MATHEMATICS (PART – I)

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BOARD'S QUESTION PAPER (MARCH 2021)

Time : 2 Hours] **[Total Marks : 40**

[**NOTE :** This examination was not conducted due to Covid-19.]

MATHEMATICS (PART – I)

BOARD'S QUESTION PAPER (SEPTEMBER 2021)

(With Full Solution)

Time : 2 Hours] **[Total Marks : 40**

Note : *(i)* ***All*** *questions are compulsory.*

(ii) Use of calculator is ***not*** *allowed.*

(iii) The numbers to the right of the questions indicate full marks.

(iv) In case of MCQ's [Q. No. ***1(A)****], only the first attempt will be evaluated and will be given credit.*

(v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the alphabet of it : **4**

(i) Which of the following number cannot represent a probability?

(A) $\frac{2}{3}$ (B) 1.5 (C) 15% (D) 0.7

(ii) Find the value of the common difference for an A.P. $-10, -6, -2, 2, \ldots$.

(A) -16 (B) -4 (C) 4 (D) 16

(iii) Which of the following quadratic equation has roots 3, 5?

(A) $x^2 - 15x + 8 = 0$ (B) $x^2 - 8x + 15 = 0$

(C) $x^2 + 3x + 5 = 0$ (D) $x^2 + 8x - 15 = 0$

(iv) Find the value of $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$.

(A) -22 (B) 2 (C) 22 (D) -2

Q. 1. (B) Solve the following subquestions : **4**

(i) Decide whether the equation $m^3 - 5m^2 + 4 = 0$ is a quadratic equation or not. Justify.

(ii) For a given A.P., $a = 3.5$, $d = 0$, then find t_n.

(iii) If $x + 2y = 5$ and $2x + y = 4$, then find the value of $x + y$.

(iv) If two coins are tossed simultaneously, write the sample space.

Q. 2. (A) Complete and write *any two* activities from the following : **4**

(i) First term and common difference of an A.P. are 6 and 3 respectively. Complete the following activity to find S_{27}.

Activity :

$a = 6$, $d = 3$, $S_{27} = ?$

$$S_n = \frac{n}{2}\left[\boxed{} + (n-1) \times d\right]$$

$$\therefore \quad S_{27} = \frac{27}{2}\left[12 + (27-1) \times \boxed{}\right]$$

$$\therefore \quad S_{27} = \frac{27}{2} \times \boxed{}$$

$$\therefore \quad S_{27} = 27 \times 45$$

$$\therefore \quad S_{27} = \boxed{}.$$

(ii) To draw the graph of $4x + 5y = 19$, complete the following activity to find y, when $x = 1$.

Activity : $4x + 5y = 19$

$\therefore\ 4 \times \boxed{} + 5y = 19$

$\therefore\ 5y = 19 - \boxed{}$

$\therefore\ y = \dfrac{\boxed{}}{5}$

$\therefore\ y = \boxed{}$

(iii) A die is rolled. Complete the following activity to find the probability of getting a prime number on the upper face of the die.

Activity : S is the sample space for a die rolled.

$\therefore\ S = \left\{\boxed{}\right\}. \quad \therefore n(S) = 6$

Event A : To get prime number on the upper face.

$\therefore\ A = \left\{\boxed{}\right\}. \quad \therefore n(A) = 3$

$P(A) = \dfrac{\boxed{}}{n(S)}$ ... (Formula)

$\therefore P(A) = \dfrac{3}{6} \quad \therefore\ P(A) = \dfrac{1}{\boxed{}}$

Q. 2. (B) Solve *any four* subquestions from the following : **8**

(i) Determine the nature of the roots of the quadratic equation $2x^2 - 5x + 7 = 0$ by using discriminant.

(ii) Solve the following simultaneous equations :

$5x + 4y = 17$, $4x + 5y = 10$.

(iii) A box contains 5 strawberry chocolates, 6 coffee chocolates and 2 peppermint chocolates. Find the probability that the chocolate picked at random from the box is a coffee chocolate.

(iv) For simultaneous equations in variables x and y, if $D_x = 49$, $D_y = -63$ and $D = 7$, then find the value of x and y.

