MATHEMATICS - 050 (E)

Set No. 3

Mathematics

QUESTION PAPER - 2

Std. - 12

Time : 3 Hours

AUGUST-2020

Total Mark : 100

PART - A : 50 Marsk ● Part - B : 50 Marks

[Time : 1 Hour] **PART – A** [Maximum Marks : 50]

Instructions :

1. There are 50 objective type (M.C.Q.) question in Part-A and all questions are compulsory.
2. The questions are serially numbred from 1 to 50 and each carries 1 marks.
3. Read each question carefully, select proper alternative and answer in the OMR Sheet.
4. The OMR Sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (C) O, (D) O. Darken the circle ● of the correct answer will ball-pen.
5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
6. Set No of question paper printed on the upper most right side of the question paper is to be wirtten in the column provided in the OMR Sheet.
7. Use of simple calculator and log table is allowed, if required.
8. Notations used in this question paper have proper meaning..

1. If $\vec{a}$ is a non zero vector of magnitude 'a' and λ is a non zero scalar, then $\lambda\vec{a}$ is a unit vector if ....

(A) $a = \dfrac{1}{|\lambda|}$ (B) $\lambda = -1$

(C) $a = |\lambda|$ (D) $\lambda = 1$

2. Vector $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}|$ and $|\vec{b}| = \dfrac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is a unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is ....

(A) $\dfrac{\pi}{2}$ (B) $\dfrac{\pi}{4}$ (C) $\dfrac{\pi}{3}$ (D) $\dfrac{\pi}{6}$

3. The value of $\hat{i}\cdot(\hat{j}\times\hat{k}) + \hat{j}\cdot(\hat{i}\times\hat{k}) + \hat{k}\cdot(\hat{i}\times\hat{j})$ is ....

(A) 3 (B) –1 (C) 1 (D) 0

4. Let $\vec{a}, \vec{b}$ and $\vec{a}+\vec{b}$ be unit vectors and θ is angle between $\vec{a}$ and $\vec{b}$ then ....

(A) $\theta = \dfrac{2\pi}{3}$ (B) $\theta = \dfrac{\pi}{3}$ (C) $\theta = \dfrac{\pi}{2}$ (D) $\theta = \dfrac{\pi}{4}$

5. if $|\vec{a}| = 8$, $|\vec{b}| = 3$ and $|\vec{a}\times\vec{b}| = 12$, then value of $\vec{a}\cdot\vec{b}$ is ....

(A) $6\sqrt{3}$ (B) $8\sqrt{3}$ (C) $12\sqrt{3}$ (D) None of these

6. The area of a parallelogram whose adjacent sides are given by the vectors $\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ is ....

(A) $\sqrt{21}$ (B) $\sqrt{42}$ (C) 42 (D) 21

7. The angle between the two planes $2x \times y - 2z = 5$ and $3x - 6y - 2z = 7$ is ....

(A) $\sin^{-1}\left(\frac{4}{21}\right)$ (B) $\sin^{-1}\left(\frac{21}{4}\right)$

(C) $\cos^{-1}\left(\frac{4}{21}\right)$ (D) $\cos^{-1}\left(\frac{21}{4}\right)$

8. The equations of the x-axis is space are ....

(A) $y=0, z=0$ (B) $x=0, z=0$ (C) $x=0$ (D) $x=0, y=0$

9. The planes $2x - y + 4z = 5$ and $5x - 2\cdot 5y + 10z = 6$ are ....

(A) passes through $\left(0, 0, \frac{5}{4}\right)$ (B) parallel

(C) intersect y - axis (D) perpendicular

10. Corner points of the feasible region are (0, 0), (25, 0), (16, 16) and (0, 24). Then maximum values of $z = 4x + 3y$ is ....

(A) 121 (B) 112 (C) 72 (D) 100

11. 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 $p, q > 0$, (3, 0) the minimum of z occurs at (3, 0) and (1, 1) then ....

(A) $p=q$ (B) $p=\frac{q}{2}$ (C) $p=3q$ (D) $p=2q$

12. The objective function of an LP problem is ....

(A) a quadratic equation (B) a function to be optimised

(C) an inequality (D) a constant

13. If A and B are events such that $P\left(A/B\right) = P\left(B/A\right) \neq 0$, then ....

(A) $P(A)=P(B)$ (B) $A=B$ (C) $A \cap B = \varnothing$ (D) $A \subset B$ but $A \neq B$

14. The probability of obtaining an even prime number on each die, when a pair of dice is rolled is ....

(A) $\frac{1}{36}$ (B) $\frac{1}{3}$ (C) $\frac{1}{12}$ (D) 0

15. In a box containing 100 bulbs. 10 are defective. The probability that out of a sample of 5 bulbs. none is defective is ....

