P-8				
PRE BOARD - I				
Set: B	**Class: XII**	**Subject & Code: - Maths (041)**	**Time: 3:00 Hrs**	**M.M.: 80**

General Instructions:

(i) This Question paper contains **38** questions. **All** questions are **compulsory.**

(ii) This Question paper is divided into **five** Sections - **A, B, C, D** and **E.**

(iii) In **Section A**, Questions no. **1** to **18** are **multiple choice questions (MCQs)** and Questions no. **19** and **20** are **Assertion-Reason based** questions of **1 mark each**.

(iv) In **Section B,** Questions no. **21** to **25** are **Very Short Answer (VSA)-type** questions, carrying **2 marks each**.

(v) In **Section C,** Questions no. **26** to **31** are **Short Answer (SA)-type** questions, carrying **3 marks each**.

(vi) In **Section D,** Questions no. **32** to **35** are **Long Answer (LA)-type** questions, carrying **5 marks each**.

(vii) In **Section E,** Questions no. **36** to **38** are **Case study-based questions,** carrying **4 marks each.**

(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.

(ix) Use of calculators is **not** allowed.

Section A

This section consists of 18 MCQs and 2 Assertion-Reasoning Based Questions of 1 mark each

1. If a matrix A = $\begin{pmatrix} 0 & k & -2 \\ 3 & 0 & 3 \\ 2 & -3 & 0 \end{pmatrix}$ is a singular matrix. Then the value of k is
   A) -3
   B) 3
   C) all real values
   D) None of these
2. The number of square matrices or order 3 x 3 whose every entry is

either -1 or 3 is
A) 9
B) 18
C) 512
D) None of these

3. Function f(x) = $\frac{1}{3}x^3 + \frac{1}{2}x^2 + x - 102$ is
   A) Increasing
   B) Strictly increasing
   C) Decreasing
   D) Strictly decreasing
4. If |A| = 4 where A is a square matrix of order 3, then the value of |adj A| + |A^I| is
   A) 64
   B) 12
   C) 20
   D) None of these
5. Integrating factor of the differential equation $\frac{dy}{dx} + \frac{y}{x} = logx$ is
   A) log x
   B) x
   C) e^x
   D) None of these
6. The diagonal elements of a skew-symmetric matrix are
   A) 0
   B) 1
   C) -1
   D) None of these
7. If a matrix A = $\begin{pmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{pmatrix}$ is a symmetric matrix. Then the correct statement from the following is
   A) ab = 1
   B) ab = -1
   C) a + b = $\frac{5}{6}$
   D) a + b = $-\frac{13}{6}$
8. In a single throw of a die, A = event of getting odd numbers and B = event of getting prime numbers, then
   A) A and B are independent events
   B) A and B are not independent events

C) $P(A|B) = \frac{1}{3}$

D) None of these

9. Projection of the vector $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 4\hat{k}$ on the vector $\vec{b} = 2\hat{\imath} - 3\hat{\jmath} - \hat{k}$ is

A) 0

B) $\frac{2\sqrt{14}}{7}$

C) 4

D) None of these

10. If $|\vec{a} \times \vec{b}| = 4$, $\vec{a} \cdot \vec{b} = 3$ and $|\vec{b}| = 5$, then $\vec{a}$ is

A) A zero vector

B) Vector with magnitude 2 units

C) A unit vector

D) None of these

11. In a linear programming problem, feasible region is the region where

A) All possible solutions satisfying all the constraints of the problems exist.

B) Only optimal solution exist

C) Only non-negative solutions exist

D) None of these

12. $\int \frac{2^x - 3^x}{5^x} dx$ is

A) $\frac{2^x log2 - 3^x log3}{5^x log5} + C$

B) $\left(\frac{2}{5}\right)^x \log\left(\frac{2}{5}\right) - \left(\frac{3}{5}\right)^x \log\left(\frac{3}{5}\right) + C$

C) $\left(-\frac{1}{5}\right)^x \log\left(\frac{1}{5}\right) + C$

D) None of these

13. $\int_{-3}^{3} x^7 cosx dx$ is

A) 0

B) 1

C) – 1

D) None of these

14. General solution of the differential equation x dx + y dy = 0 is a

A) Parabola

B) Circle

C) Hyperbola

D) Ellipse

15. Domain of $y = \sin^{-1}(2x - 1)$ is
    A) [– 1, 1]
    B) [0, 2]
    C) [0, 1]
    D) None of these
16. The corner points of the feasible region of an LPP are (0,4),(0.6,1.6) and (3,0) . The minimum value of the objective function z = 4x + 6y occurs at
    A) (0.6, 1.6) only
    B) (3, 0) only
    C) (0.6, 1.6) and (3, 0) only
    D) at every point of the line segment joining points (3, 0) & (0.6, 1.6)
17. The relation described by R = {(a, b) : a and b are natural numbers Such that a ≤ b} is
    A) Equivalence relation
    B) Not reflexive
    C) Not symmetric
    D) Not transitive
18. Area of the region bounded by x-axis, $x^2 = 12y$ and the line x = 3 in the first quadrant is
    A) $\frac{3}{4}$ sq units
    B) 9 sq units
    C) 4.5 sq units
    D) None of these

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).**

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

19. **Assertion(A):** f(x) = [x] is not differentiable at integral points.
    Reason(R): If a function is not differentiable at a point, then it is not continuous thereat.

