



Reg. No. \_\_\_\_\_

**Series AG-1899-1****CLASS XII**कोड नं. Code No. **TMC-D/79/89/36**

- Please check that this question paper contains 6 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 29 questions.
- Please write down the serial number of the question before attempting it.
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 6 हैं।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 29 प्रश्न हैं।
- कृपया प्रश्न शुरू करने से पहले, प्रश्न श्य लिखें।

**MATHEMATICS**

गणित

Time allowed : 3 hours]

निर्धारित समय : 3 घण्टे]

[Maximum Marks : 100

[अधिकतम अंक : 100

**General Instructions :**

1. All questions are compulsory.
2. The question paper consists of 29 questions divided into four sections A, B, C and D. Section A comprises 10 questions of one mark each, Section B comprises 12 questions of four marks each, Section C comprises 7 questions of six marks each.
3. All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.
4. There is no overall choice. However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculators is not permitted.

सामान्य निर्देश :

- 1 सभी प्रश्न अनिवार्य हैं।
- 2
- 3
- 4 पूर्ण प्रश्नपत्र में विकल्प नहीं है। फि ही विकल्प करना है।
- 5 कैलकुलेटरों के प्रयोग की अनुमति नहीं है।

क अंक का है। खण्ड ब में 12 प्रश्न,

**SECTION A**

खण्ड अ

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1. Evaluate : मान ज्ञात कीजिए :  $\begin{bmatrix} 1 & -1 \\ 0 & 2 \\ 2 & 3 \end{bmatrix} \left\{ \begin{bmatrix} 1 & 0 & 2 \\ 2 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 2 \end{bmatrix} \right\}$

2. If the vectors  $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$  and  $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$  are coplanar, find the value of  $\lambda$ .

यदि सदिश  $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$  तथा  $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$  एक समतलीय है, तो  $\lambda$  का मान ज्ञात कीजिए।

3. Find the vector equations of a line which passes through the point (1, 2, 3) and is parallel to the line

$$\frac{-x-2}{1} = \frac{y+3}{7} = \frac{2z-6}{3}$$

$$\frac{-x-2}{1} = \frac{y+3}{7} = \frac{2z-6}{3}$$

के समांतर है।

4. A binary operation \* on the set of rational number Q, is defined as  $a * b = a + b + ab$ . Check the operation \* for associativity.

एक परिमेय संख्या वाले समुच्चय Q

$a * b = a + b + ab$  द्वारा व्यक्त करते हैं। जाँच कीजिए कि \* साहचर्य

5. Evaluate : मान ज्ञात कीजिए :  $\sin \left[ \frac{\pi}{3} - \sin^{-1} \left( -\frac{1}{2} \right) \right]$ .

6. Find a unit vector in the direction of the resultant of vectors  $\hat{i} + 2\hat{j} + 3\hat{k}$ ,  $-\hat{i} + 2\hat{j} + \hat{k}$  and  $3\hat{i} + \hat{j}$ .

सदिशों  $\hat{i} + 2\hat{j} + 3\hat{k}$ ,  $-\hat{i} + 2\hat{j} + \hat{k}$  और  $3\hat{i} + \hat{j}$  की परिणामी दशा में एकांक सदिश ज्ञात कीजिए।

7. If  $\sin^{-1} x + \cot^{-1} \left( \frac{1}{2} \right) = \frac{\pi}{2}$ , then the value of  $x$ .

यदि  $\sin^{-1} x + \cot^{-1} \left( \frac{1}{2} \right) = \frac{\pi}{2}$ , तब  $x$  का मान होगा

8. Find the projection of the vector  $\hat{i} - 2\hat{j} + \hat{k}$  on the vector  $4\hat{i} - 4\hat{j} + 7\hat{k}$ .

सदिश  $\hat{i} - 2\hat{j} + \hat{k}$  की सदिश  $4\hat{i} - 4\hat{j} + 7\hat{k}$

9. If  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$  and  $\vec{b} = \hat{j} - \hat{k}$ , find a vector  $\vec{c}$  such that  $\vec{a} \times \vec{c} = \vec{b}$  and  $\vec{a} \cdot \vec{c} = 3$ .

यदि  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$  तथा  $\vec{b} = \hat{j} - \hat{k}$ , तो सदिश  $\vec{c}$  ज्ञात कीजिए यदि  $\vec{a} \times \vec{c} = \vec{b}$  तथा  $\vec{a} \cdot \vec{c} = 3$ ।

10. Evaluate : मान ज्ञात कीजिए :  $\int_0^{\pi/4} \sqrt{1 - \sin 2x} dx$ .

**SECTION B**

**खण्ड ब**

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11. Solve the differential equation  $x \frac{dy}{dx} = y(\log y - \log x + 1)$ .

अवकल समीकरण  $x \frac{dy}{dx} = y(\log y - \log x + 1)$  को हल कीजिए।

or / अथवा

Solve the differential equation  $(1+x^2) \frac{dy}{dx} + 2xy - 4x^2 = 0$ . Find its particular solution, given that  $y = 0$  when  $x = 0$ .

