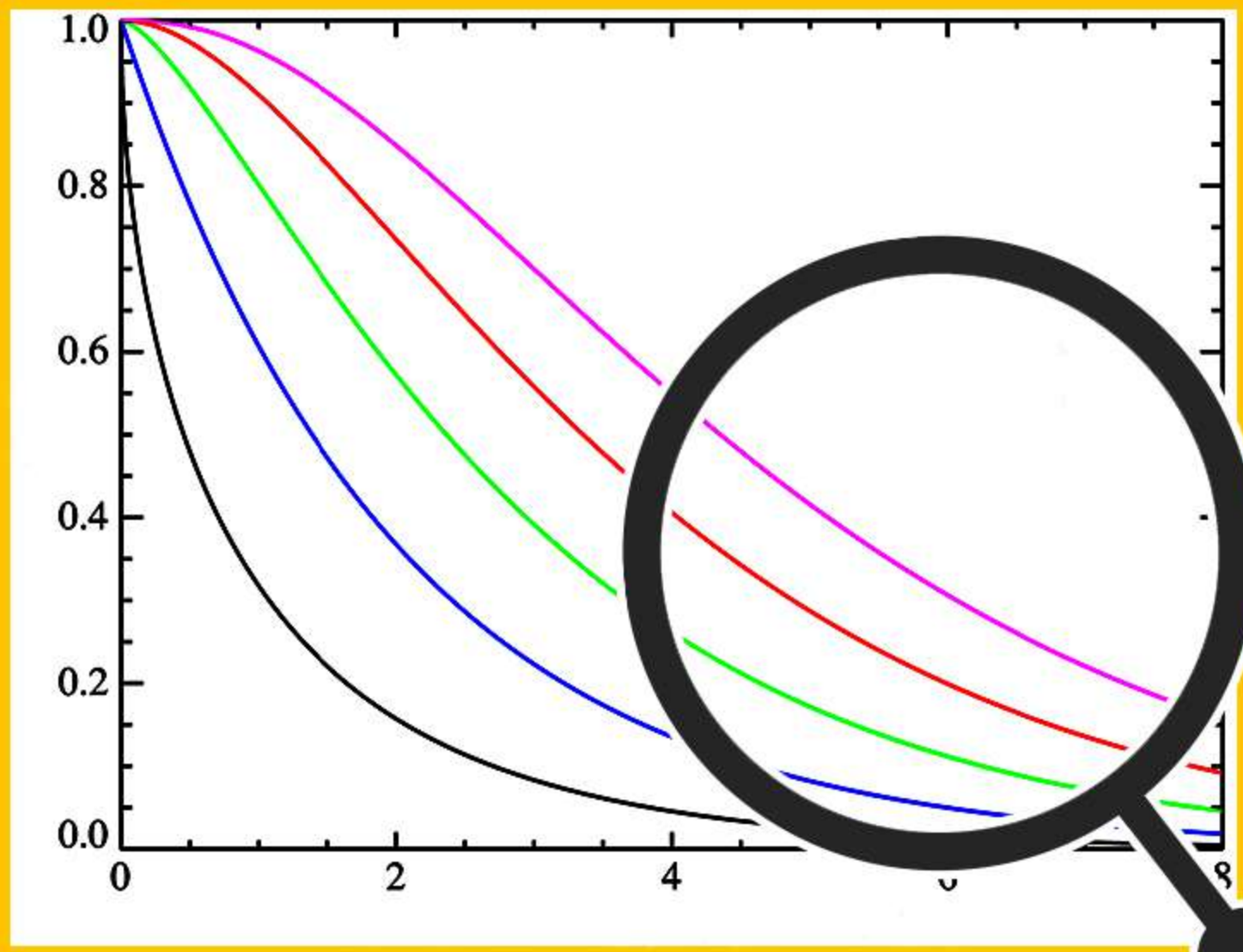
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# CHI-SQUARE TEST ($X^2$)

## A Topic You Can't Skip for Psychology Exams



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# Let's have a quick look at the type of questions that might appear in your exams from this topic!

**Ques. 1**

Which of the following is NOT an assumption of the Chi-square test?

a. Data should be in frequencies

b. Categories must be mutually exclusive

c. Expected frequency in each cell should be sufficiently large

d. The data should be normally distributed

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## Ques. 2

A contingency table has 4 rows and 3 columns.
What are the degrees of freedom for the Chi-square test?

a
6

b
7

c
12

d
9

Read carefully, challenge yourself to guess first as you go;
If you can't, the last slide has the answers.