(v) Find the 24th term of the A.P., 12, 16, 20, 24, ...

Q. 3. (A) Complete and write *any one* activity from the following : 3

(i) A two-digit number is to be formed from the digits 2, 3, 5 without repetition of the digits. Complete the following activity to find the probability that the number so formed is an odd number.

Activity : Let S be the sample space.

$\therefore S = \{23, 25, 32, \square, 52, 53\}$

$\therefore n(S) = \square$

Now condition of event A is that number so formed is an odd number.

$\therefore A = \{23, 25, \square, 53\}$ $\quad \therefore n(A) = 4$

$P(A) = \dfrac{\square}{n(S)}$ ... (Formula)

$\therefore P(A) = \dfrac{\square}{6}$

$\therefore P(A) = \dfrac{\square}{3}$

(ii) If $x = 5$ is a root of the quadratic equation $kx^2 - 14x - 5 = 0$, then find the value of k by completing the following activity.

Activity :

One of the roots of quadratic equation $kx^2 - 14x - 5 = 0$ is 5.

$\therefore$ substituting $x = \square$ in the above equation,

$k\square^2 - 14 \times 5 - 5 = 0$

$\therefore \square k - 70 - 5 = 0$

$\therefore 25k = \square$

$\therefore k = \dfrac{75}{\square}$

$\therefore k = \square$.

Q. 3. (B) Attempt *any two* subquestions from the following : 6

(i) In an A.P., the sum of three consecutive terms is 27 and their product is 504. Find the terms.

[Assume that three consecutive terms in A.P. are $(a - d, a, a + d.)$]

(ii) Solve the following simultaneous equations, using Cramer's rule.

$4m + 6n = 54$; $3m + 2n = 28$.

(iii) A die is rolled and a coin is tossed simultaneously. Write the sample space S and the number of sample points $n(S)$. Also write the events A and B in set form and their number of sample points according to the given conditions :

(a) Condition for event A : To get a head or a tail on the coin and a number divisible by 3 on the upper face of die.

(b) Condition for event B : To get a number on the upper face of die greater than 7 and a head on the coin.

(iv) Solve the following simultaneous equations graphically :

$x+y=7, x-y=-1.$

Q. 4. Attempt *any two* subquestions from the following : **8**

(i) Out of the total students of class 10th, $\frac{7}{2}$ times the square root of total number of students are playing on the ground and the remaining 2 students are studying in the classroom. Find the total number of students in class 10th.

(ii) When one is added to the numerator as well as the denominator of a certain fraction, it becomes $\frac{1}{2}$ and if one is subtracted from the numerator and denominator both, the fraction becomes $\frac{1}{3}$. Find the original fraction.

(iii) In an A.P., 16, 14, 12, ... , the sum of how many terms is 60? Write these terms with all possibilities.

Q. 5. Attempt *any one* subquestion from the following : **3**

(i) For a quadratic equation in variable m, the coefficients a, b, and c are such that $a=2$, $b=4a$, $c=3a$.

Form the quadratic equation and solve it by factorisation method.

(ii) Write any one arithmetic progression with common difference 5. Find its nth term and the sum of first n terms.

SOLUTION : BOARD'S QUESTION PAPER (SEPTEMBER 2021)

Q. 1. (A) (i) (B)

(ii) (C)

(iii) (B)

(iv) (D)

Hints : Only for guidance. Students are not expected to write this.

(i) The probability cannot be greater than 1.

(ii) $d = -6 - (-10) = -6 + 10 = 4$.

(iii) $\alpha + \beta = 3 + 5 = 8 = \frac{-b}{a}$, $\alpha\beta = 3 \times 5 = 15 = \frac{c}{a}$

(iv) $2 \times 5 - 3 \times 4$

Q. 1. (B) **(i)** The given equation is not a quadratic equation.

The maximum index of the variable is not 2.

(ii) Here, $a = 3.5$, $d = 0$, $t_n = ?$

$t_n = a + (n-1)d$ $\quad \therefore t_n = 3.5 + (n-1) \times 0$ $\quad \therefore t_n = \mathbf{3.5.}$

(iii) $x + 2y = 5$ ... (1)

$2x + y = 4$ ... (2)

$3x + 3y = 9$ ... [Adding equations (1) and (2)]

$\therefore x + y = \mathbf{3}$ ... (Dividing both the sides by 3).