अवकल समीकरण  $(1+x^2) \frac{dy}{dx} + 2xy - 4x^2 = 0$  को हल कीजिए। इस समीकरण का निश्चित हल ज्ञात कीजिए दिया है  $y = 0$  जब  $x = 0$

12. If a,b,c are non-zero numbers, show that : यदि a,b,c शून्योत्तर संख्याएँ है तो दर्शाइए :

$$\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(b+c)(c+a)(a+b)$$

13. Evaluate : मान ज्ञात कीजिए  $\int_0^{\pi} \frac{x dx}{1 - \cos \alpha \sin x}$ .

14. Find the distance of the point  $(-1, -5, -10)$  from the point of intersection of the line  $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$  and the plane  $x - y + z = 5$ .

समतल  $x - y + z = 5$  एवं रेखा  $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$   $(-1, -5, -10)$  के बीच की दूरी है।

15. Consider a function  $f: R^+ \rightarrow [-5, \infty)$  given by  $f(x) = 9x^2 + 6x - 5$ , where  $R^+$  is the set of all non-negative real numbers. show that 'f' is invertible with  $f^{-1}(x) = \frac{\sqrt{x+6}-1}{3}$ .

मान लीजिए कि फलन  $f: R^+ \rightarrow [-5, \infty)$ ,  $f(x) = 9x^2 + 6x - 5$ ,  $R^+$

समुच्चय है। दर्शाइए कि  $f^{-1}(x) = \frac{\sqrt{x+6}-1}{3}$

16. If  $y = (\sin^{-1} x)^2$ , prove that : यदि  $y = (\sin^{-1} x)^2$  हो, तो सिद्ध कीजिए :  $(1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = 2$ .

Or अथवा

If  $x = a(\theta - \sin \theta)$  &  $y = a(1 - \cos \theta)$  find  $\frac{d^2 y}{dx^2}$  at  $\theta = \frac{\pi}{2}$ .

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यदि  $x = a(\theta - \sin \theta)$  और  $y = a(1 - \cos \theta)$ ,  $\theta = \frac{\pi}{2}$  पर  $\frac{d^2y}{dx^2}$  ज्ञात कीजिए।

17. The function  $f$  is given by दिया गया फलन  $f$  है।  $f(x) = \begin{cases} \frac{1 - \sin x}{\cos^2 x} & \text{if } x < \frac{\pi}{2} \\ a & \text{if } x = \frac{\pi}{2} \\ \frac{b(1 - \sin x)}{(\pi - 2x)^2} & \text{if } x > \frac{\pi}{2} \end{cases}$  .

Find the values of  $a$  and  $b$  if  $f$  is continuous at  $x = \frac{\pi}{2}$ .  $a$  तथा  $b$  का मान ज्ञात कीजिए यदि  $x = \frac{\pi}{2}$  पर सतत् है।

18. Form the differential equation corresponding to  $y^2 = a(b - x^2)$ , where  $a$  and  $b$  are arbitrary constants.

$y^2 = a(b - x^2)$  के अवकल समीकरण ज्ञात कीजिए, जहाँ  $a$  तथा  $b$  अचर स्थिरांक है।

19. The mean and variance of a binomial distribution are 4 and  $\frac{4}{3}$  respectively. Find  $P(x \geq 1)$ .

$\frac{4}{3}$  है।  $P(x \geq 1)$  ज्ञात कीजिए।

20. Find the intervals in which the function  $f$  given by  $f(x) = \sin x - \cos x$ ,  $0 \leq x \leq 2\pi$  is (i) increasing, (ii) decreasing .

or

Find the approximate value of  $f(5.001)$ , where  $f(x) = x^3 - 7x^2 + 15$ .

फलन  $f$  जो  $f(x) = \sin x - \cos x$ , से दिया है,  $x$  के (i) निम्निष्ठ (ii) उच्चिष्ठ मान ज्ञात कीजिए, जबकि  $0 \leq x \leq 2\pi$  ।

या

$f(5.001)$  का सन्निकट मान ज्ञात कीजिए जब  $f(x) = x^3 - 7x^2 + 15$  है।

21. Evaluate: का मान ज्ञात कीजिए।  $\int \frac{x \sin^{-1} x^2}{\sqrt{1-x^4}} dx$  .

or या

Evaluate: का मान ज्ञात कीजिए।  $\int \frac{2x-1}{(x-1)(x+2)(x-3)} dx$  .

22. Solve for  $x$ :  $x$  का मान ज्ञात कीजिए :  $\sin^{-1} x + \sin^{-1} 2x = \frac{\pi}{3}$  .

**SECTION C**

**खण्ड स**

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23. If  $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$ , find  $A^{-1}$  and use it to solve the system of equations:

$$x + y + 2z = 0; x + 2y - z = 9; x - 3y + 3z = -14.$$

यदि  $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$  तो  $A^{-1}$  का मान ज्ञात कीजिए तथा इसका उपयोग समीकरण

$$x + y + 2z = 0; x + 2y - z = 9; x - 3y + 3z = -14. \text{ को हल करने में कीजिए।}$$

24. Evaluate : मान ज्ञात कीजिए :  $\int \frac{dx}{x^4 + 7x^2 + 25}$ .

25. Find the point on the line  $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{6}$  at a distance 3 from the point (1, -2, 3).