(A) $\frac{9}{10}$ (B) $\left(\frac{1}{5}\right)^5$ (C) $\left(\frac{9}{10}\right)^5$ (D) 10^{-1}

16. Let R be the relation in the set N given by $R = \{(a, b) : a = b - 2, b > 6\}$. Which of the following is true ?

(A) $(8, 7) \in R$ (B) $(3, 8) \in R$ (C) $(6, 8) \in R$ (D) $(2, 4) \in R$

17. Let the function $f : R \to R$ be defined as $f(x) = x^4$. Choose the correct answer.

(A) f is neither one-one nor onto (B) f is many-one and onto

(C) f is one-one but not onto (D) f is one-one and onto

18. Number of binary operations on the set $\{a, b\}$ is ....

(A) 8 (B) 16 (C) 20 (D) 4

19. If $\sin^{-1} x = y$, than

(A) $\frac{-\pi}{2} < y < \frac{\pi}{2}$ (B) $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$

(C) $0 < y < \pi$ (D) $0 \le y \le \pi$

20. $\cos^{-1}\left(\cos \frac{7\pi}{6}\right)$ is equal to

(A) $\frac{\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{7\pi}{6}$

21. If $\tan^{-1} x + \tan^{-1} y = \frac{4\pi}{5}$, then $\cot^{-1} x + \cot^{-1} y =$ ....

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

22. $\tan^{2}\left(\frac{1}{2}\cos^{-1}\frac{3}{4}\right) =$ ....

(A) 1 (B) $\frac{3}{7}$ (C) $\frac{1}{7}$ (D) $\frac{4}{7}$

23. For equal ordered square matrices A and B.

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

(C) $(AB)' = AB$ (D) $AB = BA$

24. If Matrix A is of the type 3×2 and Matrices B and C of the type 2×3 then $A(B - C)$ is .... matrix.

(A) 3×3 (B) 2×2 (C) 3×2 (D) 2×3

25. If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and $A + A' = I$, then the value of $\alpha =$ ....

(A) $\frac{3\pi}{2}$ (B) $\frac{\pi}{3}$ (C) π (D) $\frac{\pi}{6}$

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

(A) 3A (B) I – A

(C) I (D) A

27. Let A be a square matrix of order 3, then $|KA| =$ ....

(A) $3K|A|$ (B) $K^2|A|$ (C) $K^3|A|$ (D) $K|A|$

28. $\begin{vmatrix} 1^2 & 5^2 & 3^2 \\ 2^2 & 25^2 & 24^2 \\ 3^2 & 41^2 & 40^2 \end{vmatrix} + \begin{vmatrix} 1^2 & 5^2 & 4^2 \\ 2^2 & 25^2 & 7^2 \\ 3^2 & 41^2 & 9^2 \end{vmatrix} =$ ....

(A) 0 (B) -18 (C) 18 (D) 36

47. The are enclosed by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is ....

(A) πab^2 (B) πab (C) $\pi a^2 b$ (D) $\pi^2 ab$

48. The number of arbitary constants in the general solution of a differential equation of fourth order is ....

(A) 4 (B) 2 (C) 3 (D) 0

49. The Integrating Factor of the differential equation $x\frac{dy}{dx}-y=2x^2$ is ....

(A) x (B) e^{-y} (C) $\frac{1}{x}$ (D) e^{-x}

50. Solution of the differential equation $\frac{dx}{x}+\frac{dy}{y}=0$ is ....

(A) $x+y=c$ (B) $\log x\cdot\log y=c$

(C) $xy=c$ (D) $\frac{1}{x}+\frac{1}{y}=c$

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050 (E) AUGUST - 2020

Time : 2 Hours **PART – B** **Maximum Marks : 50**

Instructions :

1. Write in a clear legible hand writing.
2. There are three sections in Part-B of the questions paper and total to 18 questions are there.
3. All the questions are compulsory. Internal options are given.
4. The numbers at the right side represent the marks of the questions.
5. Start new section on new page.
6. Maintain Sequence.
7. Use of simple calculator and log table is allowed, if required.
8. Use the graph paper to solve the problem of L.P.

