CRACKING THE CODE

How Our AI-Based Guess Papers
Predicted 50% of JEE Main 2025 Questions

Powered by
Learne2i

"A data-driven solution for confident preparation"

- 50% Similarity in Actual Paper
- Subject-Wise Match Tables
- Learn Smarter, Not Harder

2025 Edition | For JEE Aspirants

Executive Summary

In the highly competitive landscape of JEE Main preparation, students are often overwhelmed by the sheer volume of syllabus and uncertainty surrounding the actual exam pattern. This book, *Cracking the Code*, presents a revolutionary, data-backed approach to exam readiness through **AI-powered guess papers** that have demonstrated an exceptional >**50% similarity** with actual JEE Main 2025 April session questions.

We used over **7 years of previous exam data** and advanced AI techniques like **Natural Language Processing (NLP)**, **BERT/GPT embeddings** to firstly determine similarity between questions and then used advanced statistical techniques like clustering, hierarchy generation to identify recurring patterns, evolving trends, and high-probability question structures. This isn't just guesswork—it's smart, structured forecasting rooted in real data.

Our internal analysis following the JEE Main 2025 sessions revealed that more than half of the questions bore substantial resemblance to previous year question. These findings are detailed inside this book, with **subject-wise tables**, **highlighted examples**, and **similarity explanations**.

This book is designed to help aspirants focus their efforts, boost their confidence, and reduce stress by preparing strategically rather than randomly. Given the limited time and vast syllabus, students who understand the types of questions likely to appear gain a significant edge. It's crucial to note that the JEE is notorious for its unpredictable question patterns, which can change drastically from year to year. Therefore, understanding the patterns and solving similar questions is more important than merely solving questions.Whether you're a self-studier or enrolled in coaching, this book introduces a new way to approach JEE preparation—**smarter, not harder**.

Welcome to the future of exam readiness.

The Problem with Random Preparation

You scored over 90% in your Class 12 board exam and even higher in Class 10. Suddenly, why has scoring above the 90th percentile become difficult? What do you think? How many books are there that prepare a student for JEE exams? Or, to be more specific, how many good books are essential for the JEE exam? How many questions do these books contain?

Every year, over a million students appear for the JEE Main examination, armed with thick books, multiple coaching modules, thousands of practice problems, and a dream. But beneath the surface lies a deeper issue—random preparation that often leaves even the brightest students frustrated, fatigued, and underperforming. The problem is not with the students' understanding but with the randomness of their preparation.

The Unpredictability Factor

With so many topics each in Mathematics, Physics and Chemistry, JEE Main can be utterly notorious in its **unpredictability**. The team making the question papers has to make selection from a very huge dataset of questions and thus even having more than 8 to 10 exams every session, JEE Main can maintain a very level of unpredictability in their questions. However, it is not just unpredictability its also the variation in question that can be very high. Students just don't have to prepare for concepts; they prepare for *how* those concepts will be tested. And that's where randomness causes harm. Without clear insight into exam trends, most students end up **over-preparing in some areas and under-preparing in others**, often misjudging where to focus their energy.

Too Much Syllabus, Too Little Time

A simple calculation with the number of questions that are there in the must do books suggested for JEE preparation will tell you that there are over 100,000 questions that a student should practice. Even if a student takes 5 minutes to solve a question, the total time required is more than 3 years (I am not delving deep into the calculation, you can do the math by yourself). Hence, even the most disciplined student struggles to cover every topic with depth. Add to this board exams, internal school assessments, and personal constraints, and it becomes clear that:

Time is the most valuable currency for a JEE aspirant.

But what happens when time is spent on solving the *wrong kind* of questions? The result is a poor return on investment. Hours of study may not translate into actual exam performance—not because the student is weak, but because their **direction was misaligned**.

The Gap in Generic Mock Tests

While mock test series are a good way to simulate the JEE experience, it suffers from two problems:

1. **They're generic**—mock test creators recycle old JEE questions, coaching institute questions, and randomly generated problems without considering trend analytics.
2. **They don't evolve**—test series rarely update based on recent shifts in question types or chapter weightage.

As a result, students build speed and accuracy on **questions that may never appear** and ignore the **patterns that actually do**.

Stress Without Strategy

Students put in long hours, sacrifice weekends, and push their mental limits, yet still feel uncertain before the exam. Why?

Because they're preparing for *everything*, not *what matters most*.

And sadly, it often leads to giving up on key chapters or skipping questions during the exam—not because they were hard, but because the student **hadn't seen enough of that question style**.

What Students Need (But Don't Have)

- A **data-driven compass** that tells them which areas are truly high yield
- Access to **mock questions that mimic actual JEE** in logic, language, and concept layering
- A way to **filter noise** and focus on **patterns that matter**

This book, and the AI guess paper system behind it, offers a solution to this very crisis.

Our Solution: Predictive Guess Papers

If traditional test prep is a flashlight in the dark, our system is a GPS. While most students walk into the exam hall hoping their preparation will align with what appears on the paper, our predictive model **lights up the road ahead**—making the unpredictable more predictable.

After years of analyzing JEE Main papers, one thing became clear: **questions don't repeat—but patterns do**. Concepts are revisited, framing styles are reused, and certain question archetypes quietly evolve year after year.

So we asked a simple question:
"What if we could capture those patterns before the exam?"

That's the question that led to the creation of our **AI-powered guess paper engine**—a system that goes far beyond human intuition or random trend-watching. It uses **structured data, natural language understanding, and pattern recognition** to predict what types of questions are *likely* to appear.