रेखा  $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{6}$  पर वह बिन्दु ज्ञात कीजिए जो बिन्दु (1, -2, 3) की दूरी पर हो।

or अथवा

Find the vector and cartesian form of the equation of the plane containing the lines

$$\vec{r} = (i + 2j + 3k) + \lambda(7i + 3j + 2k) \text{ and } // \text{ to line } \vec{r} = (3i - j + 3k) + \lambda(2i + 2j + 7k).$$

उस तल की सदिश तथा कार्तीय रूप में समीकरण ज्ञात कीजिए, जिस पर  $\vec{r} = (i + 2j + 3k) + \lambda(7i + 3j + 2k)$  तथा  $//$

$$\vec{r} = (3i - j + 3k) + \lambda(2i - 2j + 7k) \text{ रेखाएँ हैं।}$$

26. Draw the rough sketch of  $y^2 = x + 1$  and  $y^2 = -x + 1$  and find the area enclosed by the two curves.

$$y^2 = x + 1 \text{ तथा } y^2 = -x + 1$$

27. Prove that the height and the radius of the base of an open cylinder of given surface area and maximum volume are equal.

or अथवा

Show that the semi-vertical angle of a cone of maximum volume and of given slant height is  $\tan^{-1} \sqrt{2}$ .

दर्शाइए कि एक शंकु का अर्द्धशीर्ष कोण  $\tan^{-1} \sqrt{2}$

28. A producer has 30 and 17 units of labour and capital respectively which he can use to produce two types of goods X and Y. To produce one unit of X, 3 units of capital and 2 units of labour are required and to produce one unit of Y, 3 units of labour and 1 unit of capital is required. If X and Y are priced at Rs. 100 and Rs. 120

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respectively, how should the producer use his resources to maximize the total revenue ? From the LPP and solve it.

X तथा Y उत्पादित करता है। X

की एक इकाई का उत्पादन करने के लिए 3 इकाई पूँजी की तथा 2 इकाई श्रम की आवश्यकता होती है और Y की एक इकाई उत्पादित करने के लिए 3 इकाई श्रम की तथा 1 इकाई पूँजी की आवश्यकता होती है। यदि X और Y

? र

LPP) बनाकर

हल कीजिए।

**29.** In a test an examinee either guesses or copies or knows the answer to multiple choice question with four choices

out of which one is correct option. The probability that he makes a guess is  $\frac{1}{3}$ . The probability that he copies

the answer is  $\frac{1}{6}$ . The probability that the answer is correct, given that he copied it is  $\frac{1}{8}$ . Find the probability

that he knows the answer to the question, given that he correctly answered it.

लगाकर या नकल करके या जानते हुए देता है। उसके अनुमान लगाने की

$\frac{1}{3}$

$\frac{1}{6}$  है। उत्तर के

$\frac{1}{8}$

उत्तर सही हैं।

\*\*\*\*\*



**CODE:- AG-2-3689**



Year of quality education

**REGNO:-TMC -D/79/89/36**

### General Instructions :

- All question are compulsory.
- The question paper consists of 29 questions divided into three sections A,B and C. Section – A comprises of 10 question of 1 mark each. Section – B comprises of 12 questions of 4 marks each and Section – C comprises of 7 questions of 6 marks each .
- Question numbers 1 to 10 in Section – A are multiple choice questions where you are to select one correct option out of the given four.
- There is no overall choice. However, internal choice has been provided in 2 question of four marks and 2 questions of six marks each. You have to attempt only one If the alternatives in all such questions.
- Use of calculator is not permitted.
- Please check that this question paper contains 4 printed pages.

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7. Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

**सामान्य निर्देश :**

1. सभी प्रश्न अनिवार्य हैं।
2. इस प्रश्न पत्र में 29 प्रश्न हैं, जो 3 खण्डों में अ, ब, व स हैं। खण्ड – अ में 10 प्रश्न हैं और प्रत्येक प्रश्न 1 अंक का है। खण्ड – ब में 12 प्रश्न हैं और प्रत्येक प्रश्न 4 अंको के हैं। खण्ड – स में 7 प्रश्न हैं और प्रत्येक प्रश्न 6 अंको का है।
3. प्रश्न संख्या 1 से 10 बहुविकल्पीय प्रश्न हैं। दिए गए चार विकल्पों में से एक सही विकल्प चुनें।
4. इसमें कोई भी सर्वोपरि विकल्प नहीं है, लेकिन आंतरिक विकल्प 2 प्रश्न 4 अंको में और 2 प्रश्न 6 अंको में दिए गए हैं। आप दिए गए विकल्पों में से एक विकल्प का चयन करें।
5. कैलकुलेटर का प्रयोग वर्जित है।
6. कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 4 हैं।
7. प्रश्न-पत्र