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$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

# What is the Chi-Square Test?

The **Chi-square ($\chi^2$) test** is a non-parametric statistical test used when data are in the form of frequencies or counts, not scores or measurements.

In psychology research, it helps us answer questions like:

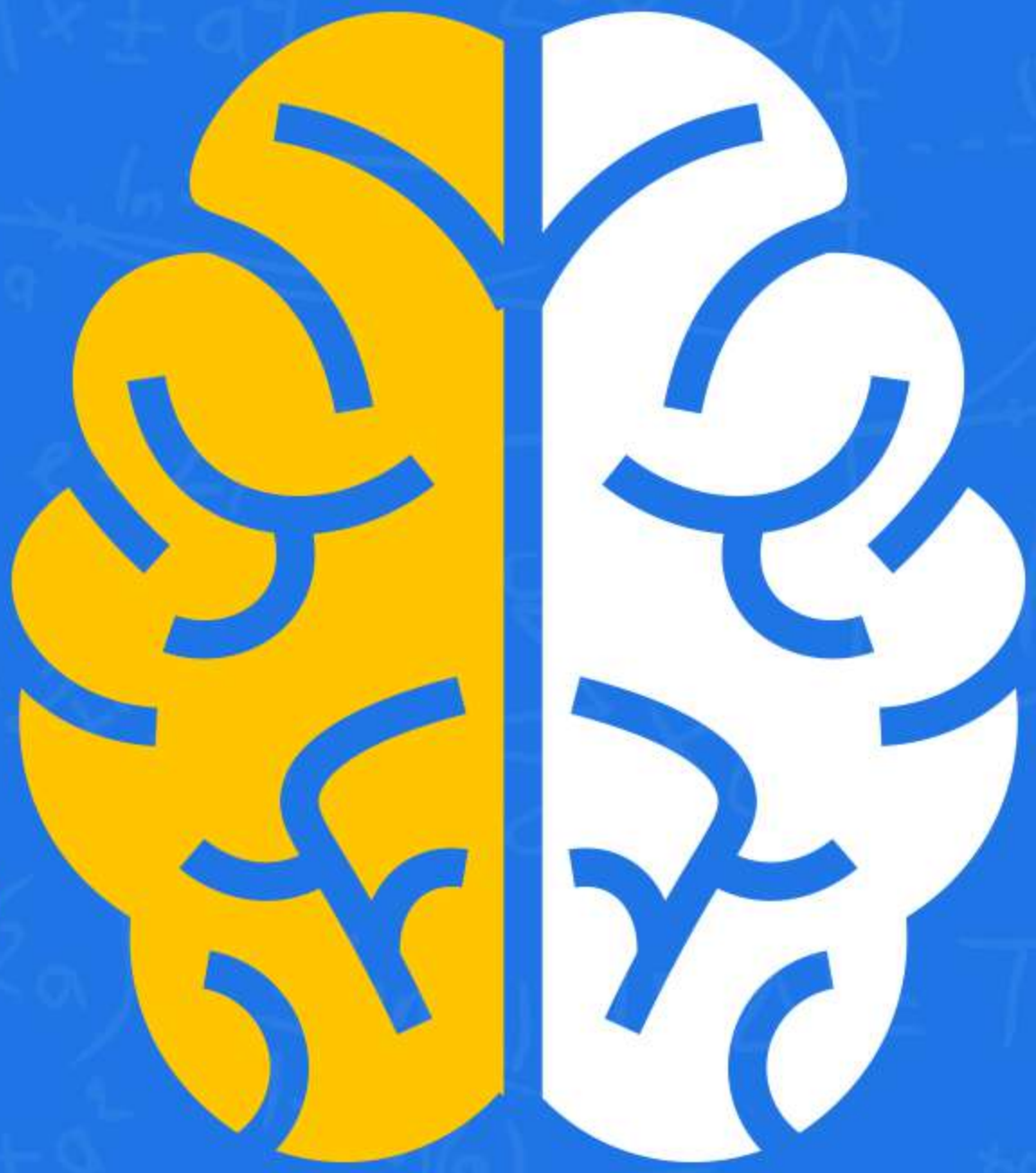
- Is there a relationship between two categorical variables?
- Does an observed frequency differ significantly from what we expect?

Because it does not assume normal distribution, it is widely used in behavioral and social sciences.

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# Why is Chi-Square Important in Psychology?



Psychological data often involve categories, not continuous scores, such as:

- Gender × Mental health status
- Therapy type × Improvement (Yes/No)
- Parenting style × Child behavior category

The Chi-square test allows researchers to statistically verify associations, rather than relying on assumptions or visual inspection.