What Makes This Guess Paper Different?

Most guess papers are either:

- Randomly selected practice questions
- Over-simplified predictions based on teacher intuition

Our system, by contrast:
✓ Uses **actual statistical modeling**
✓ **Continuously adapts** to changes in NTA's pattern
✓ Includes **question framing trends**, not just topics
✓ Produces **topic-balanced, exam-style sets**

The Results Speak for Themselves

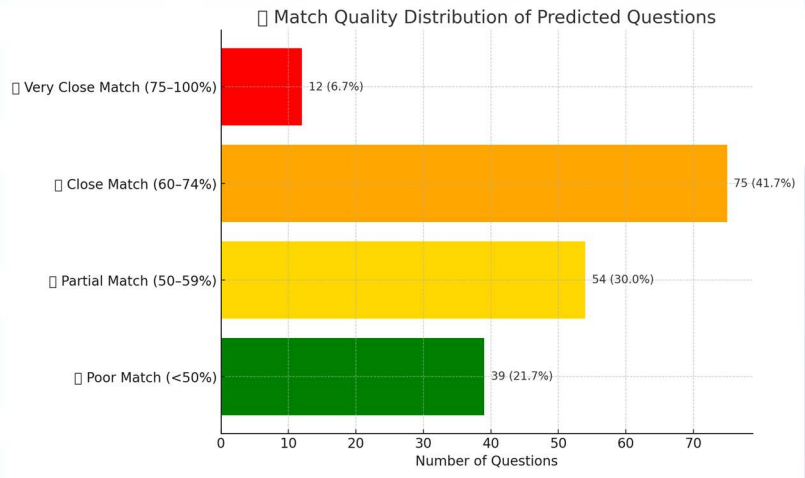
Our analysis after the JEE Main 2025 sessions shows:

- **50% of our predicted questions** were **similar** to actual exam questions.
- **Higher overlap** in Mathematics and Physics with moderate overlap in Chemistry.
- **Topic match accuracy of over 70%**

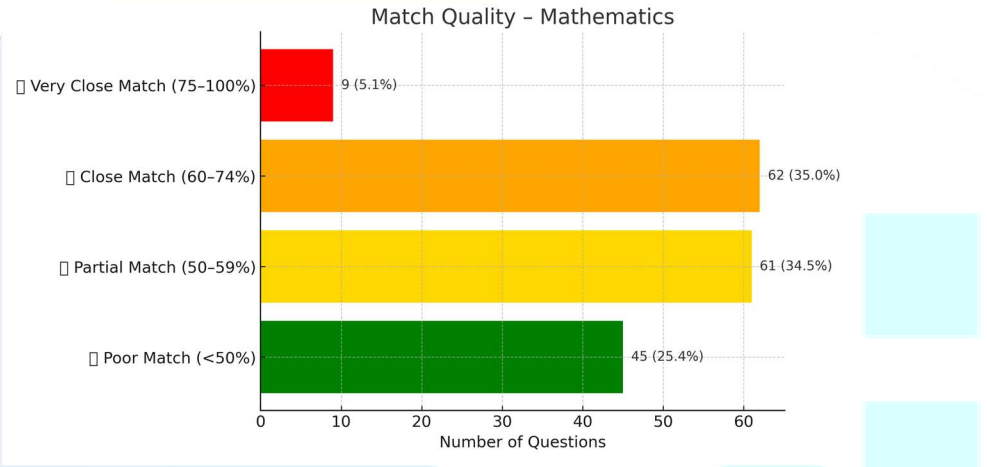
Proof of Effectiveness – JEE Main 2025 Case Study

In predictive modeling, results speak louder than claims. After the January and April 2025 sessions of the JEE Main exam, we performed a rigorous post-analysis comparing our predicted guess paper questions with the actual questions that appeared in the exam.

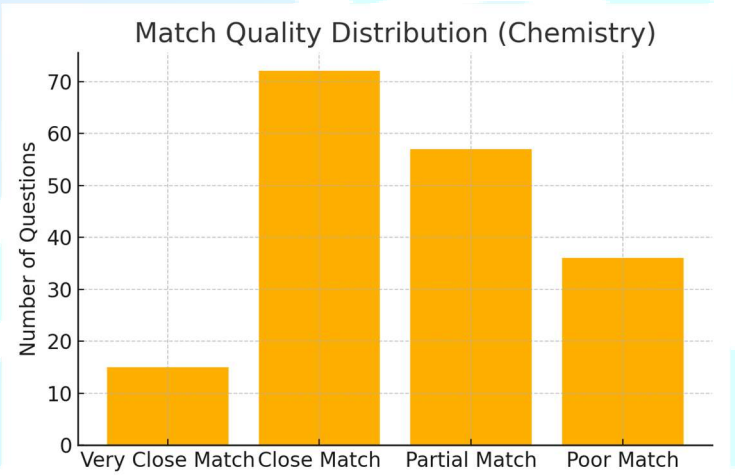
Physics - A total of 180 questions were predicted prior to the exam starting on 2nd of April 2025. The result is as below:



Mathematics – A total of 177 questions were predicted prior to the examination, and the result is as below:



Chemistry – A total of 180 questions were predicted prior to the examination, and the result is as below:



These results are not just numbers. They represent a powerful edge in exam preparation — an edge that can **reduce uncertainty, save time**, and **sharpen focus** in the final weeks before the exam.

Example Pair Highlights

Actual Questions refer to JEE Main April 2025 exams.