(iv) The sample space $S = \{HH, HT, TH, TT\}$.

Q. 2. (A) **(i)** **Activity :**

$a = 6$, $d = 3$, $S_{27} = ?$

$S_n = \frac{n}{2}[\boxed{2a} + (n-1)d]$

$\therefore S_{27} = \frac{27}{2}[12 + (27-1) \times \boxed{3}]$

$\therefore S_{27} = \frac{27}{2} \times \boxed{90}$

$\therefore S_{27} = 27 \times 45$

$\therefore S_{27} = \boxed{1215}$

$12 + (27-1) \times 3$
$= 12 + 26 \times 3$
$= 12 + 78$
$= 90$

(ii) Activity :

$4x + 5y = 19$

$\therefore\ 4 \times \boxed{\mathbf{1}} + 5y = 19$

$\therefore\ 5y = 19 - \boxed{\mathbf{4}}$

$\therefore\ y = \dfrac{\boxed{\mathbf{15}}}{5}$

$\therefore\ y = \boxed{\mathbf{3}}$

(iii) Activity :

S is the sample space for a die rolled.

$\therefore\ S = \{\boxed{\mathbf{1, 2, 3, 4, 5, 6}}\}$ $\quad\therefore\ n(S) = 6$

Event A : To get prime number on the upper face.

$A = \{\boxed{\mathbf{2, 3, 5,}}\}$ $\quad\therefore\ n(A) = 3$

$P(A) = \dfrac{\boxed{\boldsymbol{n(A)}}}{n(S)}$ ... (Formula)

$\therefore\ P(A) = \dfrac{3}{6}$

$\therefore\ P(A) = \dfrac{1}{\boxed{\mathbf{2}}}$

Q. 2. (B) (i) Solution :

Comparing $2x^2 - 5x + 7 = 0$ with $ax^2 + bx + c = 0$,

we get, $a = 2$, $b = -5$, $c = 7$.

$\Delta = b^2 - 4ac = (-5)^2 - 4(2)(7)$

$= 25 - 56$

$= -31$

Here, $\Delta < 0$

Ans. The roots of the given quadratic equation are **not real.**

(ii) Solution :

$5x + 4y = 17$ ... (1)

$4x + 5y = 10$ ... (2)

Adding equations (1) and (2),

$5x + 4y = 17$ ... (1)

$4x + 5y = 10$ ... (2)

$9x + 9y = 27$

$\therefore\ x + y = 3$ ... (Dividing both the sides by 9) ... (3)

Subtracting equation (2) from equation (1),

$$5x + 4y = 17 \quad \text{... (1)}$$

$$-\underline{4x \underset{-}{+} 5y = \underset{-}{10}} \quad \text{... (2)}$$

$$x - y = 7 \quad \text{... (4)}$$

Adding equations (3) and (4),

$$x + y = 3 \quad \text{... (3)}$$

$$\underline{x - y = 7} \quad \text{... (4)}$$

$$2x = 10 \qquad \therefore x = 5$$

Substituting $x = 5$ in equation (3),

$5 + y = 3 \qquad \therefore y = 3 - 5 \qquad \therefore y = -2$

Ans. $(x, y) = (\mathbf{5, -2})$ is the solution.

(iii) Solution :

Let the sample space be S.

$n(S) = (5 + 6 + 2) = 13.$

Let A be the event that the chocolate picked is a coffee chocolate

$\therefore n(A) = 6$

$$P(A) = \frac{n(A)}{n(S)} \qquad \therefore P(A) = \frac{6}{13}$$

Ans. The probability that the chocolate picked is a coffee chocolate is $\mathbf{\frac{6}{13}}$.

(iv) Solution :

$D_x = 49$, $D_y = -63$ and $D = 7$.

$$x = \frac{D_x}{D} = \frac{49}{7} \qquad \therefore x = 7$$

$$y = \frac{D_y}{D} = \frac{-63}{7} \qquad \therefore y = -9$$

Ans. The value of x and y are **7** and **−9** respectively.