**Pre-Board Examination 2010 -11**

Time : 3 Hours  
अधिकतम समय : 3

Maximum Marks : 100  
अधिकतम अंक : 100

Total No. Of Pages : 4  
कुल पृष्ठों की संख्या : 4

**CLASS – XII**

**CBSE**

**MATHEMATICS**

**Section A**

- |             |  |
|-------------|--|
| <b>Q.1</b>  | Let $f : \mathbb{R} - \left\{ -\frac{3}{5} \right\} \rightarrow \mathbb{R}$ be a function defined $f(x) = \frac{2x}{5x+3}$ , find $f^{-1} : \text{Range of } f \rightarrow \mathbb{R} - \left\{ -\frac{3}{5} \right\}$ . |
| <b>Q.2</b>  | Write the value of $\int_0^{\pi/2} \log \left[ \frac{3+5 \cos x}{3+5 \sin x} \right] dx$ .   |
| <b>Q.3</b>  | For two non zero vectors $\vec{a}$ and $\vec{b}$ write when $ \vec{a} + \vec{b}  =  \vec{a}  +  \vec{b} $ holds.   |
| <b>Q.4</b>  | A matrix A of order $3 \times 3$ has determinant 5. What is the value of $ 3A $ ?  |
| <b>Q.5</b>  | Cartesian equations of a line AB are. $\frac{2x-1}{2} = \frac{4-y}{7} = \frac{z+1}{2}$ Write the direction ratios of a line parallel to AB.  |
| <b>Q.6</b>  | A four digit number is formed using the digits 1,2,3,5 with no repetitions. Find the probability that the number is divisible by 5.  |
| <b>Q.7</b>  | Write the order and degree of the differential equation, $y = x \frac{dy}{dx} + a \sqrt{1 + \left( \frac{dy}{dx} \right)^2}$ .   |
| <b>Q.8</b>  | Evaluate, $\int_0^{1.5} [x] dx$ . (where $[x]$ is greatest integer function).  |
| <b>Q.9</b>  | If $4 \sin^{-1} x + \cos^{-1} x = \pi$ then find the value of $x$ .  |
| <b>Q.10</b> | Find a, for which $f(x) = a(x + \sin x)$ is increasing.  |

**Section B**

- |             |  |
|-------------|--|
| <b>Q.11</b> | Evaluate : $\int \frac{2 + \sin x}{1 + \cos x} \cdot e^{x/2} \cdot dx$ |
|             | OR   |
|             | Evaluate : $\int (x+1) \sqrt{1-x-x^2} dx$ .                            |

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<p><b>Q.12</b></p>	<p>A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lower most. Its semi-vertical angle is <math>\tan^{-1}(1/2)</math>. Water is poured into it at a constant rate of 5 cubic meter per minute. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 10m.</p>
<p><b>Q.13</b></p>	<p>If <math>A = \begin{bmatrix} 0 &amp; 1 \\ 0 &amp; 0 \end{bmatrix}</math>, prove that <math>(aI + bA)^n = a^n \cdot I + na^{n-1} bA</math> where I is a unit matrix of order 2 and n is a positive integer.</p> <p style="text-align: center;">OR</p> <p>If a, b and c are real numbers and <math>\begin{vmatrix} b+c &amp; c+a &amp; a+b \\ c+a &amp; a+b &amp; b+c \\ a+b &amp; b+c &amp; c+a \end{vmatrix} = 0</math>. Show that either <math>a + b + c = 0</math> or <math>a = b = c</math>.</p>
<p><b>Q.14</b></p>	<p>Show that the function <math>y = (A + Bx)e^{3x}</math> is a solution of the equation <math>\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 9y = 0</math>.</p>
<p><b>Q.15</b></p>	<p>Find the shortest distance between the lines, whose equations are <math>\frac{x-8}{3} = \frac{y+9}{-16} = \frac{10-z}{-7}</math> and <math>\frac{x-15}{3} = \frac{58-2y}{-16} = \frac{z-5}{-5}</math>. Also find the angle between two lines.</p> <p style="text-align: center;">OR</p> <p>Find the equation of the plane passing through the intersection of the planes, <math>2x + 3y - z + 1 = 0</math>; <math>x + y - 2z + 3 = 0</math> and perpendicular the plane <math>3x - y - 2z - 4 = 0</math>. also the inclination of this plane with the xy- plane.</p>
<p><b>Q.16</b></p>	<p>Show that the differential equations <math>2y e^{xy} dx + (y - 2x e^{xy}) dy = 0</math> is homogeneous and find its particular solution given that <math>x = 0</math> when <math>y = 1</math>.</p> <p style="text-align: center;">OR</p> <p>Solve the following differential equation: <math>(1 - x^2) \frac{dy}{dx} - xy = x^2</math>, given <math>y = 2</math> when <math>x = 0</math>.</p>
<p><b>Q.17</b></p>	<p>If <math>\vec{a}, \vec{b}</math> and <math>\vec{c}</math> are three unit vectors such that <math>\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0</math> and angle between <math>\vec{b}</math> and <math>\vec{c}</math> is <math>\frac{\pi}{6}</math>, prove that <math>\vec{a} = \pm 2(\vec{b} \times \vec{c})</math>.</p>
<p><b>Q.18</b></p>	<p>Let X denote the number of colleges where you will apply after your results and <math>P(X = x)</math> denotes your probability of getting admission in x number of colleges. It is given that</p> $P(X = x) = \begin{cases} kx & \text{If } x = 0 \text{ or } 1 \\ 2kx & \text{If } x = 2, \\ k(5 - x) & \text{If } x = 3 \text{ or } 4 \end{cases} \quad k \text{ is +ve constant .}$ <p>(a) Find the value of k.          (b) What is the probability that you will get admission in exactly two colleges?          (c) Find the mean and variance of the probability distribution.</p>
<p><b>Q.19</b></p>	<p>If <math>y = \sin^{-1}(x^2 \sqrt{1-x^2} + x \sqrt{1-x^4})</math> Prove that <math>\frac{dy}{dx} = \frac{2x}{\sqrt{1-x^4}} + \frac{1}{\sqrt{1-x^2}}</math>.</p>
<p><b>Q.20</b></p>	<p>If <math>\sin^{-1} \frac{2p}{1+p^2} - \cos^{-1} \frac{1-q^2}{1+q^2} = \tan^{-1} \frac{2x}{1-x^2}</math> then prove that <math>x = \frac{p-q}{1+pq}</math>.</p>
<p><b>Q.21</b></p>	<p>Evaluate : <math>\int_1^3 (5x^2 - e^x + 4) dx</math> as a limit of sums</p>