Predicted questions are from the previous year JEE Main questions.

Physics

Actual Question (A65):

A block of mass 1 kg , moving along x with speed v_i=10 ~m / s enters a rough region ranging from x=0.1 ~m to x=1.9 ~m. The retarding force acting on the block in this range is F_r=-k x ~N, with k=10 N / m. Then the final speed of the block as it crosses rough region is.

Predicted Question 1 (P127):

A block of mass 2 kg moving on a horizontal surface with speed of 4 ~m ~s^-1 enters a rough surface ranging from x=0.5 ~m to x=1.5 ~m. The retarding force in this range of rough surface is related to distance by F=-k x where k=12 ~N ~m^-1. The speed of the block as it just crosses the rough surface will be

Only differences: Likely just changes in numeric parameters or context wording.

Actual Question (A85):

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

Reason R: Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold frequency. In the light of the above statements, choose the correct answer from the options given below

Predicted Question 1 (P133):

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : The photoelectric effect does not take place, if the energy of the incident radiation is less than the work function of a metal.

Reason R: Kinetic energy of the photoelectrons is zero, if the energy of the incident radiation is equal to the work function of a metal.

Only differences: Likely just changes in numeric parameters or context wording.

Actual Question (A127):

A cubic block of mass m is sliding down on an inclined plane at 60^ with an acceleration of g/2, the value of coefficient of kinetic friction is

Predicted Question 1 (P174):

A block of mass m slides down the plane inclined at angle 30^ with an acceleration g/4. The value of coefficient of kinetic friction will be :

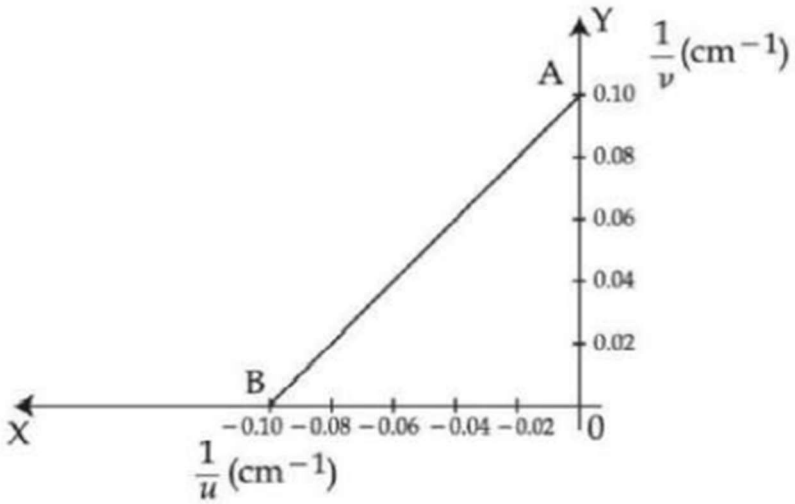
Only differences: Likely just changes in numeric parameters or context wording.

Actual Question (A57):

The radii of curvature for a thin convex lens are 10 cm and 15 cm respectively. The focal length of the lens is 12 cm . The refractive index of the lens material is

Predicted Question 1 (P89):

The graph between 1/u and 1/v for a thin convex lens in order to determine its focal length is plotted as shown in the figure. The refractive index of lens is 1.5 and its both the surfaces have same radius of curvatures R. The value of R will be cm . (Where u= object distance, v= image distance).



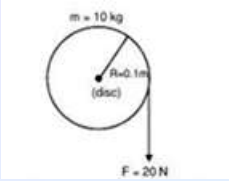
Only differences: Likely just changes in numeric parameters or context wording.

Predicted Question

A light rope is wound around a hollow cylinder of mass 5 kg and radius 70 cm. The rope is pulled with a force of 52.5 N. The angular acceleration of the cylinder will be ____ rad/s².

Actual Question Jee Mains 2nd April 2025 Shift 1

Find angular velocity when 1 m rope is pulled.



1. Similarity Points:

Feature	Question 1	Question 2	Similarity?
Involves hollow cylinder	☑ Yes	Involves Circular Disc	☑
Rope pulling	☑ Yes	☑ Yes	☑
Rotational motion	☑ Yes (α)	☑ Yes (ω)	☑
Uses force and radius	☑ F & r given	☑ Implied through length pulled	☑
Final target	Angular acceleration	Angular velocity	✗ Different output

Conclusion: These questions are conceptually very similar. Both involve applying Newton's second law for rotation on a hollow cylinder with a rope. One asks for angular acceleration (α), the other for angular velocity (ω), but both use the same system and depend on torque and moment of inertia.

Predicted Question

The magnetic field at the centre of a circular coil of radius r, due to current I flowing through it, is B. The magnetic field at a point along the axis at a distance r/2 from the centre is:

Actual Question Jee Mains 2nd April 2025 Shift 1

The ratio of magnetic field at the center of a circular coil to the magnetic field at a distance x from the centre of the coil, where (x/R = 3/4), is :

1. **Similarity Points:**

Feature	Question 1	Question 2	Similarity?
Topic	Magnetic field of circular coil	Magnetic field of circular coil	☑
Uses axial magnetic field formula	☑ Yes	☑ Yes	☑
Distance from center involved	☑ x = r/2	☑ x = 3R/4	☑
Uses B at center as reference	☑ Yes	☑ Ratio with B_center	☑
Final target	Field at axis (x = r/2)	Ratio B_center / B_x	☑

Conclusion: Both questions test the concept of magnetic field due to a circular current-carrying coil. The predicted question calculates B along the axis, and the actual question compares that with B at center using a given x/R value. Conceptually and mathematically, they are highly similar.

