Learne2i most important questions for JEE Mains 2025 April Session

Welcome to this curated collection of questions designed to reflect key concepts and high-priority topics from past JEE Mains examinations. While these samples aim to highlight recurring themes, they are not exact replicas—the JEE ensures originality in every paper.

Subject Insights

- Mathematics: Strongest predictive patterns due to structured problem-solving frameworks.
- Physics: Moderate consistency in thematic approaches (e.g., mechanics, electromagnetism).
- Chemistry: Least predictable trends, given its diverse topics and experimental formats.

Study Smart

- Master core principles, not just questions.
- Practice varied formats to adapt to new problem structures.
- Use this as a guide, not a substitute for comprehensive preparation.

Disclaimer for Predicted Questions in JEE Mains

The following set of questions has been curated as part of an analytical study aimed at identifying patterns and trends in past JEE Mains examinations. These questions are intended to serve as **sample questions** or representations of **important topics** that have historically appeared in the exam. It is crucial to understand that while these questions provide valuable insight into the types of problems that may be encountered, they are not exact replicas nor guaranteed predictions of future examination content. Instead, they are designed to highlight **key concepts** and areas of focus that students should prioritize during their preparation.

Nature of Predictions and Their Limitations

The methodology behind this analysis involves identifying similarities among questions from previous years, focusing on recurring themes, concepts, and problem-solving approaches. However, it is essential to note that:

1. **Questions will not be repeated verbatim**: JEE Mains strictly adheres to a policy of non-repetition in its question papers. The questions provided here are not exact duplicates but are conceptually similar to those seen in past exams. Students should use them as a tool for understanding the underlying principles and problem-solving techniques rather than expecting identical questions in the future.

2. **Focus on conceptual understanding**: The similarity analysis primarily emphasizes thematic connections between questions rather than their specific wording or structure. This means that while certain topics may appear repeatedly in different forms, the way they are presented can vary significantly. To succeed, students must develop a deep understanding of the concepts behind these sample questions.

3. **Subject-specific variability in prediction accuracy**: The effectiveness of these predictions varies across subjects:

    - **Mathematics**: The predictive accuracy for mathematics is notably higher due to the structured nature of mathematical problems and their reliance on well-defined concepts and formulae. Students can expect a closer alignment between sample questions and exam trends in this subject.

    - **Physics**: Predictions for physics exhibit moderate accuracy. While many physics problems share common themes (e.g., mechanics, electromagnetism), variations in question framing and numerical details can introduce unpredictability.

    - **Chemistry**: Chemistry demonstrates the lowest predictive accuracy due to its diverse range of topics, including organic reactions, inorganic properties, and physical chemistry calculations. The subject's variability makes it challenging to identify consistent patterns across years.

Recommendations for Students

To maximize the utility of these sample questions, students are advised to adopt the following approach:

- **Study the concepts thoroughly**: Treat each question as a gateway to understanding broader concepts rather than an isolated problem. For example, if a question pertains to integration techniques in mathematics or electrostatics principles in physics, focus on mastering those areas comprehensively.
- **Practice applying concepts in varied scenarios**: Since examiners often reframe similar ideas in different ways, students should practice solving problems across multiple formats and difficulty levels within each topic.
- **Do not rely solely on predictions**: While these sample questions provide valuable guidance, they should not replace a complete study plan or comprehensive syllabus coverage. JEE Mains is designed to test a student's grasp of fundamental principles across all topics in the syllabus.
- **Pay attention to weak areas**: Given the variability in prediction accuracy across subjects, students may need to allocate additional time and effort toward subjects like chemistry where trends are less predictable.

Final Note

The sample questions provided here are meant to assist students in identifying high-priority topics and honing their problem-solving skills. However, success in JEE Mains requires more than familiarity with past trends; it demands a robust understanding of core concepts, consistent practice, and adaptability to new challenges. Students are encouraged to use these resources responsibly as part of a balanced preparation strategy that includes textbooks, reference materials, coaching guidance, and mock tests.

By focusing on conceptual clarity and disciplined preparation, students can build the confidence and skills necessary to tackle any variation of questions presented in the examination effectively.

Question 1: The sum of all natural numbers n such that $100 < n < 200$ and H.C.F. $91, n > 1$ is
Option: (1) 3203
Option: (2) 3221
Option: (3) 3121
Option: (4) 3303
Question 2: The mean and variance for seven observations are 8 and 16 respectively. If 5 of the observations are 2,4,10,12,14, then the product of the remaining two observations is
Option: (1) 48
Option: (2) 45
Option: (3) 49
Option: (4) 40
Question 3: The shortest distance between the line $y = x$ and the curve $y^2 = x - 2$ is
Option: (1) $\frac{7}{4\sqrt{2}}$
Option: (2) $\frac{7}{8}$
Option: (3) $\frac{11}{4\sqrt{2}}$
Option: (4) 2
Question 4: Let A and B be two non-null events such that $A \subset B$. Then, which of the following statements is always correct?
Option: (1) $PA \mid B \geq P(A)$
Option: (2) $PA \mid B = PB - PA$
Option: (3) $PA \mid B \leq P(A)$
Option: (4) $PA \mid B = 1$
Question 5: Which one of the following statements is not a tautology?
Option: (1) $p \vee q \rightarrow p \vee (\sim q)$
Option: (2) $p \wedge q \rightarrow (\sim p \vee q)$
Option: (3) $p \rightarrow p \vee q$
Option: (4) $p \wedge q \rightarrow p$
Question 6: Given that the slope of the tangent to a curve $y = y(x)$ at any point x, y is $\frac{2y}{x^2}$. If the curve passes through the centre of the circle $x^2 + y^2 - 2x - 2y = 0$, then its equation is
Option: (1) $x^2 log_e|y| = -2(x - 1)$
Option: (2) $x log_e|y| = 2(x - 1)$
Option: (3) $x log_e|y| = -2(x - 1)$
Option: (4) $x log_e|y| = x - 1$
Question 7: Let $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + x\hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$, for some real x. Then the condition for $\vec{a} \times \vec{b} = r$ to follow
Option: (1) $0 < r \leq \sqrt{\frac{3}{2}}$
Option: (2) $r \geq 5\sqrt{\frac{3}{2}}$
Option: (3) $\sqrt{\frac{3}{2}} < r \leq 3\sqrt{\frac{3}{2}}$
Option: (4) $3\sqrt{\frac{3}{2}} < r < 5\sqrt{\frac{3}{2}}$
Question 8: The value of $\int_0^{\pi/2} \frac{sin^3 x}{sinx + cosx} dx$ is:
Option: (1) $\frac{\pi - 1}{2}$
Option: (2) $\frac{\pi - 2}{8}$
Option: (3) $\frac{\pi - 1}{4}$
Option: (4) $\frac{\pi - 2}{4}$
Question 9: The solution of the differential equation $x\frac{dy}{dx} + 2y = x^2, (x \neq 0)$ with $y(1) = 1$, is

Option: (1) $y=\frac{x^3}{5}+\frac{1}{5x^2}$
Option: (2) $y=\frac{3}{4}x^2+\frac{1}{4x^2}$
Option: (3) $y=\frac{x^2}{4}+\frac{3}{4x^2}$
Option: (4) $y=\frac{4}{5}x^3+\frac{1}{5x^2}$
Question 10: If the two lines $x+(a-1)y=1$ and $2x+a^2y=1,(a\in R-\{0,1\})$ are perpendicular, then the distance of their point of intersection from the origin is
Option: (1) $\frac{2}{\sqrt{5}}$
Option: (2) $\frac{\sqrt{2}}{5}$
Option: (3) $\frac{2}{5}$
Option: (4) $\sqrt{\frac{2}{5}}$
Question 11: Let P be the plane, which contains the line of intersection of the planes, $x+y+z-6=0$ and $2x+3y+z+5=0$ and it is perpendicular to the xy-plane. Then the distance of the point $(0,0,256)$ from P is equal to:
Option: (1) $205\sqrt{5}$ units
Option: (2) $\frac{17}{\sqrt{5}}$ units
Option: (3) $\frac{11}{\sqrt{5}}$ units
Option: (4) $63\sqrt{5}$ units
Question 12: The system of linear equations

$$x+y+z=2$$
$$2x+3y+2z=5$$
$$2x+3y+a^2-1z=a+1$$

Option: (1) is inconsistent when $a=\sqrt{3}$
Option: (2) has a unique solution for $a=\sqrt{3}$
Option: (3) has infinitely many solutions for $a=4$
Option: (4) is inconsistent when $a=4$
Question 13: Let $A(4,-4)$ and $B(9,6)$ be points on the parabola, $y^2=4x$. Let C be chosen on the arc AOB of the parabola, where O is the origin, such that the area of $\triangle ACB$ is maximum. Then, the area (in sq. units) of $\triangle ACB$, is:
Option: (1) 32
Option: (2) $31\frac{3}{4}$
Option: (3) $30\frac{1}{2}$
Option: (4) $31\frac{1}{4}$
Question 14: Lines are drawn parallel to the line $4x-3y+2=0$, at a distance $\frac{3}{5}$ units from the origin. Then which one of the following points lies on any of these lines?
Option: (1) $\frac{1}{4},-\frac{1}{3}$
Option: (2) $-\frac{1}{4},\frac{2}{3}$
Option: (3) $-\frac{1}{4},-\frac{2}{3}$
Option: (4) $\frac{1}{4},\frac{1}{3}$
Question 15: If $5x+9=0$ is the directrix of the hyperbola $16x^2-9y^2=144$, then its corresponding focus is:
Option: (1) $-5,0$
Option: (2) $5,0$
Option: (3) $-\frac{5}{3},0$
Option: (4) $\frac{5}{3},0$