(v) Solution :

$a = 12$, $d = 16 - 12 = 4$, $t_{24} = ?$

$$t_n = a + (n - 1)d \quad \text{... (Formula)}$$

$$\therefore t_{24} = 12 + (24 - 1) \times 4 \quad \text{... (Substituting the values)}$$

$$= 12 + 23 \times 4$$

$$= 12 + 92$$

$$= 104.$$

Ans. The 24th term of the A.P. is **104.**

Q. 3. (A) (i) Activity :

Let S be the sample space.

$S = \{23, 25, 32, \boxed{\mathbf{35}}, 52, 53\}$ $\therefore\ n(S) = \boxed{\mathbf{6}}$

Event A : The number so formed is an odd number.

$\therefore\ A = \{23, 25, \boxed{\mathbf{35}}, 53\}$ $\therefore\ n(A) = 4.$

$P(A) = \dfrac{\boxed{n(A)}}{n(S)}$ ... (Formula)

$\therefore\ P(A) = \dfrac{\boxed{4}}{6}$ $\therefore\ P(A) = \dfrac{\boxed{2}}{3}$

(ii) Activity :

One of the roots of the quadratic equation

$kx^2 - 14x - 5 = 0$ is 5.

Substituting $x = \boxed{\mathbf{5}}$ in the above equation,

$k\,\boxed{\mathbf{5}}^2 - 14 \times 5 - 5 = 0$

$\therefore\ \boxed{\mathbf{25}}\,k - 70 - 5 = 0$

$\therefore\ 25k = \boxed{\mathbf{75}}$

$\therefore\ k = \dfrac{75}{\boxed{\mathbf{25}}}$

$\therefore\ k = \boxed{\mathbf{3}}$

Q. 3. (B) (i) Solution :

Let the three consecutive terms in the given A.P. be

$a - d,\ a,\ a + d$

From the first condition,

$(a - d) + a + (a + d) = 27$

$\therefore\ 3a = 27$ $\therefore\ a = 9$

From the second condition,

$(a - d) \times a \times (a + d) = 504$

$\therefore\ (9 - d) \times 9 \times (9 + d) = 504$ ... (Substituting $a = 9$)

$\therefore\ (9 - d) \times (9 + d) = \dfrac{504}{9}$

$\therefore\ 81 - d^2 = 56$

$\therefore\ 81 - 56 = d^2$

$\therefore\ d^2 = 25$ $\therefore\ d = \pm 5$

When $d = 5$, the three consecutive terms are

$a - d = 9 - 5 = 4,\ a = 9,\ a + d = 9 + 5 = 14$

When $d = -5$, the three consecutive terms are

$a - d = 9 - (-5) = 9 + 5 = 14,\ a = 9,\ a + d = 9 + (-5) = 4$

Ans. The three consecutive terms of the A.P. are **4, 9, 14** or **14, 9, 4.**

(ii) Solution :

$4m + 6n = 54$. Here, $a_1 = 4$, $b_1 = 6$, $c_1 = 54$

$3m + 2n = 28$. Here, $a_2 = 3$, $b_2 = 2$, $c_2 = 28$

$$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = \begin{vmatrix} 4 & 6 \\ 3 & 2 \end{vmatrix} = 4 \times 2 - 6 \times 3$$
$$= 8 - 18 = -10$$

$$D_m = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} = \begin{vmatrix} 54 & 6 \\ 28 & 2 \end{vmatrix} = 54 \times 2 - 6 \times 28$$
$$= 108 - 168 = -60$$

$$D_n = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = \begin{vmatrix} 4 & 54 \\ 3 & 28 \end{vmatrix} = 4 \times 28 - 54 \times 3$$
$$= 112 - 162 = -50$$

By Cramer's rule,

$$m = \frac{D_m}{D} = \frac{-60}{-10} = 6 \text{ and } n = \frac{D_n}{D} = \frac{-50}{-10} = 5$$

Ans. $(m, n) = (\mathbf{6, 5})$ is the solution.

(iii) Ans.

If a die is rolled and a coin is tossed simultaneously, the sample space

$S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$

$\therefore n(S) = 12$

(a) Condition for event A : To get a head or a tail on the coin and a number divisible by 3 on the upper face of the die.

