CBSE SAMPLE PAPER2

CLASS – XII

ANNUAL EXAMINATION 2020

MATHEMATICS - 041

Write Your Roll No.

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**Max Time 3 Hrs** **Max Marks 80**

## General instructions:

1. **All the questions are compulsory.**
2. **The question paper consists of 36 questions divided into 4 sections A, B, C, and D.**
3. **Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 6 questions of 4 marks each. Section D comprises of 4 questions of 6 marks each.**
4. **There is no overall choice. However, an internal choice has been provided in three questions of 1 mark each, two questions of 2 marks each, two questions of 4 marks each, and two questions of 6 marks each. You have to attempt only one of the alternatives in all such questions.**
5. **Use of calculators is not permitted.**



### Section A

**Question numbers 1 to 10(carry 1 mark each) are multiple choice type questions. Select the correct option:**

1. The value of $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is
   (A) $\frac{\pi}{2}$ (B) $-\frac{\pi}{2}$ (C) 0 (D) $\pi$
2. The magnitude of each of the two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude such that the angle between them is $60^0$ and scalar product is $\frac{9}{2}$ is
   (A) $-\frac{3}{2}$ (B) $\frac{3}{2}$ (C) $\pm\frac{3}{2}$ (D) None of these
3. If A is any square matrix of order 3 × 3 such that |A| = 3, then the value of |adjA| is ?
   (A) 3 (B) $\frac{1}{3}$ (C) 9 (D) 27
4. Let A and B are matrices of order 3 X 2 and 2 X 4 respectively. Then the order of matrix (AB) is
   (A) 2 X 4 (B) 3 X 2 (C) 3 X 4 (D) None of these
5. Two dice are thrown. If it is known that the sum of numbers on the dice was less than 6, the probability of getting a sum 3, is
   (A) $\frac{1}{18}$ (B) $\frac{5}{18}$ (C) $\frac{1}{5}$ (D) $\frac{2}{5}$

6. If A and B are independent events such that 0 < P (A) < 1 and 0 < P (B) < 1, then which of the following is not correct?
(A) A and B are mutually exclusive (B) A and B′ are independent
(C) A′ and B are independent (D) A′ and B′ are independent

7. 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. Maximum of F – Minimum of F =
(A) 60 (B) 48 (C) 42 (D) 18

8. If $\int_0^1 \frac{e^t}{1+t} dt = a$, then $\int_0^1 \frac{e^t}{(1+t)^2} dt$ is equal to
(A) $a - 1 + \frac{e}{2}$ (B) $a + 1 - \frac{e}{2}$ (C) $a - 1 - \frac{e}{2}$ (D) $a + 1 + \frac{e}{2}$

9. The equation of the line in vector form passing through the point(−1,3,5) and parallel to line $\frac{x-3}{2} = \frac{y-4}{3}; z = 2$ is
(A) $\vec{r} = (-\hat{\imath} + 3\hat{\jmath} + 5\hat{k}) + \lambda(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$
(B) $\vec{r} = (-\hat{\imath} + 3\hat{\jmath} + 5\hat{k}) + \lambda(2\hat{\imath} + 3\hat{\jmath})$
(C) $\vec{r} = (2\hat{\imath} + 3\hat{\jmath} - 2\hat{k}) + \lambda(-\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$
(D) $\vec{r} = (2\hat{\imath} + 3\hat{\jmath}) + \lambda(-\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$

10. What is the distance(in units) between the two planes 3x + 4y + 12z = 3 and 9x + 12y + 36z = 12?
(A) 0 (B) $\frac{1}{13}$ (C) $\frac{15}{13}$ (D) $\frac{9}{13}$

**Question numbers 11 to 15(carry 1 mark each) are to be filled in the blanks:**

11. If f be the greatest integer function defined as f(x) = [x] and g be the modulus function defined as g(x) = |x| , then the value of gof$\left(-\frac{7}{3}\right)$ is _________

12. The value of ‘k’ for which the following function

$$F(x) = \begin{cases} \frac{(x+3)^2-36}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases}$$ is continuous at $x = 3$ is _________

13. If A= $\begin{pmatrix} 4 & 6 \\ 7 & 5 \end{pmatrix}$, then A.(adj. A) is _________

14. If tangent to the curve $y^2 + 3x - 7 = 0$ at the point $(h, k)$ is parallel to line x–y = 4, then value of k is_________?

OR

For the curve $y = 5x - 2x^3$ , if increases at the rate of 2units/sec, then at $x = 3$ the slope of the curve is changing at _________

15. If $|\vec{a}|$=a, then find the value of $|\vec{a}X\hat{\imath}|^2 + |\vec{a}X\hat{\jmath}|^2 + |\vec{a}X\hat{k}|^2$.

OR

If $\vec{a}$ and $\vec{b}$ are 2 unit vectors inclined to x- axis at angles $30^0$ and $120^0$ respectively, then write the value of $|\vec{a} + \vec{b}|$.