Question 16: A point P moves on the line $2x - 3y + 4 = 0$. If $Q(1,4)$ and $R(3,-2)$ are fixed points, then the locus of the centroid of $\triangle PQR$ is a line:

Option: (1) with slope $\frac{2}{3}$

Option: (2) with slope $\frac{3}{2}$

Option: (3) parallel to y-axis

Option: (4) parallel to x-axis

Question 17: Let $f(x) = \begin{cases} max(|x|, x^2), & |x| \leq 2 \\ 8 - 2|x|, & 2 < |x| \leq 4 \end{cases}$. Let S be the set of points in the interval $(-4,4)$ at which f is not differentiable. Then S

Option: (1) equals $\{-2, -1, 0, 1, 2\}$

Option: (2) equals $\{-2, 2\}$

Option: (3) is an empty set

Option: (4) equal $\{-2, -1, 1, 2\}$

Question 18: If the area of an equilateral triangle inscribed in the circle $x^2 + y^2 + 10x + 12y + c = 0$ is $27\sqrt{3}$ sq. units, then c is equal to:

Option: (1) 25

Option: (2) 13

Option: (3) -25

Option: (4) 20

Question 19: On which of the following lines lies the point of intersection of the line, $\frac{x-4}{2} = \frac{y-5}{2} = \frac{z-3}{1}$ and the plane, $x + y + z = 2$?

Option: (1) $\frac{x-4}{1} = \frac{y-5}{1} = \frac{z-5}{-1}$

Option: (2) $\frac{x-1}{1} = \frac{y-3}{2} = \frac{z+4}{-5}$

Option: (3) $\frac{x-2}{2} = \frac{y-3}{2} = \frac{z+3}{3}$

Option: (4) $\frac{x+3}{3} = \frac{4-y}{3} = \frac{z+1}{-2}$

Question 20: Let $\left(-2 - \frac{1}{3}i\right)^3 = \frac{x+iy}{27} (i = \sqrt{-1})$, where x and y are real numbers then $y - x$ equals

Option: (1) 91

Option: (2) -85

Option: (3) 85

Option: (4) -91

Question 21: If the system of linear equations $2x + 2y + 3z = a3x - y + 5z = bx - 3y + 2z = c$ where, $a, b,$ care nonzero real numbers, has more than onc solution, then

Option: (1) $b - c + a = 0$

Option: (2) $b - c - a = 0$

Option: (3) $a + b + c = 0$

Option: (4) $b + c - a = 0$

Question 22: Let a function $f: (0, \infty) \to (0, \infty)$ be defined by $f(x) = \left|1 - \frac{1}{x}\right|$. Then f is :

Option: (1) not injective but it is surjective

Option: (2) injective only
Option: (3) neither injective nor surjective
Option: (4) None of the above
Question 23: The area (in sq. units) in the first quadrant bounded by the parabola, $y = x^2 + 1$, the tangent to it at the point $(2,5)$ and the coordinate axes is :
Option: (1) $\frac{8}{3}$
Option: (2) $\frac{37}{24}$
Option: (3) $\frac{187}{24}$
Option: (4) $\frac{14}{3}$
Question 24: Considering only the principal values of inverse functions, the set

$$A = \left\{x \geq 0: tan^{-1}(2x) + tan^{-1}(3x) = \frac{\pi}{4}\right\}$$

Option: (1) Is an empty set
Option: (2) Contains more than two elements
Option: (3) Contains two elements
Option: (4) Is a singleton
Question 25: A tetrahedron has vertices $P(1,2,1), Q(2,1,3), R(-1,1,2)$ and $O(0,0,0)$. The angle between the faces OPQ and PQR is
Option: (1) $cos^{-1}\left(\frac{7}{31}\right)$
Option: (2) $cos^{-1}\left(\frac{17}{31}\right)$
Option: (3) $cos^{-1}\left(\frac{19}{35}\right)$
Option: (4) $cos^{-1}\left(\frac{9}{35}\right)$
Question 26: Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $\left(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}}\right)^{10}$ is $10k$, then k is equal to
Option: (1) 336
Option: (2) 352
Option: (3) 84
Option: (4) 176
Question 27: If $lim_{x\to 1}\frac{x+x^2+x^3+\cdots+x^n-n}{x-1} = 820, (n \in N)$ then the value of n is equal to....
Question 28: The integral $\int_0^2 ||x-1| - x|dx$ is equal to
Question 29: Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors such that $|\vec{a} - \vec{b}|^2 + |\vec{a} - \vec{c}|^2 = 8$. Then $|\vec{a} + 2\vec{b}|^2 + |\vec{a} + 2\vec{c}^2$ is equal to
Question 30: Let S be the sum of the first 9 term of the series :
$\{x + ka\} + \{x^2 + (k+2)a\} + \{x^3 + (k+4)a\} + \{x^4 + (k+6)a\} + \cdots$ where $a \neq 0$ and $x \neq$ 30. If $S = \frac{x^{10}-x+45\ (x-1)}{x-1}$, then k is equal to
Option: (1) -5
Option: (2) 1
Option: (3) -3
Option: (4) 3

Question 31: Which of the following is a tautology?
Option: (1) $(\sim p) \wedge (p \vee q) \rightarrow q$
Option: (2) $(q \rightarrow p) \vee \sim (p \rightarrow q)$
Option: (3) $(\sim q) \vee (p \wedge q) \rightarrow q$
Option: (4) $(p \rightarrow q) \wedge (q \rightarrow p)$
Question 32: Let E^C denote the complement of an event E. Let E_1, E_2 and E_3 be any pairwise independent events with $P(E_1) > 0$ and $P(E_1 \cap E_2 \cap E_3) = 0$ then $P\left((E_2^C \cap E_3^C)/E_1\right)$ is equal to
Option: (1) $P(E_2^C) + P(E_3)$
Option: (2) $P(E_3^C) - P(E_2^C)$
Option: (3) $P(E_3) - P(E_2^C)$
Option: (4) $P(E_3^C) - P(E_2)$
Question 33: For a positive integer n, $\left(1 + \frac{1}{x}\right)^n$ is expanded in increasing powers of x. If three consecutive coefficients in this expansion are in the ratio, $2:5:12$, then n is equal to
Question 34: If the variance of the terms in an increasing A.P. $b_1 b_2, b_3, \ldots \ldots, b_{11}$ is 90 then the common difference of this $A.P.$ is
Question 35: The value of $(2 \cdot \ {}^1P_0 - 3 \cdot \ {}^2P_1 + 4 \cdot \ {}^3P_2 - \cdots$ .... up to 51^{th} term $) +$ $(1! - 2! + 3! - \cdots$ ... up to 51^{th} term $)$ is equal to
Option: (1) $1 - 51(51)\,!$
Option: (2) $1 + (51)\,!$
Option: (3) $1 + (52)\,!$
Option: (4) 1
Question 36: If the number of integral terms in the expansion of $\left(3^{\frac{1}{2}} + 5^{\frac{1}{8}}\right)^n$ is exactly 33 , then the least value of n is
Option: (1) 264
Option: (2) 128
Option: (3) 256
Option: (4) 248
Question 37: Let P be a point on the parabola, $y^2 = 12x$ and N be the foot of the perpendicular drawn from P, on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the y-intercept of the line NQ is $\frac{4}{3}$, then :
Option: (1) $PN = 4$
Option: (2) $MQ = \frac{1}{3}$
Option: (3) $MQ = \frac{1}{4}$
Option: (4) $PN = 3$
Question 38: The proposition $p \rightarrow \sim (p \wedge \sim q)$ is equivalent to :
Option: (1) q
Option: (2) $(\sim p) \vee q$
Option: (3) $(\sim p) \wedge q$

Option: (4) $(\sim p) \vee (\sim q)$

Question 39: A die is thrown two times and the sum of the scores appearing on the die is observed to be a multiple of 4. Then the conditional probability that the score 4 has appeared at least once is

Option: (1) $\frac{1}{4}$

Option: (2) $\frac{1}{3}$

Option: (3) $\frac{1}{8}$

Option: (4) $\frac{1}{9}$

Question 40: If the sum of the series $20 + 19\frac{3}{5} + 19\frac{1}{5} + 18\frac{4}{5} + \cdots$ ... ... up to n^{th} term is 488 and the n^{th} term is negative, then :

Option: (1) n^{th} term is $-4\frac{2}{5}$

Option: (2) $n = 41$

Option: (3) n^{th} term is -4

Option: (4) $n = 60$

Question 41: If m arithmetic means (\href{http://A.Ms}{A.Ms}) and three geometric means (\href{http://G.Ms}{G.Ms}) are inserted between 3 and 243 such that 4^{th} A.M. is equal to 2^{nd} G.M., then m is equal to:

Question 42: Given the following two statements:

$(S_1): (q \vee p) \rightarrow (p \leftrightarrow \sim q)$ is a tautology

$(S_2): \sim q \wedge (\sim p \leftrightarrow q)$ is a fallacy. Then :

Option: (1) both (S_1) and (S_2) are not correct.