20. **Assertion(A):** f(x) = x^4, where x is any prime number is one-one function.
Reason(R): A function is one – one if $f(x_1) = f(x_2) \Rightarrow x_1 = x_2$ for all $x_1, x_2 \in$ domain

Section B
This section consists of 5 very short answer type (VSA) of 2 marks each

21. Simplify: $\tan^{-1}\left(\frac{1-sin\theta}{cos\theta}\right)$
22. Find the rate of change in area of a circle with respect to its radius when the radius is 10 cm.
23. Find the derivative of $\tan^{-1} x$ with respect to $\sin^{-1} x$, x$\in [-1,1]$

OR

Find $\frac{d^2y}{dx^2}$ if $x = a(1 + cos\theta)$ and $y = a(\theta + sin\theta)$

24. Let, α, β and γ be the angles made by a vector with the three co-ordinate axes. Find the value of $\cos^2\alpha + \cos^2\beta + \cos^2\gamma$.

OR

If $\vec{a}, \vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the angle between the vectors $\vec{a}$ and $\vec{b}$.

25. Find the unit vector which is perpendicular to the vectors $3\hat{\imath} - \hat{\jmath}$ and $\hat{\imath} + 2\hat{\jmath} - 5\hat{k}$.

Section C
This section consists of 6 short answer type (SA) of 3 marks each

26. The volume of a cube is increasing at a constant rate. Prove that the increase in surface area varies inversely as the length of the edge of the cube.
27. Show that $y = \frac{4sin\theta}{2+cos\theta} - \theta$ is an increasing function of θ in $\left[0, \frac{\pi}{2}\right]$.
28. Find the value of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles.

OR

Find the value of k if the points (k, – 10, 3), (1, –1, 3) and (3, 5, 3) are collinear.

29. Evaluate the integral: $\int \frac{x^2}{(x^2+1)(x^2+5)}\,dx$

OR

Evaluate the integral: $\int_0^2 (2-x)^m \, x \, dx$

30. Determine the maximum value of z =11x + 7y subject to the constraints
$2x + y \leq 6, x \leq 2, x \geq 0, y \geq 0$

31. Two dice are thrown together and the total score is noted. The events E, F and G are defined as 'a total score of 4', 'a total score of 9 or more' and 'a total score divisible by 5' respectively. Calculate P(E), P(F) and P(G) and decide which pairs of events are independent.

OR

Find the probability distribution of the number of heads in a single throw of four unbiased dice simultaneously.

Section D

This section consists of 4 long answer type (LA) of 5 marks each

32. Find the area of the region bounded by the ellipse $\frac{x^2}{16}+\frac{y^2}{9}$ =1 using integration.

33. An amount of ₹ 5000 is put into three investments at the rate of interest of 6%,7% and 8% per annum respectively. The total annual interest is ₹ 358. If the combined interest from the first two investments is ₹ 70 more than the interest from the third, find the amount of each investment by matrix method.

34. Examine the continuity of the function at the point x = 1 and differentiability at x = 2 given below:

$$f(x) = \begin{cases} 5x-4 & ; \quad 0 < x < 1 \\ 4x^2 - 3x & ; \quad 1 \leq x < 2 \\ 3x+4 & ; \quad x \geq 2 \end{cases}$$

OR

If x = sin t and y = sin pt, prove that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$.

35. Find the distance between the line $\frac{x}{2} = \frac{2y-6}{4} = \frac{1-z}{-1}$ and another line parallel to it which passes through the point (4, 0, –5).

OR

Find the image of the point (1, 6, 3) in the line $\vec{r} = (\hat{j} + 2\hat{k}) + \lambda(\hat{\imath} + 2\hat{j} + 3\hat{k})$, where λ is a scalar. Also, find the distance of the image from the y-axis.

Section E

This section consists of 3 case study based questions of 4 marks each

36. Case study – 1

A potter made a mud vessel where the shape of the pot is based on f(x) = |x – 3| + |x – 2|, where f(x) represents the height of the pot.

(A) When x > 4, what will be the height of the pot in terms of x? **1 mark**

(B) Will the slope of the pot vary with the value of x? **1 mark**

(C) What is $\frac{dy}{dx}$ at x = 3? **2 marks**

OR

Will the potter be able to make a pot using the function f(x) =[x]?

37. **Case study - 2**

Students of Grade 12, planned to plant saplings along straight lines, parallel to each other to one side of the playground ensuring that they had enough play area. Let us assume that they planted one of the rows of the sapling along the line y = x – 4. Let, L be the set of all lines which are parallel on the ground and R be a relation on L.

Based on the given information, answer the following questions:

(A) Let, f: R → R be defined by f(x) = x – 4, then find the range of f(x). **1 mark**

(B) Is f one-one? **1 mark**

(C) Let, R = {(L_1, L_2): L_1 || L_2 where L_1, $L_2 \in$ L}. **2 marks**

Show that R is an equivalence relation.

OR

Write the equivalence class of the line 3x – 4y = 5

38. **Case study - 3**

Jyoti CNC is the largest CNC (Computer Numerical Control) machine

manufacturing company of India. Their unit in Bhubaneswar, Odisha has three machine operators A, B and C. The operators supervise the machines while they execute the task and make any necessary adjustments to produce a better result. Their focus is to minimize defects as it increased the cost of operations.

The first operator A produces 1% defective items, whereas the other two operators B and C produces 5% and 7% defective items respectively. Job times of operators are as under:

Machine operators	% of the time on the job
A	50 %
B	30 %
C	20 %

Based on the given information, answer the following questions:

(A) What is the conditional probability that the defective item is produced by the operator A? **2 marks**

(B) The factory in charge wants to do a quality check. During inspection he picks an item from the stockpile at random. If the chosen item is defective, then what is the probability that it is not produced by the operator C? **2 marks**

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