**(Question numbers 16 to 20 carry 1 mark each) Answer the following questions:**

16. **If the matrix A=** $\begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ **is skew symmetric, find the values if 'a' and 'b'.**
17. **Find** $\int xe^{1+x^2}\,dx$
18. **Evaluate** $\int_{-2}^{2}(x^3 + \tan x + e^x)dx$

19. **Find** $\int cosec\,x(\cot x - 1)e^x dx.$

**OR**

If $\int_0^1 (3x^2 + 2x + k)\,dx = 0, write\ the\ value\ of\ k.$

20. **Write the general solution of differential equation** $\frac{dy}{dx} = e^{x+y}$

## Section B

**Question numbers 21 to 26 carry 2 marks each.**

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

**OR**

**Let f: R→ R is defined by f(x)** $= x^2 + 1$**. Then write the pre-images of 17 and -3.**

22. **Differentiate** $\tan^{-1}\left(\frac{1+\cos x}{\sin x}\right)$ **with respect to x.**
23. **A particle moves along the curve** $x^2 = 2y$**. At what point, ordinate increases at the same rate as abscissa increases?**
24. **If θ is the angle between two vectors** $\hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ **and** $3\hat{\imath} - 2\hat{\jmath} + \hat{k}$**, find** $\sin\theta$**.**

**OR**

**If** $\vec{a}, \vec{b}, \vec{c}$ **are three vectors such that** $\vec{a} + \vec{b} + \vec{c} = \vec{o}$**, then prove that** $\vec{a}X\vec{b} = \vec{b}X\vec{c} = \vec{c}X\vec{a}$**, and hence show that** $[\vec{a}\ \vec{b}\ \vec{c}] = 0$**.**

25. **Find the angle between the lines** $2x = 3y = -z$ **and** $6x = -y = -4z$**.**
26. **A black and a red die are rolled together. Find conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.**

## Section C

**Question numbers 27 to 32 carry 4 marks each.**

27. **Show that the relation R in the set R of real numbers, defined as R = {(a, b): a, b ∈ R and a≤** $b^3$**} is neither reflexive, nor symmetric nor transitive.**
28. **If** $(x^2 + y^2)^2 = xy$**, find** $\frac{dy}{dx}$**.**

**OR**

**If $x = a(2\theta - \sin 2\theta)$ and $y = a(1 - \cos 2\theta)$, find $\frac{dy}{dx}$ when $\theta = \frac{\pi}{3}$.**

29. **Find $\int \frac{2\cos x}{(1-\sin x)(1+\sin^2 x)} dx$**

30. **Find the particular solution of the differential equation $e^x \tan y \; dx + (2 - e^x) \sec^2 y \, dy = 0$, given that $y = \frac{\pi}{4}$ when $x = 0$.**
31. **Two tailors A and B earn ₹150 and ₹200 per day respectively. A can stitch 6 shirts and 4 pants per day, while B can stitch 10 shirts and 4 pants per day. Form a L.P.P to minimize the labour cost to produce (stitch) at least 60 shirts and 32 pants and solve it graphically.**
32. **Suppose a girl throws a die. If she gets a 1 or 2, she tosses a coin 3 times and notes the number of tails. If she gets $3, 4, 5$ *or* $6$, she tosses a coin once and notes whether a 'head' or 'tail' is obtained. If she obtained exactly one 'tail', what is the probability that she threw $3, 4, 5$ *or* $6$ with the die?**

**OR**

**Two numbers are selected at random (without replacement) from the first five positive integers. Let X denotes the larger of the two numbers obtained. Find the mean and variance of X.**

## Section D

**Question numbers 33 to 36 carry 6 marks each.**

33. **If A= $\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find $A^{-1}$. Use it to solve the system of equations**

$$2x - 3y + 5z = 11, 3x + 2y - 4z = -5, x + y - 2z = -3$$

**OR**

**Using properties of determinants, prove that**

$$\begin{vmatrix} 1 & 1 & 1+3x \\ 1+3y & 1 & 1 \\ 1 & 1+3z & 1 \end{vmatrix} = 9(3xyz + xy + yz + zx)$$

34. **Show that the height of a closed right circular cylinder of given surface and maximum volume is equal to the diameter of its base.**

**OR**

**Find the equations of the tangent and the normal to the curve**

$$x = 1 - cos\theta, y = \theta - sin\theta;\; at\; \theta = \frac{\pi}{4}.$$

35. **Using integration find the area of the region $\{(x, y): y^2 \leq 4x,\; 4x^2 + 4y^2 \leq 9\}$.**

36. **Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\vec{r} = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ and the plane $\vec{r}.(\hat{i} - \hat{j} + \hat{k}) = 5$.**

## Answer Key and hints

### Set 1

### Section A

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14(or) | 15 | 15(or) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | C | C | A | A | B | B | B | 3 | 12 | -22I | -3/2 | Dec 72 u/s | | |

16. $a = -2, b = 3$

### Section B

21(or). $\{4, -4\}, \Phi$ 22. $-\frac{1}{2}$ 23. $\left(1, \frac{1}{2}\right)$ 24. $\frac{\sqrt{24}}{7}$ 25. $\frac{\pi}{2}$ 26. $\frac{1}{9}$

### Section C

28 $\frac{dy}{dx} = \frac{y-4x^3-4xy^2}{4x^2y+4y^3-x}$ 14(or). $\frac{1}{\sqrt{3}}$ 29. $\frac{1}{2}\log\left|\frac{1+\sin^2 x}{(1-\sin x)^2}\right| + \tan^{-1}(\sin x) + c$ 30. $y = \tan^{-1}(2 - e^x)$

**31.** Minimum value is ₹1350 when tailor A works for 5 days and tailor B works for 3 days 32. Mean=4. Var=1

### Section D

33. $A^{-1} = \frac{1}{-1}\begin{bmatrix} 0 & -1 & 2 \\ 2 & -9 & 23 \\ 1 & -5 & 13 \end{bmatrix}, x = 1, y = 2, z = 3$ 34(or). (Tangent: $4\sqrt{2}(\sqrt{2}-1)x - 4\sqrt{2}y +$ *8+π2−16=0*, Normal: *4x+42−1y−π2−1=0* 35. $4\pi$ squ 36. (2, -1, 2); 13 u