**Q.22** Discuss the continuity and differentiability of  $f(x) = \begin{cases} 1-x & x < 1 \\ (1-x)(2-x) & 1 \leq x \leq 2 \\ 3-x & x > 2 \end{cases}$  . at  $x = 1$  &  $x = 2$  .

**Section C**

**Q.23** For  $A = \begin{bmatrix} 2 & 4 & 6 \\ 3 & -6 & 9 \\ 10 & 5 & -20 \end{bmatrix}$ , find  $A^{-1}$  and hence solve the system of equations  $\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4$  ;  
 $\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1$  &  $\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$  .

**Q.24** Find the probability distribution of the number of white balls drawn in a random draw of 3 balls without replacement from a bag containing 4 white and 6 red balls. Also find the mean and variance of the distribution.  
 OR  
 A candidate has to reach the examination centre in time. Probability of him going by bus or scooter or by other means of transport are  $\frac{3}{10}$ ,  $\frac{1}{10}$ ,  $\frac{3}{5}$  respectively. The probability that he will be late is  $\frac{1}{4}$  and  $\frac{1}{3}$  respectively, if he travels by bus or scooter. But he reaches in time if he uses any other mode of transport. He reached late at the centre. Find the probability that he travelled by bus.

**Q.25** Find the area of the origin :  $\{(x, y) : 0 \leq y \leq x^2, 0 \leq y \leq x + 2; 0 \leq x \leq 3\}$ .  
 OR  
 Find the ratio of the areas into which curve  $y^2 = 6x$  divides the region bounded by  $x^2 + y^2 = 16$ .

**Q.26** A point on the hypotenuse of a right triangle is at a distance 'a' and 'b' from the sides of the triangle. Show that the minimum length of the hypotenuse is  $[a^{2/3} + b^{2/3}]^{3/2}$ .

**Q.27** There is a factory located at each of the two places P & Q . From these locations , a certain commodity is delivered to each of the three depots situated at A , B & C. The weekly requirements of the depots 5 , 5 & 4 units of commodity while the production capacity of the factories at P & Q are respectively 8 & 6 units .The cost of transportation per unit is given below. Formulate the above L.P.P. mathematically to determine how many units should be transported from each factory to each depot in order that the transportation cost is minimum.

T O	C O S T ( i n ₹ )		
	A	B	C
P	1 6	1 0	1 5
Q	1 0	1 2	1 0

**Q.28** Find the foot of the perpendicular from P(1, 2, 3) on the line  $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$  .Also obtain the equation of the plane containing the line and the point (1, 2, 3).

**Q.29** Let X be a non – empty set. P(x) be its power set. Let \* be an operation defined on element of P(x) by  $A*B = A \cap B \forall A, B \in P(X)$  Then,  
 (i) Prove that \* is a binary operation in P(X).  
 (ii) Is\* commutative ?  
 (iii) Is\* associative?  
 (iv) find the identity element in P(X) w.r.t \* .  
 (v) find the all the invertible element of P(X)  
 (vi) if O is another binary operation defined on P(X) as  $A O B = A \cup B$  then verify that O distribution itself over \*.