Predicted Question

Match List I with List II:
A. Isothermal Process
B. Adiabatic Process
C. Isochoric Process
D. Isobaric Process
Options in List II:
I. Work done by gas decreases internal energy
II. No change in internal energy
III. The heat absorbed goes partly to increase internal energy and partly to do work
IV. No work is done on or by the gas

Actual Question Jee Mains 2nd April 2025 Shift 1

Which of the following statement(s) is/are correct for the adiabatic process?
(A) Molar heat capacity is zero
(B) Molar heat capacity is infinite
(C) Work done on gas is equal to increase in internal energy
(D) The increase in temperature results in decrease in internal energy

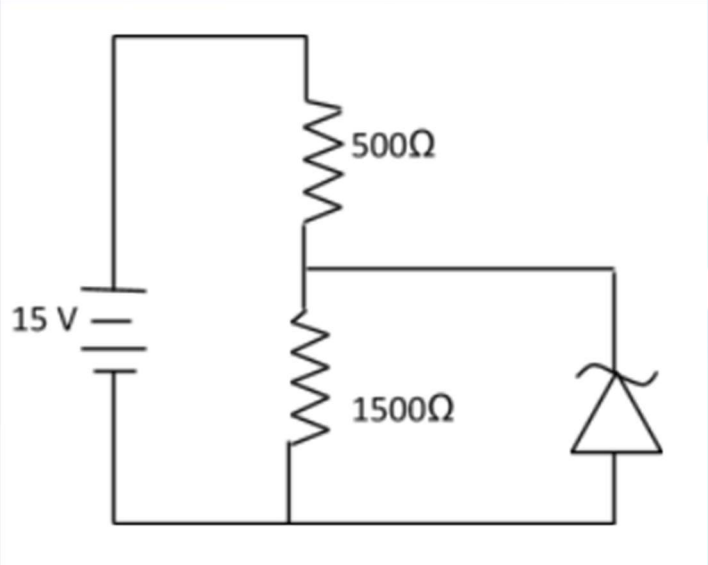
1. **Similarity Points:**

Feature	Question 1	Question 2	Similarity?
Topic	Thermodynamic Processes	Thermodynamic Processes	☑
Involves Adiabatic process	☑ Yes	☑ Yes	☑
Conceptual reasoning	☑ Yes (Match with properties)	☑ Yes (identify true statements)	☑
Multiple correct format	☑ Match multiple rows	☑ Multi-select MCQ	☑
Numerical computation	✗ No	✗ No	☑ No calculation

Conclusion: Both questions assess conceptual understanding of thermodynamic processes, especially adiabatic behavior. The predicted question uses matching format while the actual question uses multiple true/false choices, but both check the same foundational understanding.

Predicted Question

In the given circuit find the current through the Zener diode.



Actual Question Jee Mains 2nd April 2025 Shift 1

A Zener diode of Vz = 5 V is used as a voltage regulator. The unregulated supply voltage is 10 V. Series resistance is 100 Ω. The current through the Zener diode is 4 times the load current. Find load resistance and current through the load.

1. **Similarity Points:**

Feature	Question 1	Question 2	Similarity?
Topic	Zener Diode Regulation	Zener Diode Regulation	☑
Requires Zener voltage behavior	☑ Yes	☑ Yes	☑
Applies KVL and Ohm's law	☑ Yes	☑ Yes	☑
Requires calculating diode current	☑ Yes	☑ Yes	☑
Final output	Current through Zener	Load current and resistance	✗

Conclusion: Both questions are based on Zener diode voltage regulation principles. The predicted one focuses on diode current directly, while the actual one extends to load current and resistance based on a fixed voltage drop across the Zener. Same concepts and circuit analysis skills are required.

Predicted Question

The energy of He^+ ion in its first state is: (Given: Ground state energy of H atom is −13.6 eV)

Actual Question Jee Mains 2nd April 2025 Shift 1

Which statement is correct?
(A) Energy of ground state of H atom is equal to energy of He atom in first excited state
(B) Energy of ground state of H atom is equal to energy of He^+ atom in second excited state
(C) Energy of H atom is equal to energy of Li^{3+} in second excited state
(D) Energy of H atom is equal to energy of Li^{3+} in their excited state

Similarity Points:

Feature	Question 1	Question 2	Similarity?
Topic	Energy of He^+ atom	Energy of hydrogen-like atoms	☑
Formula used	$E = -13.6Z^2/n^2$	$E = -13.6Z^2/n^2$	☑
Comparison with hydrogen	☑ Yes	☑ Yes	☑
Conceptual vs Numerical	☑ Direct calculation	☑ Conceptual matching	☑
Final target	Energy of He^+ (Z=2, n=1)	Matching energy levels of different ions	☑

Conclusion: Both questions test the concept of energy levels in hydrogen-like atoms using the same formula. One is a direct computation, while the other asks for conceptual matching of levels across species (He^+, Li^{2+}, H). They assess the same conceptual understanding of quantum energy levels.

Predicted Question

In Young's double slit experiment, carried out with light of wavelength 5000 Å, the distance between the slits is 0.3 mm and the screen is at 200 cm from the slits. The central maximum is at x = 0 cm. The value of x for the third maxima is ___ mm.

Actual Question Jee Mains 2nd April 2025 Shift 1

Angular separation between second maximum of left side of central maxima and third maxima of right side of central maxima is 30°, when 628 nm light is used in YDSE. Find slit width in μm.