Option: (2) only (S_1) is correct.

Option: (3) only (S_2) is correct.

Option: (4) both (S_1) and (S_2) are correct.

Question 43: Let $a_1, a_2, \ldots, a_n$ be a given A.P. whose common difference is an integer and $S_n = a_1 + a_2 + \cdots + a_n$. If $a_1 = 1, a_n = 300$ and $15 \leq n \leq 50$, then the ordered pair (S_{n-4}, a_{n-4}) is equal to:

Option: (1) $(2490,249)$

Option: (2) $(2480,249)$

Option: (3) $(2480,248)$

Option: (4) $(2490,248)$

Question 44: If for some positive integer n, the coefficients of three consecutive terms in the binomial expansion of $(1+x)^{n+5}$ are in the ratio $5: 10: 14$, then the largest coefficient in the expansion is :

Option: (1) 462

Option: (2) 330

Option: (3) 792

Option: (4) 252

Question 45: Let $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^{n} Y_i = T$, where each X_i contains 10 elements and each Y_i contains 5 elements. If each element of the set T is an element of exactly 20 of sets X_i 's and exactly 6 of sets Y_i 's then n is equal to :

Option: (1) 15

Option: (2) 50
Option: (3) 45
Option: (4) 30

Question 46: If the variance of the following frequency distribution:
Class: $10-20$
Frequency: 2
Question 47: The mean and variance of 7 observations are 8 and 16 , respectively. If five observations are 2,4,10,12,14 then the absolute difference of the remaining two observations is :
Option: (1) 1
Option: (2) 4
Option: (3) 2
Option: (4) 3
Question 48: If the function $f(x)=\begin{cases} k_1(x-\pi)^2-1, & x \leq \pi \\ k_2 cos x, & x>\pi \end{cases}$ is twice differentiable, then the ordered pair (k_1, k_2) is equal to:
Option: (1) $\left(\frac{1}{2}, 1\right)$
Option: (2) $(1,0)$
Option: (3) $\left(\frac{1}{2},-1\right)$
Option: (4) $(1,1)$
Question 49: The natural number m, for which the coefficient of x in the binomial expansion of $\left(x^m+\frac{1}{x^2}\right)^{22}$ is 1540 , is
Question 50: There are 3 sections in a question paper and each section contains 5 questions. A candidate has to answer a total of 5 questions, choosing at least one question from each section. Then the number of ways, in which the candidate can choose the questions, is:
Option: (1) 3000
Option: (2) 1500
Option: (3) 2255
Option: (4) 2250
Question 51: If the sum of the second, third and fourth terms of a positive term G.P. is 3 and the sum of its sixth, seventh and eighth terms is 243 , then the sum of the first 50 terms of this G.P. is :
Option: (1) $\frac{1}{26}(3^{49}-1)$
Option: (2) $\frac{1}{26}(3^{50}-1)$
Option: (3) $\frac{2}{13}(3^{50}-1)$
Option: (4) $\frac{1}{13}(3^{50}-1)$
Question 52: If the sum of the first 20 terms of the series $log_{(7^{1/2})} x+log_{(7^{1/3})} x+log_{(7^{1/4})} x+\cdots$ is 460 , then x is equal to:
Option: (1) 7^2
Option: (2) $7^{1/2}$

Option: (3) e^2
Option: (4) $7^{46/21}$
Question 53: The area (in sq. units) of the region $A=\left\{(x,y):(x-1)[x]\leq y\leq 2\sqrt{x}, 0\leq x\leq 2\right\}$, where $[t]$ denotes the greatest integer function, is :
Option: (1) $\frac{8}{3}\sqrt{2}-\frac{1}{2}$
Option: (2) $\frac{4}{3}\sqrt{2}+1$
Option: (3) $\frac{8}{3}\sqrt{2}-1$
Option: (4) $\frac{4}{3}\sqrt{2}-\frac{1}{2}$
Question 54: In a bombing attack, there is 50% chance that a bomb will hit the target. At least two independent hits are required to destroy the target completely. Then the minimum number of bombs, that must be dropped to ensure that there is at least 99% chance of completely destroying the target, is .....
Question 55: The common difference of the A.P. $b_1, b_2, \ldots, b_m$ is 2 more than common difference of
A.P. $a_1, a_2, \ldots \ldots, a_n$. If $a_{40}=-159, a_{100}=-399$ and $b_{100}=a_{70}$, then b_1 is equal to :
Option: (1) 81
Option: (2) -127
Option: (3) -81
Option: (4) 127
Question 56: Consider the statement: "For an integer n, if n^3-1 is even, then n is odd". The contrapositive statement of this statement is:
Option: (1) For an integer n, if n is even, then n^3-1 is odd.
Option: (2) For an integer n, if n^3-1 is not even, then n is not odd.
Option: (3) For an integer n, if n is even, then n^3-1 is even.(4) For an integer n, if n is odd, then n^3-1 is even.
Question 57: For a suitably chosen real constant a , let a function, $f: R-\{-a\}\rightarrow R$ be defined by $f(x)=\frac{a-x}{a+x}$. Further supposed that for any real number $x\neq -a$, and $f(x)\neq -a$, (fof)$(x)=x$. Then $f\left(-\frac{1}{2}\right)$ is equal to :
Option: (1) $\frac{1}{3}$
Option: (2) $-\frac{1}{3}$
Option: (3) -3
Option: (4) 3
Question 58: The area (in sq. units) of the region enclosed by the curves $y=x^2-1$ and $y=1-x^2$ is equal to:
Option: (1) $\frac{4}{3}$
Option: (2) $\frac{8}{3}$
Option: (3) $\frac{7}{2}$
Option: (4) $\frac{16}{3}$

Question 59: The probabilities of three events A, B and C are given $P(A)=0.6, P(B)=0.4$ and $P(C)=0.5$. If $P(A \cup B)=0.8, P(A \cap C)=0.3, P(A \cap B \cap C)=0.2, P(B \cap C)=\beta$ and $P(A \cup B \cup C)=\alpha$, where $0.85 \leq \alpha \leq 0.95$, then β lies in the interval :

Option: (1) $[0.35,0.36]$

Option: (2) $[0.25,0.35]$

Option: (3) $[0.20,0.25]$

Option: (4) $[0.36,0.40]$

Question 60: The number of words (with or without meaning) that can be formed from all the letters of the word "LETTER" in which vowels never come together is.

Question 61: Five numbers are in A.P., whose sum is 25 and product is 2520 . If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is

Option: (1) 27

Option: (2) 7

Option: (3) $\frac{21}{2}$

Option: (4) 16

Question 62: For two statements p and q, the logical statement $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to

Option: (1) p

Option: (2) q

Option: (3) $\sim p$

Option: (4) $\sim q$

Question 63: The sum $\sum_{k=1}^{20}(1+2+3+\cdots+k)$ is .

Question 64:

If $f(x)=\begin{cases}\frac{\sin(a+2)x+si}{x}; x<0 b; x=0 is continuous at x=0, then a+ \end{cases}$

$2b is equal to: \frac{(x+3x^2)^{1/3}-x^{1/3}}{x^{1/3}}; x>0$

Option: (1) 1

Option: (2) -1

Option: (3) 0

Option: (4) -2

Question 65: A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm^3/min. When the thickness of ice is 5 cm , then the rate (in cm/min.) at which of the thickness of ice decreases, is:

Option: (1) $\frac{5}{6\pi}$

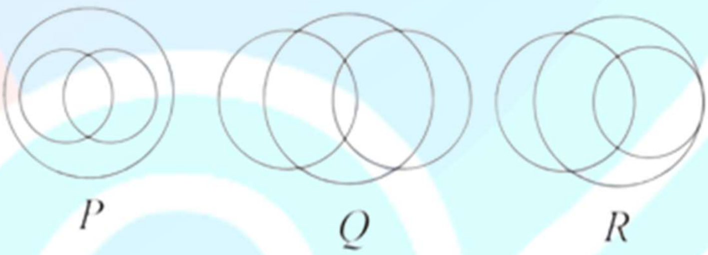
Option: (2) $\frac{1}{54\pi}$

Option: (3) $\frac{1}{36}$

Option: (4) $\frac{1}{18\pi}$

Question 66: Consider the parabola with vertex $\frac{1}{2}, \frac{3}{4}$ and the directrix $y=\frac{1}{2}$. Let P be the point where the parabola meets the line $x=-\frac{1}{2}$. If the normal to the parabola at P intersects the parabola again at the point Q . then (PQ $)^2$ is equal to :

