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PRE-BOARD EAMINATION SET-C
Class XII Session 2025-26
Mathematics (Code-041)

Time: 3 hours **Maximum marks: 80**

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This Question paper contains five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub-parts.

Section – A
(Multiple Choice Questions. Each question carries 1 mark)

Q1. The function $f: R \to R$ defined by $f(x) = (x-1)(x-2)(x-3)$ is

a) One -one but not onto
b) Both one-one and onto
c) Onto but not one-one
d) Neither one-one nor onto

Q2. If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then A^{2025} is equal to

a) $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$
b) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
c) $\begin{bmatrix} 0 & 2025 \\ 0 & 0 \end{bmatrix}$
d) None of these

Q3. If A and B are square matrices of order 3 such that $AB = 6I$ *and* $|A| = 18$, then $|B|$ equals

a) 12 b) 6 c) 18 d) 3

Q4. If $|A| = 4$, where A is a 2×2 matrix, then $|8A^{-1}|$ equals

a) 4 b) 16 c) 8 d) $\frac{1}{24}$

Q5. The derivative of $\cos^{-1}(1-2x^2)$ $w.r.t$ $\sin^{-1} x$ is

a) $\frac{1}{x}$ b) $\frac{1}{\sqrt{1-x^2}}$ c) 2 d) None of these

Q6. If matrix $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $A^2 = kA$, then the value of k is

a)1 b) -2 c)-1 d) 2

Q7. The sides of an equilateral triangle is increasing at a rate of 2cm/sec. The rate at which area increases, when side is 10cm is

a)$100cm^2/sec$ b) $\sqrt{3}cm^2/sec$ c) $10cm^2/sec$ d)$10\sqrt{3}cm^2/sec$

Q8. The area bounded by the curve $y = x^3$, the $x - axis$ and the ordinates $x = -1$ and $x = 1$ is

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{1}{2}$ d) $\frac{1}{4}$

Q9.$\int 4^x 3^x \, dx \; equals$

a) $\frac{4^x}{log4}$ +c b) $\frac{12^x}{log12}$ +c c) $\frac{4^x.3^x}{log4\, log3}$ +c d) $\frac{3^x}{log3}$ +c

Q10. $\int \frac{secx}{secx-tanx} dx$ equals

a) $secx - tanx + c$ c) $secx + tanx + c$

b) $tanx - secx + c$ d) $-(secx + tanx) + c$

Q11. The degree of the differential equation $\left\{1 + (\frac{dy}{dx})^2\right\}^{\frac{3}{2}} = \frac{d^2y}{dx^2}$ is

a)4 b) $\frac{3}{2}$ c) 2 d) Not defined

Q12. The solution of the differential equation $tanysec^2xdx + tanxsec^2ydy = 0$ is

a) $tanx + tany = k$ b) $tanx - tany = k$

$c) \frac{tanx}{tany} = k$ d) $tanx\, tany = k$

Q13. The domain of the function $f(x) = \cos^{-1} x + \sin x$ is

$a)\ [-1,1]$ b) $[0,1]$ c)$(-\infty, \infty)$ d) None of these

Q14. If $|\vec{a}| = 6, |\vec{b}| = 5, \quad \vec{a}.\vec{b} = 18$ then $|\vec{a} \times \vec{b}|$is

a)8 b) 10 c) 12 d) 24

Q15. The point which lies in the half plane $2x + y \leq 4$ is

a)(0,6) b) (0,3) c) (4,4) d) (5,3)

Q16 The straight line $\frac{x-3}{3} = \frac{y-2}{1} = \frac{z-1}{0}$ is

a) Parallel to X-axis b) Parallel to Y-axis

c) Parallel to Z-axis d) Perpendicular to Z-axis

Q17. In a college,25% students fail in English and 20% students fail in Hindi and 15% fail in both.
One student is chosen at random. The probability that he fails in English if he fails in Hindi is
$a)\frac{3}{10}$ b) $\frac{2}{5}$ c) $\frac{3}{4}$ d) $\frac{4}{5}$

Q18. The graph of the inequality $2x + 3y > 6$ is
a) Half plane that neither contains origin neither the points on the line $2x + 3y = 6$
b) Half plane that contains origin.
c) Whole XY plane excluding the line $2x + 3y = 6$
d)Entire XY plane.

ASSERTION -REASON BASED QUESTIONS

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true and R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

Q19. **Assertion (A):** Vector perpendicular to $\vec{a} = 2\hat{\imath} - \hat{\jmath} + 2\hat{k}$ and $\vec{b} = 4\hat{\imath} - \hat{\jmath} + 3\hat{k}$ are given by $\lambda(-\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$
Reason (R) : $\vec{a} \times \vec{b}$ is a vector perpendicular to $\vec{a}$ and $\vec{b}$

Q20. **Assertion (A):** If $f(x)$ is differentiable at $x = a$, then $\lim_{x\to a} f(x) = f(a)$.
Reason (R) : Every differentiable function is continuous.