Similarity Points:

Feature	Question 1	Question 2	Similarity?
Topic	Young's Double Slit Experiment	Young's Double Slit Experiment	☑
Wavelength of light used	☑ Given (5000 Å)	☑ Given (628 nm)	☑
Involves maxima	☑ Yes (3rd maxima)	☑ Yes (2nd & 3rd maxima)	☑
Uses fringe position or angle	☑ Linear displacement (x)	☑ Angular displacement (θ)	☑
Target parameter	Fringe position	Slit width	✗ Different goal

Conclusion: Both questions are based on the core concepts of interference in Young's double slit setup. The predicted question focuses on fringe location on the screen, whereas the actual one evaluates angular fringe position to calculate slit separation. Both require the formula for maxima and are tightly related.

Mathematics

Predicted Question

Let $y = mx + c$, $m > 0$ be the focal chord of $y^2 = -64x$, which is tangent to $(x + 10)^2 + y^2 = 4$. Find the value of $4\sqrt{2}(m + c)$.

Actual Question Jee Mains 2nd April 2025 Shift 1

Focal Chord PQ of the parabola $y^2 = 4x$ makes an angle 60° with positive x-axis, where P lies in the first quadrant. A circle is drawn with SP as diameter, and it touches the tangent at the vertex of the parabola at $(0, \alpha)$. Find α^2, where S is the focus of the parabola.

1. **Similarity Points:**

Feature	Question 1	Question 2	Similarity?
Involves parabola	☑ Yes	☑ Yes	☑
Involves focal chord	☑ Yes	☑ Yes	☑
Focus involved	☑ Implicitly	☑ Explicitly (SP as diameter)	☑
Uses external geometry (circle)	☑ Circle tangent to line	☑ Circle touches tangent	☑
Uses slope/angle of chord	☑ m > 0 used	☑ Angle = 60° given	☑
Objective	Find value involving m and c	Find α^2	✗ Different objective

Conclusion: Both questions are **highly similar** in terms of parabola geometry, focus, focal chord, and their relationship with circles. They differ in what needs to be calculated (expression vs coordinate).

2. Concept Used in Both Questions

Both questions require understanding of:

- Definition and geometry of focal chords in parabolas

- Use of slopes or angles for determining point coordinates

- External geometry involving circle and tangency condition

- Parametric equations of parabolas and properties of focus

3. Solution to Question 1 (Predicted)

Parabola: $y^2 = -64x \rightarrow$ opens left, focus at $(-16, 0)$

Focal chord means the line $y = mx + c$ passes through two points on the parabola whose product of parameters is constant (say $t_1t_2 = -1$).

Also, this line is tangent to a circle: $(x + 10)^2 + y^2 = 4 \rightarrow$ center at $(-10, 0)$, radius = 2

Substitute $y = mx + c$ into circle to get quadratic and apply condition for tangency (discriminant = 0)

From condition, solve for m and c

Then compute $4\sqrt{2}(m + c)$

4. Solution to Question 2 (Actual)

Parabola: $y^2 = 4x \Rightarrow$ standard right-opening parabola, focus = (1, 0)

Chord PQ is focal chord at 60° to x-axis $\Rightarrow$ use slope $m = \tan(60°) = \sqrt{3}$

Using slope and focal chord property, get coordinates of P and Q via parametric form

SP is diameter of circle $\Rightarrow$ center is midpoint of S and P, radius = half of SP

This circle touches the tangent at vertex $\Rightarrow$ apply perpendicular distance = radius from center to tangent line $y = 0$

Solve for y-coordinate of center (α), square it to get α^2

5. Final Comparison of Concepts

Feature	**Question 1**	**Question 2**
Parabola used	$y^2 = -64x$	$y^2 = 4x$
Focal chord concept	Yes	Yes
Slope or angle given	$m > 0$	60° with x-axis
Circle geometry involved	Yes – tangency to circle	Yes – circle touches tangent
Final value needed	Expression $(m + c)$	Coordinate squared (α^2)

Conclusion: These are conceptually similar questions with parabola, focal chord, and geometric conditions involving tangents and circles. The final targets are different but the underlying geometry is closely aligned.

Predicted Question

Let α and β be two real numbers such that α + β = 1 and αβ = -1. Let $p_n = \alpha^n + \beta^n$, and $p_{n-1} = 11$, $p_{n+1} = 29$. Find p_n^2.

Actual Question Jee Mains 2nd April 2025 Shift 1

Let α, β be roots of a quadratic equation and $P_n = \alpha^n + \beta^n$. Given $P_8 = 47$, $P_9 = 76$, $P_{10} = 123$, find the quadratic equation whose roots are 1/α and 1/β.

Similarity Points:

Feature	Question 1	Question 2	Similarity?
Defines $P_n = \alpha^n + \beta^n$	☑ Yes	☑ Yes	☑
Uses recurrence relation	☑ Yes (implicitly)	☑ Yes (implicitly)	☑
Uses symmetric expressions	☑ Yes	☑ Yes	☑
Final goal	Find p_n^2	Find new quadratic equation	✗ Different target
Provided data	p_{n-1}, p_{n+1}	P_8, P_9, P_{10}	☑ Similar

Conclusion: They are highly similar in concept, both based on recursive relations involving $\alpha^n + \beta^n$ and use of symmetric functions. Difference lies in goal of the problem.

Concept Used in Both Questions

Both use recurrence relations derived from:

If α + β = s, αβ = p, then:

$P_n = sP_{n-1} - pP_{n-2}$

This is key for both.