Option: (1) $\frac{25}{2}$
Option: (2) $\frac{75}{8}$
Option: (3) $\frac{125}{16}$
Option: (4) $\frac{15}{2}$
Question 67: If n is the number of irrational terms in the expansion of $\left(3^{1/4}+5^{1/8}\right)^{60}$, then $(n-1)$ is divisible by :
Option: (1) 26
Option: (2) 30
Option: (3) 8
Option: (4) 7
Question 68: Let $f: R \rightarrow R$ be a continuous function such that $f(x)+f(x+1)=2$ for all $x \in R$. If $I_1=\int_0^8 f(x) d x$ and $I_2=\int_{-1}^3 f(x) d x$, then the value of $I_1+2 I_2$ is equal to -.
Question 69: Let $\vec{c}$ be a vector perpendicular to the vectors $\vec{a}=\hat{\imath}+\hat{\jmath}-\hat{k}$ and $\vec{b}=\hat{\imath}+2 \hat{\jmath}+\hat{k}$. If $\vec{c} \cdot(\hat{\imath}+\hat{\jmath}+3 \hat{k})=8$, then the value of $\vec{c} \cdot(\vec{a} \times \vec{b})$ is equal to
Question 70: In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above



statement?
Option: (1) P and Q
Option: (2) P and R
Option: (3) Q and R
Option: (4) None of these
Question 71: Two dices are rolled. If both dices have six faces numbered 1,2,3,5,7 and 11 , then the probability that the sum of the numbers on the top faces is less than or equal to 8 is:
Option: (1) $\frac{4}{9}$
Option: (2) $\frac{17}{36}$
Option: (3) $\frac{5}{12}$
Option: (4) $\frac{1}{2}$
Question 72: The number of solutions of the equation $sin^{-1}\left[x^2+\frac{1}{3}\right]+cos^{-1}\left[x^2-\frac{2}{3}\right]=x^2$ for $x \in[-1,1]$, and $[x]$ denotes the greatest integer less than or equal to x, is :
Option: (1) 2
Option: (2) 0

Option: (3) 4
Option: (4) Infinite
Question 73: If P and Q are two statements, then which of the following compound statement is a tautology?
Option: (1) $\left((P \Rightarrow Q) \wedge \sim Q\right) \Rightarrow Q$
Option: (2) $\left((P \Rightarrow Q) \wedge \sim Q\right) \Rightarrow \sim P$
Option: (3) $\left((P \Rightarrow Q) \wedge \sim Q\right) \Rightarrow P$
Option: (4) $\left((P \Rightarrow Q) \wedge \sim Q\right) \Rightarrow (P \wedge Q)$
Question 74: Let $y = mx + c, m > 0$ be the focal chord of $y^2 = -64x$, which is tangent to $(x + 10)^2 + y^2 = 4$. Then, the value of $4\sqrt{2}(m + c)$ is equal to
Question 75: Let r_1 and r_2 be the radii of the largest and smallest circles, respectively, which pass through the point $(-4,1)$ and having their centres on the circumference of the circle $x^2 + y^2 + 2x + 4y - 4 = 0$. If $\frac{r_1}{r_2} = a + b\sqrt{2}$, then $a + b$ is equal to:
Option: (1) 3
Option: (2) 11
Option: (3) 5
Option: (4) 7

Question 76: Let a function $g: [0,4] \to R$ be defined as
$g(x) = \begin{cases} max\{t^3 - 6t^2 + 9t - 3\}, & 0 \le x \le 3 \\ \quad 0 \le t \le x & \\ \quad 4 - x, & 3 < x \le 4 \end{cases}$ then the number of points in the interval $(0,4)$ where $g(x)$ is NOT differentiable, is .
Question 77: Let $E_1: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a > b$. Let E_2 be another ellipse such that it touches the end points of major axis of E_1 and the foci of E_2 are the end points of minor axis of E_1. If E_1 and E_2 have same eccentricities, then its value is:
Option: (1) $\frac{-1+\sqrt{5}}{2}$
Option: (2) $\frac{-1+\sqrt{8}}{2}$
Option: (3) $\frac{-1+\sqrt{3}}{2}$
Option: (4) $\frac{-1+\sqrt{6}}{2}$
Question 78: Consider the following frequency distribution:

Class	**0-6**	**6-12**	**12-18**	**18-24**	**24-30**
Frequency	a	b	12	9	5

If mean $= \frac{309}{22}$ and median $= 14$, then the value $(a - b)^2$ is equal to
Question 79: Let $f: R \to R$ be a function defined as $f(x) = \begin{cases} 3\left(1 - \frac{|x|}{2}\right) & if \quad |x| \le 2 \\ \quad 0 & if \quad |x| > 2 \end{cases}$.
Let $g: R \to R$ be given by $g(x) = f(x + 2) - f(x - 2)$. If n and m denote the number of points in R where g is not continuous and not differentiable, respectively, then $n + m$ is equal to .

Question 80: When a missile is fired from a ship, the probability that it is intercepted is $\frac{1}{3}$ and the probability that the missile hits the target, given that it is not intercepted, is $\frac{3}{4}$. If three missiles are fired independently from the ship, then the probability that all three hit the target, is:

Option: (1) $\frac{3}{8}$

Option: (2) $\frac{1}{27}$

Option: (3) $\frac{1}{8}$

Option: (4) $\frac{3}{4}$

Question 81: The Boolean expression $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to :

Option: (1) $\sim q$

Option: (2) q

Option: (3) p

Option: (4) $\sim p$

Question 82: The values of a and b, for which the system of equations

$$2x + 3y + 6z = 8$$
$$x + 2y + az = 5$$
$$3x + 5y + 9z = b$$

has no solution, are :

Option: (1) $a = 3, b \neq 13$

Option: (2) $a \neq 3, b \neq 13$

Option: (3) $a \neq 3, b = 3$

Option: (4) $a = 3, b = 13$

Question 83: The sum of all those terms which are rational numbers in the expansion of $\left(2^{\frac{1}{3}} + 3^{\frac{1}{4}}\right)^{12}$ is:

Option: (1) 89

Option: (2) 27

Option: (3) 35

Option: (4) 43

Question 84: A seven digit number is formed using digits 3,3,4,4,4,5,5. The probability, that number so formed is divisible by 2 , is

Option: (1) $\frac{4}{7}$

Option: (2) $\frac{3}{7}$

Option: (3) $\frac{1}{7}$

Option: (4) $\frac{6}{7}$

Question 85: Let α and β be two real numbers such that $\alpha + \beta = 1$ and $\alpha\beta = -1$. Let $p_n = (\alpha)^n + (\beta)^n, p_{n-1} = 11$ and $p_{n+1} = 29$ for some integer $n \geq 1$. Then, the value of p_n^2 is .

Question 86: The total number of 4-digit numbers whose greatest common divisor with 18 is 3 is .

Question 87: The compound statement $(P \vee Q) \wedge (\sim P) \Rightarrow Q$ equivalent to:

Option: (1) $P \vee Q$

Option: (2) $P \wedge\sim Q$
Option: (3) $\sim (P \Rightarrow Q)$
Option: (4) $\sim (P \Rightarrow Q) \Leftrightarrow P \wedge\sim Q$
Question 88: The value of the definite integral $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{dx}{(1+e^{x\cos x})(\sin^4 x+\cos^4 x)}$ is equal to :
Option: (1) $-\frac{\pi}{2}$
Option: (2) $\frac{\pi}{2\sqrt{2}}$
Option: (3) $-\frac{\pi}{4}$
Option: (4) $\frac{\pi}{\sqrt{2}}$
Question 89: Let the domain of the function $f(x) = log_4\left(log_5\left(log_3(18x - x^2 - 77)\right)\right)$ be (a, b). Then the value of the integral $\int_a^b \frac{\sin^3 x}{(\sin^3 x+\sin^3(a+b-x))}$ is equal to –
Question 90: Negation of the statement $(p \vee r) \Rightarrow (q \vee r)$ is :
Option: (1) $\sim p \wedge q \wedge\sim r$
Option: (2) $\sim p \wedge q \wedge r$
Option: (3) $p \wedge\sim q \wedge\sim r$
Option: (4) $p \wedge q \wedge r$

Question 91: If $\frac{dy}{dx} = \frac{2^x y+2^y \cdot 2^x}{2^x+2^{x+y} log_e 2}$, $y0 = 0$, then for $y = 1$, the value of x lies in the interval :
Option: (1) 1,2
Option: (2) $\frac{1}{2}, 1$
Option: (3) 2,3
Option: (4) $0, \frac{1}{2}$
Question 92: Let $\lambda x - 2y = \mu$ be a tangent to the hyperbola $a^2x^2 - y^2 = b^2$. Then $\left(\frac{\lambda}{a}\right)^2 - \left(\frac{\mu}{b}\right)^2$ is equal to
Option: (1) -2
Option: (2) -4
Option: (3) 2
Option: (4) 4
Question 93: If $lim_{n\to\infty}\sqrt{n^2 - n - 1} + n\alpha + \beta = 0$ then $8\alpha + \beta$ is equal to
Option: (1) 4
Option: (2) -8
Option: (3) -4
Option: (4) 8
Question 94: A tower PQ stands on a horizontal ground with base Q on the ground. The point R divides the tower in two parts such that $QR = 15\ m$. If from a point A on the ground the angle of elevation of R is 60° and the part PR of the tower subtends an angle of 15° at A, then the height of the tower is
Option: (1) $52\sqrt{3} + 3\ m$
Option: (2) $5\sqrt{3} + 3\ m$

Option: (3) $10\sqrt{3}+1\ m$

Option: (4) $102\sqrt{3}+1\ m$

Question 95: The sum of diameters of the circles that touch (i) the parabola $75x^2=645y-3$ at the point $\frac{8}{5},\frac{6}{5}$ and (ii) the y axis, is equal to .