SECTION : A

- **Answer the following 1 to 8 questions as directed in the question. (Each question carries 2 marks.)** 16

1. Prove that : $3\cos^{-1}x=\cos^{-1}(4x^3-3x), x\in\left[\frac{1}{2},1\right]$.

2. Differentiate $\sin\left(\tan^{-1}e^{-x^2}\right)$ with respect to x.

3. Find $\int\frac{1}{\cos^2 x(1-\tan x)^2}dx$.

4. Find the area bounded by the curve $y=\cos x$ between $x=0$ and $x=2\pi$.

5. Find the area of the region bounded by $y^2=9x, x=2, x=4$ and x - axis in the first quadrent.

OR

5. Find the area of the parabola $y^2=4ax$ bounded by its latus rectum.

6. If $\vec{a}=2\hat{i}+2\hat{j}+3\hat{k}, \vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+\hat{j}$ are such that, $\vec{a}+\lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value fo λ.

7. Find the angle between the line $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and the plane $10x+2y-11z=3$.

8. A random Variable X has the following probability distribution :

X	0	1	2	3	4	5	6	7
P(X)	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

Determine : $P(0<X<3)$

OR

8. Evaluate $P(A\cup B)$, if $2P(A)=P(B)=\frac{5}{13}$ and $P(A/B)=\frac{2}{5}$.

SECTION : B

- **Answer the following 9 to 14 questions as directed in the question.** **18**
(Each question carries 3 marks.)

9. If $f(x)=\frac{4x+3}{6x-4}, x\neq\frac{2}{3}$. Show that $fof\,(x)=x$, for all $x\neq\frac{2}{3}$. What is the inverse of f?

10. Let $A=\begin{bmatrix}2 & -1\\ 3 & 4\end{bmatrix}, B=\begin{bmatrix}5 & 2\\ 7 & 4\end{bmatrix}, C=\begin{bmatrix}2 & 5\\ 3 & 8\end{bmatrix}$. Find a matrix D such that $CD-AB=0$, where 0 is 2×2 zero matrix.

OR

10. If $A^{-1}=\begin{pmatrix}3 & -1 & 1\\ -15 & 6 & -5\\ 5 & -2 & 2\end{pmatrix}$ and $B=\begin{pmatrix}1 & 2 & -2\\ -1 & 3 & 0\\ 0 & -2 & 1\end{pmatrix}$, find $(AB)^{-1}$

11. If $(x-a)^2+(y-b)^2=c^2$, for some $c>0$, prove that : $\frac{[1+y_1^2]^{\frac{3}{2}}}{y_2}$ is a constant independent of a and b.

12. Show that the line $\frac{x-a+d}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-b-c}{\beta+\gamma}$ are coplannar.

OR

12. Find the shortest distance between the lines, $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$ and $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$.

13. Solve the following linear programming problem graphically :
Minimise and Maximise $z=3x+9y$
Subject to the constraints : $x+3y\leq60, x+y\geq10, x\leq y, x\geq0, y\geq0$

14. Two cards are drawn simultaneously (or successively without replacement) from a well shuffled pack of 52 cards. Find mean, variance and standard deviation of the number of kings.

SECTION : C

16

- **Answer the following 15 to 18 questions as directed in the question.**
  (Each question carries 4 marks.)

15. Using the property of determinant solve the equation for x.

$$\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$$

16. Show that Semi-vartical angle, of the cone of the maximum volume and of given slant height, is $\tan^{-1}\sqrt{2}$.

OR

16. Show that the euation of normal at any point on the curve.
$x = 3\cos\theta - \cos^3\theta$, $y = 3\sin\theta - \sin^3\theta$ is $4(y\cos^3\theta - x\sin^3\theta) = 3\sin 4\theta$.

17. Evaluate $\int_0^{\pi} \frac{x\,dx}{a^2\cos^2 x + b^2\sin^2 x}$.

18. Solve the differentaial equation

$$(x\,dy - y\,dx)\,y\sin\left(\frac{y}{x}\right) = (ydx + xdy)\,x\cos\left(\frac{y}{x}\right).$$

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BOARD QUESTION PAPER - 2 - SOLUTIONS (AUGUST 2020)

PART – A

1. A	2. B	3. C	4. A	5. C	6. B	7. C	8. A	9. B	10. B
11. B	12. B	13. A	14. A	15. C	16. C	17. A	18. B	19. B	20. B
21. D	22. C	23. A	24. A	25. B	26. C	27. C	28. A	29. B	30. D
31. A	32. A	33. B	34. A	35. D	36. C	37. D	38. B	39. B	40. D
41. D	42. B	43. A	44. C	45. B	46. B	47. A	48. A	49. C	50. C

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