X

*There is no substitute for hard work*

Reg. No.

**Series AG-3****CLASS XII (CBSE)****कोड नं. Code No.TMC 89/2/3**

- Please check that this question paper contains 6 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 29 questions.
- Please write down the serial number of the question before attempting it.
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 6 हैं।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 29 प्रश्न हैं।
- कृपया प्रश्न शुरू करने से पहले, प्रश्न श्य लिखें।

**MATHEMATICS**  
गणित

Time allowed : 3 hours]

निर्धारित समय : 3 घण्टे]

[Maximum Marks : 100

[अधिकतम अंक : 100

**General Instructions :**

6. All questions are compulsory.
7. The question paper consists of 29 questions divided into four sections – A, B, C and D. Section A comprises 10 questions of one mark each, Section B comprises of 12 questions of four marks each, Section C comprises of 7 questions of six marks each.
8. All questions in Section A are to be answered in one word, one word, one sentence or as per the exact requirement of question.
9. There is no overall choice. However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each, You have to attempt only one of the alternatives in all such questions.
10. Use of calculators is not permitted.

सामान्य निर्देश :

6 सभी प्रश्न अनिवार्य हैं।

7 खण्ड ब में 12 प्रश्न,

8

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- 9 पूर्ण प्रश्नपत्र में विकल्प नहीं है। फिर भी चार अंकों वाले 4 प्रश्नों में तथा छः अंकों वाले 2 प्रश्नों में आन्तरिक विकल्प हैं।  
ही विकल्प करना है।
- 10 कैलकुलेटर्स के प्रयोग की अनुमति नहीं है।

**SECTION A**  
**खण्ड अ**

30. For the determinant  $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ , find the value of  $a_{21}A_{11} + a_{22}A_{12} + a_{23}A_{13}$ ,  $A_{ij}$  is cofactor of element  $a_{ij}$ .

सारणिक  $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$  के लिए  $a_{21}A_{11} + a_{22}A_{12} + a_{23}A_{13}$ , का मान ज्ञात कीजिए जबकि  $A_{ij}$  अवयव  $a_{ij}$  का सहखण्ड है।

2. If the binary operation  $*$ , defined on  $Q$ , is defined as  $a * b = 2a + b - ab$ , for all  $a, b \in Q$ , find the value of  $3 * 4$ .  
\*, समुच्चय  $Q$  पर इस प्रकार परिभाषित है कि  $a * b = 2a + b - ab$ , सभी  $a, b \in Q$  के लिए, तो  $3 * 4$  का मान ज्ञात कीजिए।

3. If  $A = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$ , and  $B = [-2 \quad -1 \quad -4]$ , Find  $(AB)^T$ .

यदि  $A = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$  तथा  $B = [-2 \quad -1 \quad -4]$  तो  $(AB)^T$  का मान ज्ञात कीजिए।

4. If  $|\vec{a}| = \sqrt{3}, |\vec{b}| = 2$  and  $\vec{a} \cdot \vec{b} = \sqrt{3}$  find  $|\vec{a} \times \vec{b}|$ .

यदि  $|\vec{a}| = \sqrt{3}, |\vec{b}| = 2$  तथा  $\vec{a} \cdot \vec{b} = \sqrt{3}$  है, तो  $|\vec{a} \times \vec{b}|$  ज्ञात कीजिए।

5. Is sine function onto in the set of real numbers? Give reasons.

क्या फलन sine वास्तविक संख्याओं के समूह में आच्छादक है? कारण दीजिए।

6. Prove that: सिद्ध कीजिए कि:  $\sin\left(2 \cos^{-1}\left(-\frac{3}{5}\right)\right) = -\frac{24}{25}$ .

7. If  $\vec{a}$  is a unit vector and  $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$ , find  $|\vec{x}|$ .

यदि  $\vec{a}$  एक एकांक सदिश है तथा  $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$ , तो  $|\vec{x}|$  को मान ज्ञात कीजिए।

8. Evaluate : मान ज्ञात कीजिए :  $\int \frac{e^{5 \log e x} - e^{4 \log e x}}{e^{3 \log e x} - e^{2 \log e x}} dx$ .

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

यदि दिया है कि अंतराल  $[0, 2]$  में  $x = 1$  पर फलन  $x^4 - 62x^2 + ax + 9$  उच्चतम मान प्राप्त करता है, तो  $a$  का मान ज्ञात कीजिए।

10. Let  $A = \begin{bmatrix} 3 & 2 & 3 \\ 4 & 5 & 3 \\ 2 & 4 & 5 \end{bmatrix}$ . Express A as sum of two matrices such that one is symmetric and the other is skew symmetric.