Section –B

This section comprises of 5 very short answer type questions (VSA) of 2 marks each.

Q21. Find the domain of $f(x) = \sec^{-1}(3x - 1)$

OR

If $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\frac{1}{\sqrt{3}}$, find the value of x.

Q22. Find the intervals in which the function $f(x) = sinx + cosx$,
$0 \leq x \leq 2\pi$ is increasing or decreasing.

Q23. If $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$, $\vec{b} = -\hat{\imath} + \hat{k}$ and $\vec{c} = 2\hat{\jmath} - \hat{k}$ are three vectors, find the area of parallelogram having diagonals $(\vec{a} + \vec{b})and$ $(\vec{b} + \vec{c})$

Q24. If two vectors $\vec{a}$ and $\vec{b}$ are $such$ $that$ $|\vec{a}| = 3$ and $|\vec{b}| = 2$ and $\vec{a}.\vec{b} = 6$, Then find the value of $|\vec{a} + \vec{b}|$ and $|\vec{a} - \vec{b}|$

OR

Find the angle between unit vectors $\vec{a}$ and $\vec{b}$ if $\sqrt{3}\,\vec{a} - \vec{b}$ is a unit vector.

Q25. The x coordinate of a point on the line joining the points $P(2,2,1)\ and\ Q(5,1,-2)$ is 4. Find its z- coordinate.

Section –C

This section comprises of 6 short answer type questions (SA) of 3 marks each.

Q26. Integrate: $\int \frac{e^x}{e^{2x}+4e^x+3}dx$

Q27. Integrate: $\int \frac{Cosx}{(2+Sinx)(3+4Sinx)}dx$

OR

Integrate: $\int \frac{Sinx+Cosx}{9+16Sin2x}dx$

Q28. An inverted water tank conical in shape has semi-vertical angle $\tan^{-1}(\frac{1}{2})$.Water is poured into it at a constant rate of $5m^3/hour$. Find the rate at which level of water in the cone is rising when the depth is 4cm.

Q29. If $x = a(cos\theta + \theta sin\theta)\ and\ y = a(sin\theta - \theta\cos\theta)$ find $\frac{dy}{dx}$.

OR

Find the smallest value of the polynomial $x^3 - 18x^2 + 96x$ in [0, 9].

Q30. Solve the following linear programming problem graphically:

Maximize $Z = x + 2y$ subject to: $x + 2y \geq 100, 2x - y \leq 0,\ \ 2x + y \leq 200, x, y \geq 0$

Q31. An urn contains 4 White and 3 Red balls. Find the probability distribution of number of red balls in a random draw of three balls. Also find the mean of number of red balls.

OR

The probability of a student A passing an examination is $\frac{3}{7}$ and of student B passing is $\frac{5}{7}$. Assuming the two events as independent, find the probability of:

a) Only A passing the examination. b) Only one of them passing the examination.

Section-D

This section comprises of long answer type questions (LA) of 5 marks each.

Q32. Solve the differential equation: $xlogx\frac{dy}{dx} + y = \frac{2}{x}logx$

OR

Find the particular solution of the differential equation:

$$2x^2\frac{dy}{dx} - 2xy + y^2 = 0, x = e, y = e$$

Q33. Use the product $\begin{bmatrix} -3 & -2 & -4 \\ 2 & 1 & 2 \\ 2 & 1 & 3 \end{bmatrix}\begin{bmatrix} 1 & 2 & 0 \\ -2 & -1 & -2 \\ 0 & -1 & 1 \end{bmatrix}$ to solve the following system of equations:

$x - 2y = 3, 2x - y - z = 2, -2y + z = -3$

Q34. Using integration find the area of the region bounded by the lines

$$x + 2y = 2, y - x = 1 \; and \; 2x + y = 7$$

Q35. Find the equation of the perpendicular from point (3, -1,11) to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Also find the coordinates of the foot of perpendicular and the length of the perpendicular.