Question 96: Consider the following statements:

P: Ramu is intelligent.

Q: Ramu is rich.

R : Ramu is not honest.

The negation of the statement "Ramu is intelligent and honest if and only if Ramu is not rich" can be expressed as:

Option: (1) $\left((P\wedge(\sim R))\wedge Q\right)\wedge\left((\sim Q)\wedge((\sim P)\vee R)\right)$

Option: (2) $\left((P\wedge R)\wedge Q\right)\vee\left((\sim Q)\wedge((\sim P)\vee(\sim R))\right)$

Option: (3) $\left((P\wedge R)\wedge Q\right)\wedge\left((\sim Q)\wedge((\sim P)\vee(\sim R))\right)$

Option: (4) $\left((P\wedge(\sim R))\wedge Q\right)\vee\left((\sim Q)\wedge((\sim P)\wedge R)\right)$

Question 97: Let $A=\{1,2,3,4,5,6,7\}$. Define $B=\{T\subseteq A$: either $1\notin T$ or $2\in T\}$ and $C=\{T\subseteq A: T$ the sum of all the elements of T is a prime number. $\}$ Then the number of elements in the set $B\cup C$ is .

Question 98: The total number of three-digit numbers, with one digit repeated exactly two times, is .

Question 99: Let $fx=x-1x^2-2x-3+x-3, x\in\mathbb{R}$. If m and M are respectively the number of points of local minimum and local maximum of f in the interval 0,4 , then $m+M$ is equal to .

Question 100: Let X be a binomially distributed random variable with mean 4 and variance $\frac{4}{3}$. Then $54PX\leq 2$ is equal to

Option: (1) $\frac{73}{27}$

Option: (2) $\frac{146}{27}$

Option: (3) $\frac{146}{81}$

Option: (4) $\frac{126}{81}$

Question 101: The plane passing through the line $L: lx-y+31-lz=1, x+2y-z=2$ and perpendicular to the plane $3x+2y+z=6$ is $3x-8y+7z=4$. If θ is the acute angle between the line L and the y-axis, then $415cos^2\theta$ is equal to .

Question 102: If the two lines $l_1:\frac{x-2}{3}=\frac{y+1}{-2}, z=2$ and $l_2:\frac{x-1}{1}=\frac{2y+3}{\alpha}=\frac{z+5}{2}$ are perpendicular, then an angle between the lines l_2 and $l_3:\frac{1-x}{3}=\frac{2y-1}{-4}=\frac{z}{4}$ is

Option: (1) $cos^{-1}\left(\frac{29}{4}\right)$

Option: (2) $sec^{-1}\left(\frac{29}{4}\right)$

Option: (3) $cos^{-1}\left(\frac{2}{29}\right)$

Option: (4) $cos^{-1}\left(\frac{2}{\sqrt{29}}\right)$

Question 103: Let a line L_1 be tangent to the hyperbola $\frac{x^2}{16}-\frac{y^2}{4}=1$ and let L_2 be the line passing through the origin and perpendicular to L_1. If the locus of the point of intersection of L_1 and L_2 is $(x^2+y^2)^2=\alpha x^2+\beta y^2$, then $\alpha+\beta$ is equal to -.

Question 104: $I=\int_{\frac{\pi}{4}}^{\frac{\pi}{3}}\left(\frac{8sinx-sin2x}{x}\right)dx$. Then

Option: (1) $\frac{\pi}{2}<I<\frac{3\pi}{4}$

Option: (2) $\frac{\pi}{5}<I<\frac{5\pi}{12}$

Option: (3) $\frac{5\pi}{12}<I<\frac{\sqrt{2}}{3}\pi$

Option: (4) $\frac{3\pi}{4}<I<\pi$

Question 105: Let $\vec{a}=\alpha\hat{\imath}+\hat{\jmath}+\beta\hat{k}$ and $\vec{b}=3\hat{\imath}-5\hat{\jmath}+4\hat{k}$ be two vectors, such that $\vec{a}\times\vec{b}=-\hat{\imath}+9\hat{\imath}+12\hat{k}$. Then the projection of $\vec{b}-2\vec{a}$ on $\vec{b}+\vec{a}$ is equal to

Option: (1) 2

Option: (2) $\frac{39}{5}$

Option: (3) 9

Option: (4) $\frac{46}{5}$

Question 106: An ellipse $E:\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ passes through the vertices of the hyperbola $H:\frac{x^2}{49}-\frac{y^2}{64}=-1$. Let the major and minor axes of the ellipse E coincide with the transverse and conjugate axes of the hyperbola H. Let the product of the eccentricities of E and H be $\frac{1}{2}$. If l is the length of the latus rectum of the ellipse E, then the value of $113l$ is equal to .

Question 107: Let the line $\frac{x-3}{7}=\frac{y-2}{-1}=\frac{z-3}{-4}$ intersect the plane containing the lines $\frac{x-4}{1}=\frac{y+1}{-2}=\frac{z}{1}$ and $4ax-y+5z-7a=0=2x-5y-z-3, a\in\mathbb{R}$ at the point $P(\alpha,\beta,\gamma)$. Then the value of $\alpha+\beta+\gamma$ equals

.

Question 108: Let $A=\begin{pmatrix}4 & -2\\ \alpha & \beta\end{pmatrix}$. If $A^2+\gamma A+18I=O$, then $det(A)$ is equal to $\cdots$

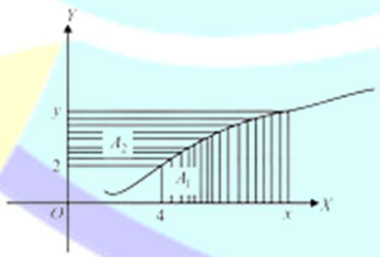
Option: (1) -18

Option: (2) 18

Option: (3) -50

Option: (4) 50

Question 109: Consider a curve $y=y(x)$ in the first quadrant as shown in the figure. Let the area A_1 is twice the area A_2. Then the normal to the curve perpendicular to the line $2x-12y=15$ does NOT pass through the point



Option: (1) $(6,21)$
Option: (2) $(8,9)$
Option: (3) $(10,-4)$
Option: (4) $(12,-15)$
Question 110: A rectangle R with end points of the one of its sides as $(1,2)$ and $(3,6)$ is inscribed in a circle. If the equation of a diameter of the circle is $2x-y+4=0$, then the area of R is .
Question 111: 010
Let the matrix $A=100$ and the matrix $B_0=A^{49}+2A^{98}$. If $B_n=AdjB_{n-1}$ for all $n\geq 1$, then det B_4 is equal to
Option: (1) 3^{28}
Option: (2) 3^{30}
Option: (3) 3^{32}
Option: (4) 3^{36}
Question 112: Let
p : Ramesh listens to music.
q: Ramesh is out of his village
r: It is Sunday
s: It is Saturday
Then the statement "Ramesh listens to music only if he is in his village and it is Sunday or Saturday" can be expressed as
Option: (1) $\left((\sim q)\wedge(r\vee s)\right)\Rightarrow p$
Option: (2) $\left(q\wedge(r\vee s)\right)\Rightarrow p$
Option: (3) $p\Rightarrow\left(q\wedge(r\vee s)\right)$
Option: (4) $p\Rightarrow\left((\sim q)\wedge(r\vee s)\right)$
Question 113: The function $f:R\rightarrow R$ defined by $f(x)=lim_{n\rightarrow\infty}\frac{cos(2\pi x)-x^{2n}sin(x-1)}{1+x^{2n+1}-x^{2n}}$ is continuous for all x in
Option: (1) $R-\{-1\}$
Option: (2) $R-\{-1,1\}$
Option: (3) $R-\{1\}$
Option: (4) $R-\{0\}$
Question 114: The differential equation of the family of circles passing through the points $(0,2)$ and $(0,-2)$ is
Option: (1) $2xy\frac{dy}{dx}+(x^2-y^2+4)=0$
Option: (2) $2xy\frac{dy}{dx}+(x^2+y^2-4)=0$
Option: (3) $2xy\frac{dy}{dx}+(y^2-x^2+4)=0$
Option: (4) $2xy\frac{dy}{dx}-(x^2-y^2+4)=0$
Question 115: The value of $lim_{n\rightarrow\infty}6tan\left\{\sum_{r=1}^{n}tan^{-1}\left(\frac{1}{r^2+3r+3}\right)\right\}$ is equal to
Option: (1) 1
Option: (2) 2
Option: (3) 3