Solution to Question 1

Given:

α + β = 1, αβ = -1

$p_{n-1} = 11$, $p_{n+1} = 29$

Use recurrence:

$p_n = p_{n-1} + p_{n-2} \rightarrow p_{n+1} = p_n + p_{n-1}$

$29 = p_n + 11 \rightarrow p_n = 18 \rightarrow p_n^2 = 324$

Answer: 324

Solution to Question 2

Given: $P_8 = 47$, $P_9 = 76$, $P_{10} = 123$

Assume $P_n = P_{n-1} + P_{n-2}$ (Fibonacci type)

Check: $47 + 76 = 123$ ☑

So same recurrence as Fibonacci:

$\alpha + \beta = 1$, $\alpha\beta = -1 \Rightarrow$ original quadratic: $x^2 - x - 1 = 0$

Then inverse roots: $1/\alpha$ and $1/\beta$

New quadratic: $x^2 + x - 1 = 0$

Answer: $x^2 + x - 1 = 0$

Final Comparison of Concepts

Feature	**Question 1**	**Question 2**
Uses recurrence	Yes — $p_n = p_{n-1} + p_{n-2}$	Yes — $P_n = P_{n-1} + P_{n-2}$
Based on root properties	Yes — $\alpha + \beta$, $\alpha\beta$	Yes — Roots of quadratic used
Final Goal	Compute p_n^2	Find new quadratic with inverse roots

Conclusion: Both questions are structurally and conceptually similar. The key concept is the recurrence relation based on the sum and product of roots.

Predicted Question

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.

Actual Question Jee Mains 2nd April 2025 Shift 1

The total number of 10-digit numbers formed using only {0,1,2}, where 1 should be used at least 5 times and 2 should be used exactly 3 times.

1. **Similarity Points:**

Feature	Question 1	Question 2	Similarity?
Involves number formation	☑ Yes	☑ Yes	☑
Digit restrictions	☑ Uses specific digits	☑ Uses specific digits	☑
Condition on divisibility/occurrence	☑ Divisible by 3	☑ Constraints on digit counts	❌ Different condition type
Repetition allowed?	☑ Yes	☑ Yes	☑
Key concept	Divisibility + Permutations	Digit count-based Combinations	❌ Different focus

Conclusion: These two questions are moderately similar. Both are in the domain of digit-based counting and permutations/combinations, but differ in goal. The predicted one focuses on divisibility and permutations, the actual one on constrained digit usage and combinations.

2. Concept Used in Both Questions

Both questions use combinatorics but from different angles:

Question 1: Counts valid permutations satisfying a divisibility constraint (using the rule of divisibility by 3).

Question 2: Counts arrangements satisfying exact/at-least digit count constraints, typically using combinations with restrictions.

3. Solution to Question 1 (Predicted)

Digits available: 1, 3, 5, 8 (repetition allowed).

Total 3-digit numbers = $4 \times 4 \times 4 = 64$

Now filter those divisible by 3 using the sum of digits % 3 = 0 rule.

Loop through all 64 combinations (brute-force or mod-3 sum logic) and count satisfying numbers.

Final Answer depends on exact count, which needs enumeration.

4. Solution to Question 2 (Actual)

We must form a 10-digit number using only 0, 1, 2.

Constraints:

• 1 must be used at least 5 times.

• 2 must be used exactly 3 times.

Let's say number of 1s = $x \geq 5$, then number of 0s = $10 - x - 3 = 7 - x$

x can be 5, 6, or 7 ⇒ check all possible valid values.

For each valid x, compute:

• Total permutations of 10 digits = $10! / (x! \times 3! \times (7 - x)!)$

• Subtract those starting with 0 (invalid as leading 0 not allowed).

Sum all valid cases.

5. Final Comparison of Concepts

Feature	**Question 1**	**Question 2**
Concept type	Permutations + Divisibility	Combinations + Constraints
Involves digit arrangement	Yes	Yes
Has specific numeric constraints	Yes – Divisible by 3	Yes – Exact/At-least usage
Repetition allowed	Yes	Yes
Difficulty level	Moderate	High (more conditions)

Conclusion: Both questions test combinatorial logic, but focus on different types of constraints – one focuses on digit-sum based divisibility and the other on fixed digit counts

Predicted Question

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.

Actual Question Jee Mains 2nd April 2025 Shift 1

Let ABCD be a tetrahedron in which ∠BAC, ∠CAD, ∠BAD are right angles and the area of faces ABC, BAD, and CAD are 5, 7, and 6 respectively. Find the area of face BCD.

1. Similarity Points:

Feature	Question 1	Question 2	Similarity?
Involves a tetrahedron	☑ Yes	☑ Yes	☑
3D geometry concept	☑ Vector angle between faces	☑ Area of triangle faces	☑
Given points or angles	☑ Coordinates of vertices	☑ Right angles at vertex A	☑
Final goal	Find angle between two planes	Find area of opposite face	✗ Different goal
Vector/Area-based logic	☑ Yes	☑ Yes	☑

Conclusion: These questions are quite similar in setup and geometry type (tetrahedron). Both involve properties of 3D figures, use of vector geometry, and plane analysis, although the final objectives differ.

2. Concept Used in Both Questions

Both use vector geometry in 3D. Question 1 involves computing angle between planes using normal vectors, while Question 2 uses geometric decomposition with orthogonality and triangle area formulas.