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# Types of Chi-Square Tests

There are three important types you must remember for exams:

## 1. Chi-Square Test of Independence

- Checks whether two categorical variables are related
- **Example:** Study habit × Academic performance

## 2. Chi-Square Test of Goodness of Fit

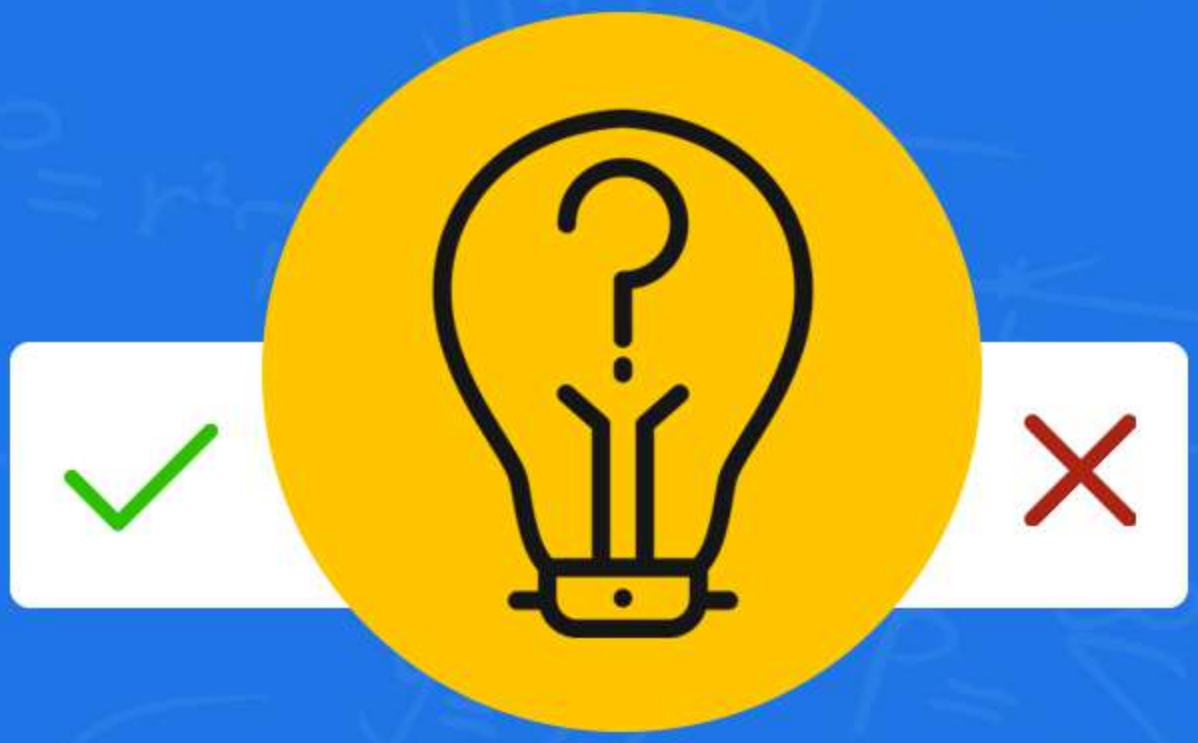
- Checks whether observed frequencies match expected frequencies
- **Example:** Preference for learning styles compared to equal distribution

## 3. Chi-Square Test of Homogeneity

- Checks whether the distribution of a categorical variable is the same across different populations or groups
- **Example:** Distribution of anxiety levels across different colleges

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# Assumptions of the Chi-Square Test

For valid results, the Chi-square test requires:

- Data must be in the form of frequencies (counts)
- Observations must be independent
- Categories should be mutually exclusive
- Expected frequency in each cell should ideally be 5 or more

A key exam point:
Chi-square does NOT require normal distribution

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# Formula and Core Logic

The Chi-square formula is:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where:

**O** = Observed frequency

**E** = Expected frequency

Remember: The test compares what you observed with what you expected under the null hypothesis.

A larger $\chi^2$ value indicates a greater deviation from expectation, increasing the chance of rejecting $H_0$.

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# Degrees of Freedom

For a Chi-square test of independence, degrees of freedom are calculated as:

$$df = (Rows - 1) \times (Columns - 1)$$

This value is crucial because:

- It determines the critical value from the Chi-square table
- A small mistake in df calculation can lead to a wrong conclusion

Exams frequently test df through short numerical problems.

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**Q1: D.** The data should be normally distributed

**Q2: A.** 6