Option: (4) 6

Question 116: Let the circumcentre of a triangle with vertices $A(a,3), B(b,5)$ and $C(a,b), ab > 0$ be $P(1,1)$. If the line AP intersects the line BC at the point $Q(k_1,k_2)$, then $k_1 + k_2$ is equal to

Option: (1) 2

Option: (2) $\frac{4}{7}$

Option: (3) $\frac{2}{7}$

Option: (4) 4

Question 117: The angle of elevation of the top of a tower from a point A due north of it is α and from a point B at a distance of 9 units due west of A is $cos^{-1}\left(\frac{3}{\sqrt{13}}\right)$. If the distance of the point B from the tower is 15 units, then $cot\alpha$ is equal to

Option: (1) $\frac{6}{5}$

Option: (2) $\frac{9}{5}$

Option: (3) $\frac{4}{3}$

Option: (4) $\frac{7}{3}$

Question 118: Let the mirror image of a circle $c_1: x^2 + y^2 - 2x - 6y + \alpha = 0$ in line $y = x + 1$ be $c_2: 5x^2 + 5y^2 + 10gx + 10fy + 38 = 0$. If r is the radius of circle c_2, then $\alpha + 6r^2$ is equal to **Question 119:** If the mirror image of the point $(2,4,7)$ in the plane $3x - y + 4z = 2$ is (a,b,c), the $2a + b + 2c$ is equal to

Option: (1) 54

Option: (2) -6

Option: (3) 50

Option: (4) -42

Question 120: Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{\sqrt{2}y}{2cos^4x - cos2x} = xe^{tan^{-1}(\sqrt{2}cot2x)}, 0 < x < \frac{\pi}{2}$ with $y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{32}$. If $y\left(\frac{\pi}{3}\right) = \frac{\pi^2}{18}e^{-tan^{-1}(\alpha)}$, then the value of $3\alpha^2$ is equal to .

Question 121: In a binomial distribution $B(n,p)$, the sum and product of the mean & variance are 5 and 6 respectively, then find $6(n + p - q)$ is equal to :-

Option: (1) 51

Option: (2) 52

Option: (3) 53

Option: (4) 50

Question 122: The sum of the abosolute maximum and minimum values of the function $f(x) = |x^2 - 5x + 6| - 3x + 2$ in the interval $[-1,3]$ is equal to :

Option: (1) 10

Option: (2) 12

Option: (3) 13

Option: (4) 24

Question 123: The straight lines l_1 and l_2 pass through the origin and trisect the line segment of the line $L: 9x + 5y = 45$ between the axes. If m_1 and m_2 are the slopes of the lines l_1 and l_2, then the point of intersection of the line $y = (m_1 + m_2)x$ with L lies on

Option: (1) $y - 2x = 5$

Option: (2) $6x + y = 10$

Option: (3) $y - x = 5$

Option: (4) $6x - y = 15$

Question 124: Among the statements :

$(S1)$: $2023^{2022} - 1999^{2022}$ is divisible by 8 .

$(S2)$: $13(13)^n - 11n - 13$ is divisible by 144 for infinitely many $n \in \mathbb{N}$

Option: (1) Only ($S2$) is correct

Option: (2) Only $(S1)$ is correct

Option: (3) Both ($S1$) and ($S2$) are correct

Option: (4) Both $(S1)$ and $(S2)$ are incorrect

Question 125: Let the solution curve $x = x(y), 0 < y < \frac{\pi}{2}$, of the differential equation $\left(log_e(cosy)\right)^2 cosydx - \left(1 + 3xlog_e(cosy)\right)sinydy = 0$ satisfy $x\left(\frac{\pi}{3}\right) = \frac{1}{2log_e 2}$. If $x\left(\frac{\pi}{6}\right) = \frac{1}{log_e m - log_e n}$, where m and n are coprime, then mn is equal to

Question 126: If the coefficient of x^7 in $ax - \frac{1}{bx^2}^{13}$ and the coefficient of x^{-5} in $ax + \frac{1}{bx^2}^{13}$ are equal, then a^4b^4 is equal to:

Option: (1) 11

Option: (2) 44

Option: (3) 22

Option: (4) 33.

Question 127: 96 $cos\frac{\pi}{33} cos\frac{2\pi}{33} cos\frac{4\pi}{33} cos\frac{8\pi}{33} cos\frac{16\pi}{33}$ is equal to

Option: (1) 3

Option: (2) 1

Option: (3) 4

Option: (4) 2

Question 128: An $arcPQ$ of a circle subtends a right angle at its centre O. The mid point of the $arcPQ$ is R. If $\overrightarrow{OP} = \vec{u}, \overrightarrow{OR} = \vec{v}$ and $\overrightarrow{OQ} = \alpha\vec{u} + \beta\vec{v}$, then α, β^2, are the roots of the equation

Option: (1) $x^2 + x - 2 = 0$

Option: (2) $x^2 - x - 2 = 0$

Option: (3) $3x^2 - 2x - 1 = 0$

Option: (4) $3x^2 + 2x - 1 = 0$

Question 129: In the figure, $\theta_1 + \theta_2 = \frac{\pi}{2}$ and $\sqrt{3}BE = 4AB$. If the area of ΔCAB is $2\sqrt{3} - 3$ unit ^{2}, when $\frac{\theta_2}{\theta_1}$ is the largest, then the perimeter (in unit) of $\triangle$ CED is equal to

Question 130: Let the function $f: [0,2] \rightarrow \mathbb{R}$ be defined as $f(x) = \begin{cases} e^{min\{x^2, x-[x]\}}, & x \in [0,1) \\ e^{[x - log_e x]}, & x \in [1,2] \end{cases}$, where $[t]$ denotes the greatest integer less than or equal to t. Then the value of the integral $\int_0^2 xf(x)dx$ is

Option: (1) $1+\frac{3e}{2}$
Option: (2) $(e-1)\left(e^2+\frac{1}{2}\right)$
Option: (3) $2e-1$
Option: (4) $2e-\frac{1}{2}$
Question 131: Let the digits a, b, c be in A.P. Nine-digit numbers are to be formed using each of these three digits thrice such that three consecutive digits are in A.P. at least once. How many such numbers can be formed?

Question 132: If the total maximum value of the function $f(x)=\left(\frac{\sqrt{3e}}{2sinx}\right)^{sin^2x}, x \in \left(0,\frac{\pi}{2}\right)$, is $\frac{k}{e}$, then $\left(\frac{k}{e}\right)^8+\frac{k^8}{e^5}+k^8$ is equal to
Option: (1) $e^3+e^6+e^{11}$
Option: (2) $e^5+e^6+e^{11}$
Option: (3) $e^3+e^6+e^{10}$
Option: (4) $e^3+e^5+e^{11}$
Question 133: Let α be the constant term in the binomial expansion of $\left(\sqrt{x}-\frac{6}{x^{\frac{3}{2}}}\right)^n, n \leq 15$. If the sum of the coefficients of the remaining terms in the expansion is 649 and the coefficient of x^{-n} is $\lambda\alpha$, then λ is equal to
Question 134: Let $a_1, a_2, a_3, \ldots$ be a G.P. of increasing positive numbers. Let the sum of its 6^{th} and 8^{th} terms be 2 and the product of its 3^{rd} and 5^{th} terms be $\frac{1}{9}$. Then $6a_2+a_4a_4+a_6$ is equal to
Option: (1) 3
Option: (2) $3\sqrt{3}$
Option: (3) 2
Option: (4) $2\sqrt{2}$
Question 135: Let $fx=\sum_{k=1}^{10} k\cdot x^k, x \in \mathbb{R}$, if $2f2+f'2=1192^n+1$ then n is equal to $-$

Question 136: The total number of three-digit numbers, divisible by 3 , which can be formed using the digits 1,3,5,8, if repetition of digits is allowed, is
Option: (1) 21
Option: (2) 20
Option: (3) 22
Option: (4) 18
Question 137: The mean and standard deviation of 10 observations are 20 and 8 respectively. Later on, it was observed that one observation was recorded as 50 instead of 40 . Then the correct variance is
Option: (1) 11
Option: (2) 13
Option: (3) 12
Option: (4) 14
Question 138: A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the

sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is .

Question 139: If A and B are two non-zero $n \times n$ matrices such that $A^2 + B = A^2B$, then

Option: (1) $AB = I$

Option: (2) $A^2B = I$

Option: (3) $A^2 = I$ or $B = I$

Option: (4) $A^2B = BA^2$

Question 140: Let Ω be the sample space and $A \subseteq \Omega$ be an event. Given below are two statements:

(S1): If $P(A) = 0$, then $A = \varphi$

(S2): If $P(A) =$, then $A = \Omega$

Then

Option: (1) only (S1) is true

Option: (2) only (S2) is true

Option: (3) both (S1) and (S2) are true

Option: (4) both (S1) and (S2) are false

Question 141: The number of 9 digit numbers, that can be formed using all the digits of the number 123412341 so that the even digits occupy only even places, is

Question 142: Suppose $\sum_{r=0}^{2023} r^2 \cdot \quad {}^{2023}C_r = 2023 \times \alpha \times 2^{2022}$, then the value of α is

Question 143: The number of integers, greater than 7000 that can be formed, using the digits 3,5,6,7,8 without repetition is

Option: (1) 120

Option: (2) 168

Option: (3) 220

Option: (4) 48

Question 144: Let the plane containing the line of intersection of the planes $P_1: x + (\lambda + 4)y + z = 1$ and $P_2: 2x + y + z = 2$ pass through the points $(0,1,0)$ and $(1,0,1)$. Then the distance of the point $(2\lambda, \lambda, -\lambda)$ from the plane P_2 is

Option: (1) $5\sqrt{6}$

Option: (2) $4\sqrt{6}$

Option: (3) $2\sqrt{6}$

Option: (4) $3\sqrt{6}$

Question 145: Let x and y be distinct integers where $1 \leq x \leq 25$ and $1 \leq y \leq 25$. Then, the number of ways of choosing x and y, such that $x + y$ is divisible by 5 , is .