3. Solution to Question 1 (Predicted)

Given coordinates of P, Q, R, and O.

1. Compute normal vector to plane OPQ using cross product of OP and OQ.

2. Compute normal vector to plane PQR using cross product of PQ and PR.

3. Use angle between two planes = angle between normal vectors:

$\cos\theta = (n1 \cdot n2) / (|n1||n2|)$

$\theta = \cos^{-1}(\text{result})$ gives angle between planes.

4. Solution to Question 2 (Actual)

Let ABCD be such that ∠BAC, ∠CAD, ∠BAD = 90°. So, triangle ABC, ACD, and ABD lie on mutually perpendicular planes.

Thus, the vectors AB, AC, and AD are mutually perpendicular.

If area of triangles at A are given as 5, 6, 7, we can relate them to triangle sides:

Area of triangle = (1/2) × base × height ⇒ get AB, AC, AD values.

Use Pythagoras in 3D and area formula for triangle BCD using sides derived from AB, AC, AD.

Apply Heron's formula or vector cross-product for BCD's area.

5. Final Comparison of Concepts

Feature	**Question 1**	**Question 2**
Geometry Type	Tetrahedron (3D)	Tetrahedron (3D)
Concepts Used	Vector geometry, plane normals	Orthogonal vectors, triangle area
Final Goal	Angle between planes	Area of 4th face
Vectors/Planes	Yes	Yes
Requires cross product	Yes	Possibly (if using vectors)

Conclusion: The two questions are conceptually related through 3D vector geometry. Question 1 deals with angle between faces, while Question 2 focuses on area using right angle properties.

Predicted Question

Let E_1: $x^2/a^2 + y^2/b^2 = 1$, where $a > b$. Let E_2 be another ellipse that touches the endpoints of the major axis of E_1 and has its foci as the endpoints of the minor axis of E_1. If E_1 and E_2 have the same eccentricity, find its value.

Actual Question Jee Mains 2nd April 2025 Shift 1

Let P be any point on the ellipse $x^2/18 + y^2/9 = 1$. If S_1 and S_2 are the foci of the ellipse, find the product of the maximum and minimum values of $PS_1 \times PS_2$.

1. Similarity Points:

Feature	**Question 1**	**Question 2**	**Similarity?**
Involves ellipse	☑ Yes	☑ Yes	☑
Foci of ellipse used	☑ Used as foci of E_2	☑ Used for distance from point P	☑
Concept of eccentricity	☑ Required to be equal	☑ Implicit in geometry	☑

Algebraic ellipse equation	☑ General form	☑ Given equation	☑
Final goal	Find eccentricity	Find value involving $PS_1 \times PS_2$	✗ Different target

Conclusion: These questions are quite similar as both deeply involve properties of ellipses and their foci. The predicted question explores geometric construction and eccentricity, while the actual question explores the extremum of a geometric product related to the ellipse.

2. Concept Used in Both Questions

Both problems use:

- Standard form of an ellipse and the relation between a, b, and eccentricity

- Properties of foci ($c^2 = a^2 - b^2$)

- Geometric understanding of distances related to foci and ellipse structure

- Eccentricity \(e = \sqrt{1 - b^2/a^2} \)

3. Solution to Question 1 (Predicted)

Given ellipse E_1: $x^2/a^2 + y^2/b^2 = 1$, $a > b$ ⇒ eccentricity of E_1 is $e = \sqrt{(1 - b^2/a^2)}$.

Endpoints of major axis: $(\pm a, 0)$, endpoints of minor axis: $(0, \pm b)$.

E_2 touches the endpoints of major axis ⇒ endpoints lie on E_2 ⇒ semi-major axis = a.

E_2 has foci at $(0, \pm b)$, so distance from center to focus = b ⇒ eccentricity of E_2 is $e = b/a$.

Equating eccentricities:

$\sqrt{(1 - b^2/a^2)} = b/a$ ⇒ Squaring: $1 - b^2/a^2 = b^2/a^2$ ⇒ $1 = 2b^2/a^2$ ⇒ $a^2 = 2b^2$ ⇒ $e^2 = 1 - b^2/a^2 = 1 - 1/2 = 1/2$ ⇒ $e = 1/\sqrt{2}$

4. Solution to Question 2 (Actual)

Ellipse: $x^2/18 + y^2/9 = 1$ ⇒ $a^2 = 18$, $b^2 = 9$ ⇒ $c^2 = a^2 - b^2 = 9$ ⇒ $c = 3$

Foci: $S_1 = (\pm 3, 0)$

Let P be any point on ellipse, need max and min value of $PS_1 \times PS_2$

It is known from ellipse properties that for point P on ellipse, the product $PS_1 \times PS_2$ has maximum = $a^2 = 18$ and minimum = $b^2 = 9$

So, required product = $18 \times 9 = 162$

5. Final Comparison of Concepts

Feature	Question 1	Question 2
Ellipse form	General: $x^2/a^2 + y^2/b^2 = 1$	Specific: $x^2/18 + y^2/9 = 1$
Uses foci	As foci of second ellipse	To measure distances from P
Target value	Eccentricity	$PS_1 \times PS_2$ (extremum)
Eccentricity used	Explicitly equated	Implicit in geometry
Geometric reasoning	Yes – construction based	Yes – extremum analysis

Conclusion: Both questions revolve around ellipses and their geometric properties, especially involving foci and eccentricity. Though the final questions differ, the base concepts show a clear overlap.