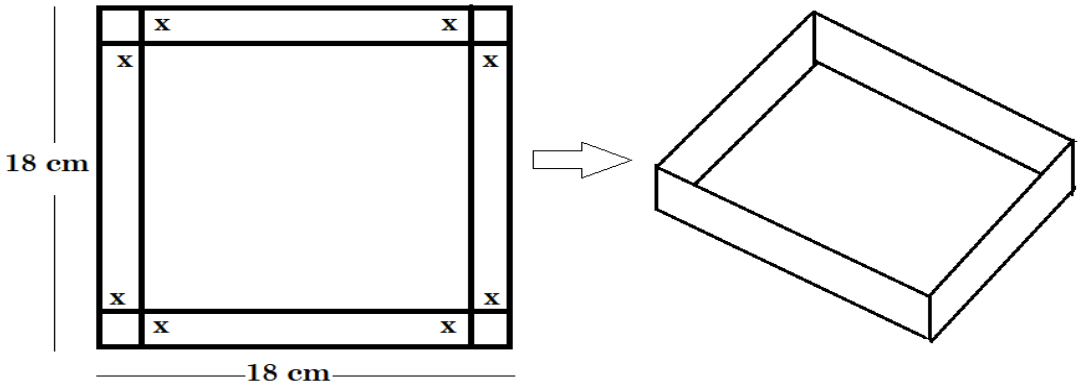
OR

The two lines $\frac{x-1}{3} = \frac{-y}{1}, \frac{z+1}{1} = 0$ and $\frac{-x}{2} = \frac{y+1}{2} = \frac{z+2}{1}$ intersect at a point whose y-coordinate is 1. Find the co-ordinates of their point of intersection. Find the vector equation of a line perpendicular to both the given lines and passing through this point of intersection.

Section –E

This section comprises of 3 case- study/passage-based questions of 4 marks each

Q36. For an EMC project, a student of Class XII makes an open cardboard box for a jewellery shop from a square sheet of side 18 cm by cutting off squares from each corner and folding up the flaps.



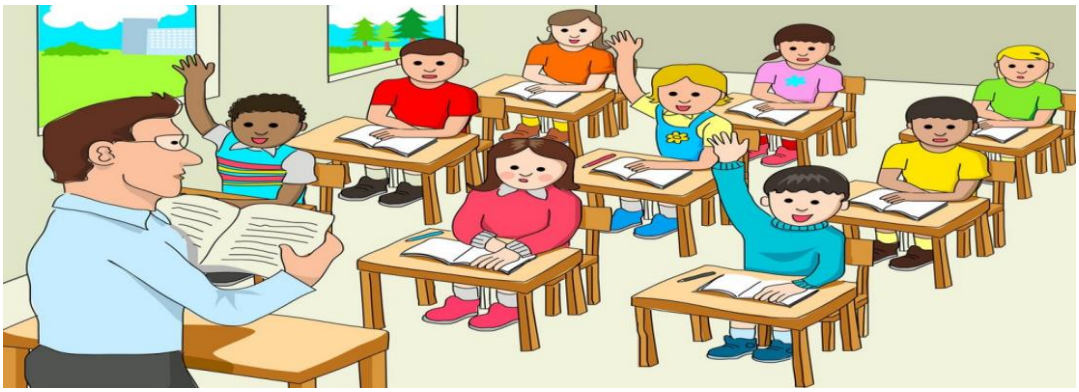
Assume that 'x' be the side of squares cut off from each corner (as shown in the diagram above). Based on the given information, answer the following questions.

(i) For the open box, find the length, breadth and height in terms of x.
(ii) Write an expression for the volume of the open box.
(iii) What should be the side of square to be cut off so that the volume is Maximum?

OR

What is maximum volume?

Q37. Read the following passage and answer the questions given below.



A teacher teaching functions in the class wrote two sets A = {0,1,2,3} and B= {7,9,11,13} on the blackboard and asked some students to write a rule from A to B. one student wrote f(x) = 2x+7 and another student wrote g(x) = 2x+3.

Based on the above information answer the following questions.

i) Which rule (f or g) is a function from A to B?

ii) Write C if g: A →C and g is one – one into.

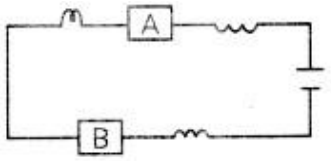
iii) Check function f is bijective or not?

OR

If both A and B are replaced by the Set of Natural number N then check which function is bijective f or g.

Q38. Electric circuit includes a device that gives energy to the charged particles constituting the current, such as a battery or a generator; devices that use current, such as lamps, electric motors, or computers; and the connecting wires or transmission lines.

An electric circuit consists of two subsystems say A and B as shown below:



For previous testing procedures, the following probabilities are assumed to be known. P(A fails) = 0.2, P(B fails alone) = 0.15, P(A and B fail) = 0.15

Based on the above information answer the following questions:

(a) What is the probability that B fails? [1]

(b) What is the probability that A fails alone? [1]

(c) Find the probability that the whole of the electric system fails? [2]

OR

Find the conditional probability that B fails when A has already failed. [2]

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