Question 146: The distance of the point $\left(6, -2\sqrt{2}\right)$ from the common tangent $y = mx + c, m > 0$, of the curves $x = 2y^2$ and $x = 1 + y^2$ is

Option: (1) $\frac{1}{3}$

Option: (2) 5

Option: (3) $\frac{14}{3}$

Option: (4) $5\sqrt{3}$

Question 147: The minimum value of the function $f(x) = \int_0^2 e^{|x-t|} dt$ is

Option: (1) $2(e - 1)$

Option: (2) $2e-1$
Option: (3) 2
Option: (4) $e(e-1)$
Question 148: Consider the lines L_1 and L_2 given by

$$L_1: \frac{x-1}{2} = \frac{y-3}{1} = \frac{z-2}{2}$$
$$L_2: \frac{x-2}{1} = \frac{y-2}{2} = \frac{z-3}{3}$$

A line L_3 having direction ratios $1, -1, -2$, intersects L_1 and L_2 at the points P and Q respectively. Then the length of line segment PQ is
Option: (1) $2\sqrt{6}$
Option: (2) $3\sqrt{2}$
Option: (3) $4\sqrt{3}$
Option: (4) 4
Question 149: If the four points, whose position vectors are $3\hat{\imath}-4\hat{\jmath}+2\hat{k}, \hat{\imath}+2\hat{\jmath}-\hat{k}, -2\hat{\imath}-\hat{\jmath}+3\hat{k}$ and $5\hat{\imath}-2\alpha\hat{\jmath}+4\hat{k}$ are coplanar, then α is equal to
Option: (1) $\frac{73}{17}$
Option: (2) $-\frac{107}{17}$
Option: (3) $-\frac{73}{17}$
Option: (4) $\frac{107}{17}$
Question 150: If all the six digit numbers $x_1x_2x_3x_4x_5x_6$ with $0 < x_1 < x_2 < x_3 < x_4 < x_5 < x_6$ are arranged in the increasing order, then the sum of the digits in the 72^{th} number is .

Question 151: Let $\vec{a} = 4\hat{\imath}+3\hat{\jmath}$ and $\vec{b} = 3\hat{\imath}-4\hat{\jmath}+5\hat{k}$ and $\vec{c}$ is a vector such that $\vec{c}\cdot(\vec{a}\times\vec{b}) + 25 = 0, \vec{c}\cdot(\hat{\imath}+\hat{\jmath}+\hat{k}) = 4$ and projection of $\vec{c}$ on $\vec{a}$ is 1 , then the projection of $\vec{c}$ on $\vec{b}$ equals:
Option: (1) $\frac{5}{\sqrt{2}}$
Option: (2) $\frac{1}{5}$
Option: (3) $\frac{1}{\sqrt{2}}$
Option: (4) $\frac{3}{\sqrt{2}}$
Question 152: If $P(h,k)$ be point on the parabola $x = 4y^2$, which is nearest to the point $Q(0,33)$, then the distance of P from the directrix of the parabola $y^2 = 4(x+y)$ is equal to:
Option: (1) 2
Option: (2) 4
Option: (3) 8
Option: (4) 6
Question 153: Let α be the area of the larger region bounded by the curve $y^2 = 8x$ and the lines $y = x$ and $x = 2$, which lies in the first quadrant. Then the value of 3α is equal to
Question 154: Let $A = \{1,2,3,5,8,9\}$. Then the number of possible functions $f: A \to A$ such that $f(m\cdot n) = f(m)\cdot f(n)$ for every $m, n \in A$ with $m\cdot n \in A$ is equal to
Question 155: If a plane passes through the points $(-1,k,0), (2,k,-1), (1,1,2)$ and is parallel to the line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$, then the value of $\frac{k^2+1}{(k-1)(k-2)}$ is

Option: (1) $\frac{17}{5}$

Option: (2) $\frac{5}{17}$

Option: (3) $\frac{6}{13}$

Option: (4) $\frac{13}{6}$

Question 156: A bag contains six balls of different colours. Two balls are drawn in succession with replacement. The probability that both the balls are of the same colour is p. Next four balls are drawn in succession with replacement and the probability that exactly three balls are of the same colours is q. If $p: q = m: n$, where m and n are co-prime, then $m + n$ is equal to

Question 157: A bag contains 6 balls. Two balls are drawn from it at random and both are found to be black. The probability that the bag contains at least 5 black balls is

Option: (1) $\frac{5}{3}$

Option: (2) $\frac{2}{7}$

Option: (3) $\frac{3}{7}$

Option: (4) $\frac{5}{6}$

Question 158: If the variance of the frequency distribution

xi	**2**	**3**	**4**	**5**	**6**	**7**	**8**
fi	3	6	16	α	9	5	6

If the mean of the frequencies is 3, then α is equal to:

Question 159: Let P be the plane, passing through the point $(1, -1, -5)$ and perpendicular to the line joining the points $(4,1,-3)$ and $(2,4,3)$. Then the distance of P from the point $(3, -2,2)$ is

Option: (1) 6

Option: (2) 4

Option: (3) 5

Option: (4) 7

Question 160: Let S_n denote the sum of the first n terms of an arithmetic progression. If $S_{10} = 390$ and the ratio of the tenth and the fifth terms is $15: 7$, then $S_{15} - S_5$ is equal to:

Option: (1) 800

Option: (2) 890

Option: (3) 790

Option: (4) 690

Question 161: Let Ajay will not appear in JEE exam with probability $p = \frac{2}{7}$, while both Ajay and Vijay will appear in the exam with probability $q = \frac{1}{5}$. Then the probability, that Ajay will appear in the exam and Vijay will not appear is:

Option: (1) $\frac{9}{35}$

Option: (2) $\frac{18}{35}$

Option: (3) $\frac{24}{35}$

Option: (4) $\frac{3}{35}$

Question 162: Let $\alpha, \beta \in R$. Let the mean and the variance of 6 observations $-3,4,7,-6,\alpha,\beta$ be 2 and 23 , respectively. The mean deviation about the mean of these 6 observations is :
Option: (1) $\frac{13}{3}$
Option: (2) $\frac{16}{3}$
Option: (3) $\frac{11}{3}$
Option: (4) $\frac{14}{3}$
Question 163: Let $\alpha \in (0, \infty)$ and $A = \begin{bmatrix} 1 & 2 & \alpha \\ 1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}$. If det $\left(adj(2A - A^T) \cdot adj(A - 2A^T)\right) = 2^8$, then $\left(det(A)\right)^2$ is equal to:
Option: (1) 36
Option: (2) 16
Option: (3) 1
Option: (4) 49
Question 164: Let the sum of the maximum and the minimum values of the function $f(x) = \frac{2x^2-3x+8}{2x^2+3x+8}$ be $\frac{m}{n}$, where $gcd(m,n) = 1$. Then $m + n$ is equal to :
Option: (1) 195
Option: (2) 201
Option: (3) 217
Option: (4) 182
Question 165: Let C be a circle with radius $\sqrt{10}$ units and centre at the origin. Let the line $x + y = 2$ intersects the circle C at the points P and Q . Let MN be a chord of C of length 2 unit and slope -1 . Then, a distance (in units) between the chord PQ and the chord MN is
Option: (1) $3 - \sqrt{2}$
Option: (2) $\sqrt{2} + 1$
Option: (3) $\sqrt{2} - 1$
Option: (4) $2 - \sqrt{3}$

Question 166: Let a variable line of slope $m > 0$ passing through the point $(4, -9)$ intersect the coordinate axes at the points A and B. The minimum value of the sum of the distances of A and B from the origin is
Option: (1) 30
Option: (2) 25
Option: (3) 15
Option: (4) 10
Question 167: Let $\overrightarrow{OA} = 2\vec{a}, \overrightarrow{OB} = 6\vec{a} + 5\vec{b}$ and $\overrightarrow{OC} = 3\vec{b}$, where O is the origin. If the area of the parallelogram with adjacent sides $\overrightarrow{OA}$ and $\overrightarrow{OC}$ is 15 sq. units, then the area (in sq. units) of the quadrilateral OABC is equal to :
Option: (1) 32
Option: (2) 40
Option: (3) 38
Option: (4) 35