$\therefore A = \{H3, H6\ T3, T6\}$ $\quad\quad \therefore n(A) = 4$

(b) Condition for event B : To get a number on the upper face of the die greater than 7 and a head on the coin.

$\therefore B = \{\quad\}$ $\quad\quad \therefore n(B) = 0.$

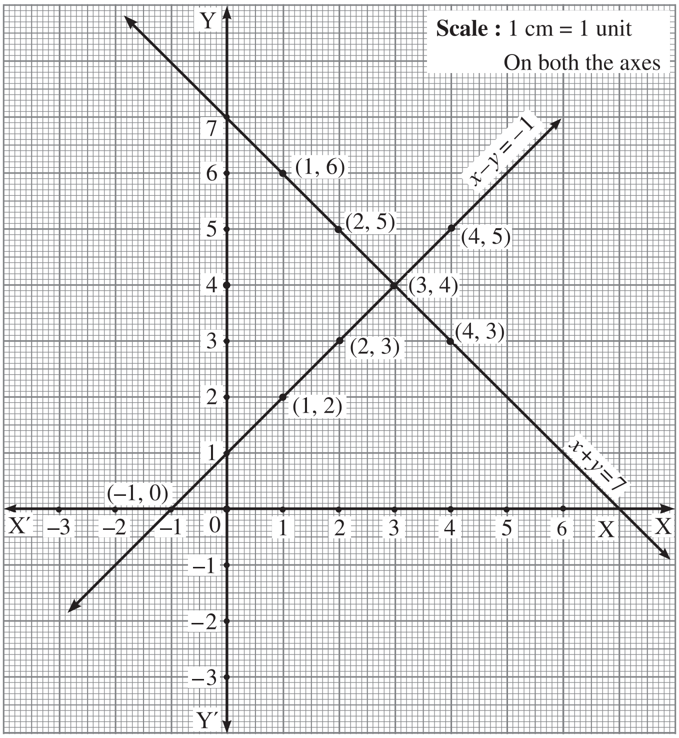
(iv) Solution :

$x + y = 7 \quad\quad \therefore y = 7 - x$

x	1	2	3	4
y	6	5	4	3
(x, y)	(1, 6)	(2, 5)	(3, 4)	(4, 3)

$x - y = -1 \quad\quad \therefore y = x + 1$

x	-1	1	2	4
y	0	2	3	5
(x, y)	$(-1, 0)$	(1, 2)	(2, 3)	(4, 5)



The coordinates of the point of intersection are (3, 4).

Ans. The solution of the given simultaneous equations is $x = \mathbf{3}$**,** $y = \mathbf{4}$**.**

Q. 4. (i) Solution :

Let the number of students of class 10th be x.

From the first condition, the number of students playing on the ground $= \frac{7}{2}\sqrt{x}$.

The remaining two students are studying in the classroom.

$\therefore\ x = \frac{7}{2}\sqrt{x} + 2.$

$\therefore\ x - 2 = \frac{7}{2}\sqrt{x}$

$\therefore\ (x-2)^2 = (\frac{7}{2}\sqrt{x})^2$ ... (Squaring both the sides)

$\therefore\ x^2 - 4x + 4 = \frac{49x}{4}$

$\therefore\ 4x^2 - 16x + 16 = 49x$ ... (Multiplying both the sides by 4)

$\therefore\ 4x^2 - 16x - 49x + 16 = 0$

$\therefore\ 4x^2 - 65x + 16 = 0.$

$\therefore\ 4x^2 - 64x - x + 16 = 0$

$\therefore\ 4x(x-16) - 1(x-16) = 0$

$\therefore\ (x-16)(4x-1) = 0$

$\therefore\ x - 16 = 0$ or $4x - 1 = 0$

$\therefore\ x = 16$ or $x = \frac{1}{4}$

$4 \times 16 = 64$

$-64 \quad -1$

But the number of students cannot be in fraction.

$\therefore\ x = \frac{1}{4}$ is unacceptable.