माना  $\begin{bmatrix} 3 & 2 & 3 \\ 4 & 5 & 3 \\ 2 & 4 & 5 \end{bmatrix}$  A को ऐसे दो आव्यूहों के योग के रूप में लिखिए जिनमें से एक सममित आव्यूह तथा दूसरा विषम सममित

आव्यूह है। **SECTION B**

**खण्ड ब**

11. Evaluate : मान ज्ञात कीजिए :  $\int \frac{\sin^{-1} \sqrt{x} - \cos^{-1} \sqrt{x}}{\sin^{-1} \sqrt{x} + \cos^{-1} \sqrt{x}} dx$ .

12. Write in the simplest form: सरलतम रूप में लिखिए :  $\tan^{-1} \left[ \frac{\sqrt{1 + \sin x} - \sqrt{1 - \sin x}}{\sqrt{1 + \sin x} + \sqrt{1 - \sin x}} \right]$

or अथवा

IF  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$ , then prove that  $x^2 + y^2 + z^2 + 2xyz = 1$ .

यदि  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$ , तो सिद्ध करो कि  $x^2 + y^2 + z^2 + 2xyz = 1$  .

13. A pair of dice is thrown. Find the probability of getting 7 as a sum, if it is known that second dice always exhibits a prime number

14. Find the foot of the perpendicular drawn from the point A (1,0,3) to the join of the points B(4,7,1) and C(3,5,3).

बिन्दु A (1,0,3) से समरेख बिन्दुओं B(4,7,1) तथा C(3,5,3) पर खींचे गए लम्ब का पाद ज्ञात कीजिए।

15. If  $\hat{i} + \hat{j} + \hat{k}$ ,  $2\hat{i} + 5\hat{j} + 3\hat{k}$  and  $\hat{i} - 6\hat{j} - \hat{k}$  are the position vectors of the points A, B, C and D respectively, find the angle between  $\overline{AB}$  and  $\overline{CD}$ . Deduce that  $\overline{AB}$  and  $\overline{CD}$  are collinear.

or

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Points L, M, N divide the sides BC, CA and AB of triangle ABC in the ratio 1:4, 3:2 and 3:7

respectively. Prove that  $\overline{AL} + \overline{BM} + \overline{CN}$  is a vector parallel to  $\overline{CK}$ , where K divides AB in the ratio 1:3.

यदि  $\hat{i} + \hat{j} + \hat{k}$ ,  $2\hat{i} + 5\hat{j}$ ,  $3\hat{i} + 2\hat{j} - 3\hat{k}$  तथा  $\hat{i} - 6\hat{j} - \hat{k}$  A, B, C तथा D के स्थिति सदिश हैं तो  $\overline{AB}$  तथा  $\overline{CD}$  के

बीच का कोण ज्ञात कीजिए। तर्क द्वारा बताइए कि  $\overline{AB}$  तथा  $\overline{CD}$  सरेख है।

अथवा

बिन्दु L, M, N ABC BC, CA तथा AB 1: 4, 3 : 2 तथा 3 : 7 के अनुपात में बँटते हैं।

सिद्ध कीजिए कि  $\overline{AL} + \overline{BM} + \overline{CN}$  सदिश  $\overline{CK}$  के समान्तर है जबकि K, AB

16. Solve the following differential equation :  $ydx - (x + 2y^2)dy = 0$ .

निम्न अवकल समीकरण हल कीजिए :  $ydx - (x + 2y^2)dy = 0$  ..

or अथवा

Solve the following differential equation: निम्न अवकल समीकरण हल कीजिए :  $(x^3 + x^2 + x + 1) \frac{dy}{dx} = 2x^2 + x$ .

17. Let  $f : \{2, 3, 4, 5\} \rightarrow \{3, 4, 5, 9\}$  and  $g : \{3, 4, 5, 9\} \rightarrow \{7, 11, 15\}$  be functions defined as  $f(2)=3, f(3)=4, f(4)=5, f(5)=5$  and  $g(3)=7, g(4)=7$  and  $g(5)=g(9)=11$ . Find gof. Also find the domain and the range of gof.

मान लीजिए फलन  $f : \{2, 3, 4, 5\} \rightarrow \{3, 4, 5, 9\}$  तथा  $g : \{3, 4, 5, 9\} \rightarrow \{7, 11, 15\}$   $f(2) = 3, f(3) = 4, f(4) = 5, f(5) = 5$  तथा  $g(3) = g(4) = 7$  and  $g(5) = g(9) = 11$

18. Find the intervals in which the function  $f$  given by  $f(x) = 2 \log(x - 2) - x^2 + 4x + 1$  is (i) increasing, (ii) decreasing .

फलन  $f$  जो  $f(x) = 2 \log(x - 2) - x^2 + 4x + 1$ , से दिया है,  $x$  के (i) निम्निष्ठ (ii) उच्चिष्ठ मान ज्ञात कीजिए,।

19. Form the differential equation corresponding to  $y = e^x (a \cos x + b \sin x)$ , where  $a$  and  $b$  are arbitrary constants.