Question 168: Let the foci of a hyperbola H coincide with the foci of the ellipse $E: \frac{(x-1)^2}{100} + \frac{(y-1)^2}{75} = 1$ and the eccentricity of the hyperbola H be the reciprocal of the eccentricity of the ellipse E. If the length of the transverse axis of
H is α and the length of its conjugate axis is β, then $3\alpha^2 + 2\beta^2$ is equal to
Option: (1) 237
Option: (2) 242
Option: (3) 205
Option: (4) 225
Question 169: Let A, B and C be three points on the parabola $y^2 = 6x$ and let the line segment AB meet the line L through C parallel to the x-axis at the point D. Let M and N respectively be the feet of the perpendiculars from A and B on L. Then $\left(\frac{AM \cdot BN}{CD}\right)^2$ is equal to
Question 170: The 20^{th} term from the end of the progression $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \ldots, -129\frac{1}{4}$ is :-
Option: (1) -118
Option: (2) -110
Option: (3) -115
Option: (4) -100
Question 171: The position vectors of the vertices A, B and C of a triangle are $2\hat{\imath} - 3\hat{\jmath} + 3\hat{k}, 2\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ and $-\hat{\imath} + \hat{\jmath} + 3\hat{k}$ respectively. Let l denotes the length of the angle bisector AD of $\angle BAC$ where D is on the line segment BC , then $2l^2$ equals :
Option: (1) 49
Option: (2) 42
Option: (3) 50
Option: (4) 45
Question 172: An urn contains 6 white and 9 black balls. Two successive draws of 4 balls are made without replacement. The probability, that the first draw gives all white balls and the second draw gives all black balls, is :
Option: (1) $\frac{5}{256}$
Option: (2) $\frac{5}{715}$
Option: (3) $\frac{3}{715}$
Option: (4) $\frac{3}{256}$
Question 173: Let $\left(5, \frac{a}{4}\right)$, be the circumcenter of a triangle with vertices $A(a, -2), B(a, 6)$ and $C\left(\frac{a}{4}, -2\right)$. Let α denote the circumradius, β denote the area and γ denote the perimeter of the triangle. Then $\alpha + \beta + \gamma$ is
Option: (1) 60
Option: (2) 53
Option: (3) 62
Option: (4) 30
Question 174: Two integers x and y are chosen with replacement from the set $\{0,1,2,3, \ldots, 10\}$. Then the probability that $|x - y| > 5$ is :

Option: (1) $\frac{30}{121}$
Option: (2) $\frac{62}{121}$
Option: (3) $\frac{60}{121}$
Option: (4) $\frac{31}{121}$
Question 175: A group of 40 students appeared in an examination of 3 subjects - Mathematics, Physics \& Chemistry. It was found that all students passed in at least one of the subjects, 20 students passed in Mathematics, 25 students passed in Physics, 16 students passed in Chemistry, at most 11 students passed in both Mathematics and Physics, at most 15 students passed in both Physics and Chemistry, at most 15 students passed in both Mathematics and Chemistry. The maximum number of students passed in all the three subjects is .
Question 176: Suppose $28-p, p, 70-\alpha, \alpha$ are the coefficient of four consecutive terms in the expansion of $(1+x)^n$. Then the value of $2\alpha - 3p$ equals
Option: (1) 7
Option: (2) 10
Option: (3) 4
Option: (4) 6
Question 177: Let $\vec{a} = \hat{\imath} + \alpha\hat{j} + \beta\hat{k}, \alpha, \beta \in R$. Let a vector $\vec{b}$ be such that the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{4}$ and $\vec{b}^2 = 6$, If $\vec{a} \cdot \vec{b} = 3\sqrt{2}$, then the value of $\alpha^2 + \beta^2 |\vec{a} \times \vec{b}|^2$ is equal to
Option: (1) 90
Option: (2) 75
Option: (3) 95
Option: (4) 85
Question 178: In an examination of Mathematics paper, there are 20 questions of equal marks and the question paper is divided into three sections : A, B and C. A student is required to attempt total 15 questions taking at least 4 questions from each section. If section A has 8 questions, section B has 6 questions and section C has 6 questions, then the total number of ways a student can select 15 questions is .
Question 179: If the variance σ^2 of the data

x_i	0	1	5	6	10	12	17
f_i	3	2	3	2	6	3	3

is k then the value of k is \{where . denotes the greatest integer function \}
Question 180: If one of the diameters of the circle $x^2 + y^2 - 10x + 4y + 13 = 0$ is a chord of another circle C, whose center is the point of intersection of the lines $2x + 3y = 12$ and $3x - 2y = 5$, then the radius of the circle C is
Option: (1) $\sqrt{20}$
Option: (2) 4
Option: (3) 6
Option: (4) $3\sqrt{2}$

Question 181: Two marbles are drawn in succession from a box containing 10 red, 30 white, 20 blue and 15 orange marbles, with replacement being made after each drawing. Then the probability, that first drawn marble is red and second drawn marble is white, is
Option: (1) $\frac{2}{25}$

Option: (2) $\frac{4}{25}$

Option: (3) $\frac{2}{3}$

Option: (4) $\frac{4}{75}$

Question 182: The total number of words (with or without meaning) that can be formed out of the letters of the word "DISTRIBUTION" taken four at a time, is equal to -

Question 183: Let $A=\{1,2,3\}$. The number of relations on A, containing $(1,2)$ and $(2,3)$, which are reflexive and transitive but not symmetric, is -

Question 184: The product of all the rational roots of the equation $(x^2-9x+11)^2-(x-4)(x-5)=3$, is equal to

Option: (1) 14

Option: (2) 21

Option: (3) 28

Option: (4) 7

Question 185: A and B alternately throw a pair of dice. A wins if he throws a sum of 5 before B throws a sum of 8 , and B wins if he throws a sum of 8 before A throws a sum of 5 . The probability, that A wins if A makes the first throw, is

Option: (1) $\frac{8}{17}$

Option: (2) $\frac{9}{19}$

Option: (3) $\frac{9}{17}$

Option: (4) $\frac{8}{19}$

Question 186: Let $(2,3)$ be the largest open interval in which the function $f(x)=2log_e(x-2)-x^2+ax+1$ is strictly increasing and (b,c) be the largest open interval, in which the function $g(x)=(x-1)^3(x+2-a)^2$ is strictly decreasing. Then $100(a+b-c)$ is equal to :

Option: (1) 420

Option: (2) 360

Option: (3) 160

Option: (4) 280

Question 187:

Let $f(x)=\begin{cases}3x, & x<0\\ min\{1+x+[x],x+2[x]\}, & 0\leq x\leq 2\\ 5, & x>2,\end{cases}$ where [.] denotes greatest integer function. If α and β are the number of points, where f is not continuous and is not differentiable, respectively, then $\alpha+\beta$ equals

Question 188: Let M denote the set of all real matrices of order 3×3 and let $S=\{-3,-2,-1,1,2\}$. Let

S1={*A*=[*aij*]∈*M*: *A*=*AT* and *aij*∈*S*,∀*i*,*j*},
S2={*A*=[*aij*]∈*M*: *A*=−*AT* and *aij*∈*S*,∀*i*,*j*},
S3={*A*=[*aij*]∈*M*: *a*11+*a*22+*a*33=0 and *aij*∈*S*,∀*i*,*j*}.
If $n(\,S_1\cup_2 US_3)=125\alpha$, then α equals

Question 189: Let f be a real valued continuous function defined on the positive real axis such that $g(x) = \int_0^x t\, f(t)dt$. If $g(x^3) = x^6 + x^7$, then value of $\sum_{r=1}^{15} f(r^3)$ is :

Option: (1) 270

Option: (2) 340

Option: (3) 320

Option: (4) 310

Question 190: Two parabolas have the same focus $(4,3)$ and their directrices are the x-axis and the y-axis, respectively. If these parabolas intersects at the points A and B, then $(AB)^2$ is equal to :

Option: (1) 392

Option: (2) 384

Option: (3) 192

Option: (4) 96

Question 191: If $\alpha x + \beta y = 109$ is the equation of the chord of the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$, whose mid point is $\left(\frac{5}{2}, \frac{1}{2}\right)$, then $\alpha + \beta$ is equal to :

Option: (1) 58

Option: (2) 46

Option: (3) 37

Option: (4) 72

Question 192: If the domain of the function $log_5(18x - x^2 - 77)$ is (α, β) and the domain of the function $log_{(x-1)}\left(\frac{2x^2+3x-2}{x^2-3x-4}\right)$ is (γ, δ), then $\alpha^2 + \beta^2 + \gamma^2$ is equal to :

Option: (1) 195

Option: (2) 179

Option: (3) 186

Option: (4) 174

Question 193: Let $\alpha, \beta (\alpha \neq \beta)$ be the values of m , for which the equations $x + y + z = 1; x + 2y + 4z = m$ and $x + 4y + 10z = m^2$ have infinitely many solutions. Then the value of $\sum_{n=1}^{10}(n^\alpha + n^\beta)$ is equal to :

Option: (1) 3080

Option: (2) 560

Option: (3) 3410

Option: (4) 440