(-3h^2 + 4hr)$
c. $\frac{1}{4}\pi(-3h^2 + 4hr)$
d. $\frac{1}{3}\pi(-3h^2 + 4hr)$

48 What is the value of h for which the volume is maximum

a. $\frac{3r}{r}$
b. $\frac{4r}{3}$
c. $\frac{r}{3}$
d. None of these

49 $What\ is\ the\ value\ of\ \frac{d^2v}{dh^2} in\ terms\ of\ r$

a. $\frac{-4\pi r^2}{3}$
b. $\frac{-4\pi r^3}{3}$
c. $\frac{-4\pi r}{3}$
d. $\frac{-4\pi r^5}{3}$

50 What is the value of OD

a. r- h
b. h-r
c. r – h / 2
d. h- r / 2

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