$\therefore\ x = 16$

Ans. The total number of students in class 10th is **16.**

(ii) Solution :

Let the numerator of the fraction be x and its denominator be y

From the first condition,

$\frac{x+1}{y+1} = \frac{1}{2}$

$\therefore\ 2(x+1) = y+1$

$\therefore\ 2x + 2 = y + 1$

$\therefore\ 2x - y = -1$ ... (1)

From the second condition,

$\frac{x-1}{y-1} = \frac{1}{3}$

$\therefore\ 3(x-1) = y-1$

$\therefore\ 3x - 3 = y - 1$

$\therefore\ 3x - y = -1 + 3$

$\therefore\ 3x - y = 2$ ... (2)

Subtracting equation (1) from equation (2),

$$\begin{array}{rcl} 3x - y &=& 2 \quad \text{... (2)} \\ 2x - y &=& -1 \quad \text{... (1)} \\ - \quad + & & + \\ \hline x \quad\quad &=& 3 \end{array}$$

Substituting $x = 3$ in equation (1),

$2(3) - y = -1$ $\therefore\ 6 - y = -1$ $-y = -1 - 6$

$\therefore\ -y = -7$ $\therefore\ y = 7$

The numerator x is 3 and the denominator y is 7.

Ans. The original fraction is $\mathbf{\frac{3}{7}}$.

(iii) Solution :

Here, $a = 16$, $d = 14 - 16 = -2$, $S_n = 60$

$S_n = \frac{n}{2}\ [2a + (n-1)d]$ ... (Formula)

$\therefore\ 60 = \frac{n}{2}\ [2 \times 16 + (n-1) \times (-2)]$ ... (Substituting the values)

$\therefore\ 60 = \frac{n}{2}\ [32 - 2n + 2]$

$\therefore\ 60 = \frac{n}{2}\ [2(17 - n)]$

$\therefore\ 60 = n\ (17 - n)$

$\therefore\ 60 = 17n - n^2$

$\therefore\ n^2 - 17n + 60 = 0$

$\therefore\ n^2 - 5n - 12n + 60 = 0$

$\therefore\ n(n - 5) - 12(n - 5) = 0$

$\therefore\ (n - 5)\ (n - 12) = 0$

$\therefore\ n - 5 = 0$ or $n - 12 = 0$

$\therefore\ n = 5$ or $n = 12$

Ans. For $n = 5$, the terms are **16, 14, 12, 10, 8.**

For $n = 12$, the terms are **16, 14, 12, 10, 8, 6, 4, 2, 0, − 2, − 4, − 6.**

Q. 5. (i) Solution :

$a = 2$, $b = 4a$, $c = 3a$

$b = 4a = 4 \times 2 = 8$

$c = 3a = 3 \times 2 = 6$

The quadratic equation in variable m is

$am^2 + bm + c = 0$

$\therefore\ 2m^2 + 8m + 6 = 0$ ... (Substituting the values of a, b and c)

$\therefore\ m^2 + 4m + 3 = 0$ ... (Dividing by 2)

$\therefore\ m^2 + m + 3m + 3 = 0$

$\therefore\ m(m + 1) + 3(m + 1) = 0$

$\therefore\ (m + 1)\ (m + 3) = 0$

$\therefore\ m + 1 = 0$ or $m + 3 = 0$

$\therefore\ m = -1$ or $m = -3$

Ans. **− 1, − 3** are the roots.

(ii) Solution :

Let the value of $a\,(t_1)$ be 3, $d = 5$, $t_n = ?$ $S_n = ?$

The A.P. is 3, 8, 13, ... n

$t_n = a + (n - 1)\ d$ ... (Formula)

$= 3 + (n - 1) \times 5$ ... (Substituting the values)

$= 3 + 5n - 5$

$\therefore\ t_n = 5n - 2$ ... (1)

$S_n = \frac{n}{2} [t_1 + t_n]$ ... (Formula)

$= \frac{n}{2} (3 + 5n - 2)$ ... (Substituting the values)

$= \frac{n}{2} (5n + 1)$

$\therefore S_n = \frac{n(5n + 1)}{2}$

Ans. The *n*th term is $\mathbf{5n - 2}$.

The sum of the first *n* terms is $\mathbf{\frac{n(5n + 1)}{2}}$.

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