Predicted Question

Let r_1 and r_2 be the radii of the largest and smallest circles, respectively, which pass through the point (-4, 1) and have their centres on the circumference of the circle $x^2 + y^2 + 2x + 4y - 4 = 0$. If $r_1/r_2 = a + b\sqrt{2}$, find $a + b$.

Actual Question Jee Mains 2nd April 2025 Shift 1

Two circles touch the lines $x + y = 3$ and $x - y = 3$, and also pass through the point (9, -4). Find the absolute difference of the radii of the two circles.

Similarity Points:

Feature	Question 1	Question 2	Similarity?
Involves circles	☑ Yes	☑ Yes	☑
Common point condition	☑ Both pass through (-4, 1)	☑ Both pass through (9, -4)	☑
Tangency to lines or circles	☑ Centers lie on given circle	☑ Tangent to given lines	☑
Optimization of radius	☑ Max and min radius	☑ Two radii with absolute difference	☑
Final goal	Find expression involving r_1/r_2	Find $\lvert r_1 - r_2 \rvert$	✗ Different operation

Conclusion: Both problems revolve around geometric constraints on circles passing through a fixed point and touching a curve or lines. The focus is on radius-based comparison under given tangency conditions.

2. Concept Used in Both Questions

Key concepts used include:

- Distance between point and center (to compute radius)

- Locus constraint on circle centers (circle or line)

- Tangency to lines (perpendicular distance from center to line equals radius)

- Geometric optimization (max/min distance, ratio, or difference)

3. Solution to Question 1 (Predicted)

Given fixed point (-4, 1) and center of varying circle lies on circle C: $x^2 + y^2 + 2x + 4y - 4 = 0$

Simplify to center form: $(x + 1)^2 + (y + 2)^2 = 9 \Rightarrow$ center lies on this circle

Distance from (-4, 1) to center gives radius r $\Rightarrow$ r = distance

Maximum and minimum such distances from (-4, 1) to any point on the circle $\Rightarrow r_1$ = max distance, r_2 = min distance

Use geometry: max = R + d, min = |R - d|, where d = distance from (-4,1) to center (-1, -2), R = 3

Compute ratio r_1/r_2 and express in form $a + b\sqrt{2} \Rightarrow$ find a + b

4. Solution to Question 2 (Actual)

Let center be (h, k), radius = r

Circle touches x + y = 3 and x - y = 3 $\Rightarrow$ perpendicular distances from center to these lines equal r

Apply distance formula to both lines $\Rightarrow$ equations involving h, k, and r

Circle also passes through (9, -4): use distance from center to this point = r

Solve system of equations $\Rightarrow$ get two radii $\Rightarrow$ compute absolute difference

5. Final Comparison of Concepts

Feature	Question 1	Question 2
Circle condition	Center on fixed circle	Touches fixed lines
Passes through fixed point	Yes (−4,1)	Yes (9,−4)
Goal	Ratio of max/min radius	Difference of two radii
Distance-based logic	Yes (point to center)	Yes (center to line & point)
Optimization type	Ratio (r_1/r_2)	Absolute difference ($\|r_1-r_2\|$)

Conclusion: Both questions involve determining radii of circles under geometric constraints and a shared point. Though the form of answer varies, the core concept of using distance and tangency remains central.

What This Means for Students

These findings are more than statistics — they are **proof of potential**. They demonstrate that:

- Our system isn't just generating random questions—it's **learning the pulse of the exam**.
- With each passing year and more data, the system **gets stronger and more accurate**.
- Students who practiced using this guess paper were **already familiar with many actual question types**, reducing stress and boosting confidence during the real exam.

Continuous Improvement

We treat every JEE paper as an opportunity to **refine our models**:

- Questions from JEE Main 2025 have already been fed into our updated system.
- Predictions for 2026 will be **even sharper** and **more targeted**.

Final Word from the Creator

"I built this system because I was tired of watching students work endlessly and still fall short—not because they lacked ability, but because they lacked direction. This book and this pack are for every student who wants to prepare smarter, not harder."

— Priyadarshini Sweta, Learne2i

About the Author

Priyadarshini Sweta is the visionary founder behind *Learne2i*, a next-generation learning platform built on the convergence of artificial intelligence, academic insight, and student psychology. An engineer and masters in global economy (Italy) by training and an **AI ambassador by conviction**, Priyadarshini has spent the last decade bridging the gap between **big tech capabilities and real-world education challenges**.

With a strong foundation in Electronics engineering and advanced analytics, Priyadarshini worked with global technology companies, where she led **AI-driven transformation initiatives** for complex industrial systems. But beyond corporate success, she saw a more urgent mission — **to redefine how Indian students prepare for high-stakes exams like JEE Main and NEET**.

Driven by the belief that "smart preparation beats hard preparation," Priyadarshini built *Learne2i* as a platform where **data science meets educational content**. Her work incorporates everything from **GPT-based question analysis and predictive modeling** to **curriculum-aware learning systems**, giving students not just practice—but strategy.

Recognized as a **thought leader in AI for education**, Priyadarshini collaborates with edtech communities and has consulted on **AI content pipelines and test intelligence systems** for institutions across India and abroad. She is often referred to as a **bridge between coders and classrooms**, making cutting-edge technology understandable and useful for learners.

As an **AI education evangelist**, Priyadarshini continues to push the boundaries of what's possible in personalized test preparation, trend forecasting, and content intelligence. Her mission is clear:

"To empower every student with the strategic advantage of data—regardless of where they study or how much they can afford."

Learne2i's AI-driven guess paper model, featured in this book, is a living proof of that mission.