$y = e^x (a \cos x + b \sin x)$  के अवकल समीकरण ज्ञात कीजिए, जहाँ  $a$  तथा  $b$  अचर स्थिरांक हैं।

20. The function  $f$  is given by दिया गया फलन  $f$  है।  $f(x) = \begin{cases} \frac{x-4}{|x-4|} + a & x < 4 \\ a + b & x = 4 \\ \frac{x-4}{|x-4|} + b & x > 4 \end{cases}$

Find the values of  $a$  and  $b$  if  $f$  is continuous at  $x = 4$ .  $a$  तथा  $b$  का मान ज्ञात कीजिए यदि  $x = 4$  पर सतत् है।

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21. Using properties of determinants, prove : 
$$\begin{vmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)(a^2+b^2+c^2) .$$

$$\begin{vmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)(a^2+b^2+c^2) .$$

or / अथवा

If  $A = \begin{bmatrix} \cos \theta & i \sin \theta \\ i \sin \theta & \cos \theta \end{bmatrix}$ , then prove by the principle of mathematical induction that :  $A^n = \begin{bmatrix} \cos n\theta & i \sin n\theta \\ i \sin n\theta & \cos n\theta \end{bmatrix}$ .

यदि  $A = \begin{bmatrix} \cos \theta & i \sin \theta \\ i \sin \theta & \cos \theta \end{bmatrix}$  तो गणितीय आगमन के सिद्धांत द्वारा सिद्ध करो कि :  $A^n = \begin{bmatrix} \cos n\theta & i \sin n\theta \\ i \sin n\theta & \cos n\theta \end{bmatrix}$ .

22. Evaluate : मान ज्ञात कीजिए  $\int_0^{\pi/2} (\sqrt{\tan x} + \sqrt{\cot x}) dx$ .

or / अथवा

Evaluate : मान ज्ञात कीजिए  $\int_{-\pi}^{\pi} \frac{2x(1 + \sin x)}{1 + \cos^2 x} dx$ .

**SECTION C**

खण्ड स

23. Evaluate:  $\int_1^3 (5x^2 - e^{2x-5} + 4) dx$ , as limit of sums.

योगों की कुछ मान विधि द्वारा  $\int_1^3 (5x^2 - e^{2x-5} + 4) dx$ , का मान ज्ञात कीजिए।

24. Use the product  $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$  to solve the following system of equations :

$x - y + 2z = 1 ; 2y - 3z = 1 ; 3x - 2y + 4z = 2 .$

$\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$  के ग :  $x - y + 2z = 1 ; 2y - 3z = 1 ; 3x -$

$2y + 4z = 2 .$  ।

25. Using integration find the area of the region bounded by the parabola  $y^2 \leq 4x$  and the circle  $4x^2 + 4y^2 \leq 9$ .

समाकलन का प्रयोग करते हुए परवलय  $y^2 \leq 4x$   $4x^2 + 4y^2 \leq 9$  के मध्यवर्ती क्षेत्र का क्षेत्रफल ज्ञात कीजिए।

26. An open topped box is to be constructed by removing equal squares from each corner of a 3 metre by 8 metre rectangular sheet of aluminium and folding up the sides. Find the volume of the largest such box. ।

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एल्यूमिनियम की  $3\text{ m} \times 8\text{ m}$  की आयताकार चादर वेफ प्रत्येक कोने से समान वर्ग काटने पर बने एल्यूमिनियम वेफ फलकों को मोड़कर ढक्कन रहित एक संदूक बनाना है। इस प्रकार बने संदूक का अधिकतम आयतन ज्ञात कीजिए।

27. The probability that a student entering a college will graduate is 0.6. find the probability that out of a group of 6 students  
(i) None (ii) At least one (iii) At most 3 will graduate.

(i) (ii) कम से कम एक (iii) अधिक से अधिक 3 विद्यार्थी स्नातक होंगे।।

28. Find the vector equation in the scalar product form, of the plane passing through the points  $(1, 0, -1), (3, 2, 2)$  and parallel to the line  $\vec{r} = i + j + \lambda(i - 2j + 3k)$ .

बिन्दुओं  $(1, 0, -1), (3, 2, 2)$  से जाने वाला समतल जो कि रेखा  $\vec{r} = i + j + \lambda(i - 2j + 3k)$  के समान्तर है, कि अदिश गुणन रूप में सदिश समीकरण लिखिए।

29. A farmer decides to plant upto 10 hectares with cabbages and potatoes. He decides to grow at least 2 but not more than 8 hectares of cabbages and at least 1 but not more than 6 hectares of potatoes. If he can make a profit of ₹ 1500 per hectare on cabbages and ₹ 2000 per hectare on potatoes, how should he plan his farming so as to get the maximum profit? From an LPP and solve it graphically.

उगाने का निश्चय करता है तथा कम से कम 1 हेक्टर तथा अधिक से अधिक 6 हेक्टर क्षेत्र में आलू उगाने का निश्चय करता है। यदि उसे 1500 रु.

की कृषि योजना बनानी चाहिए? एक

(LPP) बनाइए तथा ग्राफ द्वारा इसे हल कीजिए।।

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**Think only of the best ,**

**work only for the best ,**

**and expect only the best .**

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