P Value

with

Chi-Square Distribution

What is **P Value**?

Assuming H_0 is valid, the p-value is is the probability of getting a value of the Computed Test Statistics that is at least as extreme as the one representing the sample data.

What does **P Value** provide?

The p-value provides the smallest level of significance for which the null hypothesis H_0 would be rejected and the alternative hypothesis H_1 would be supported.

What is **Chi-Square Distribution**?

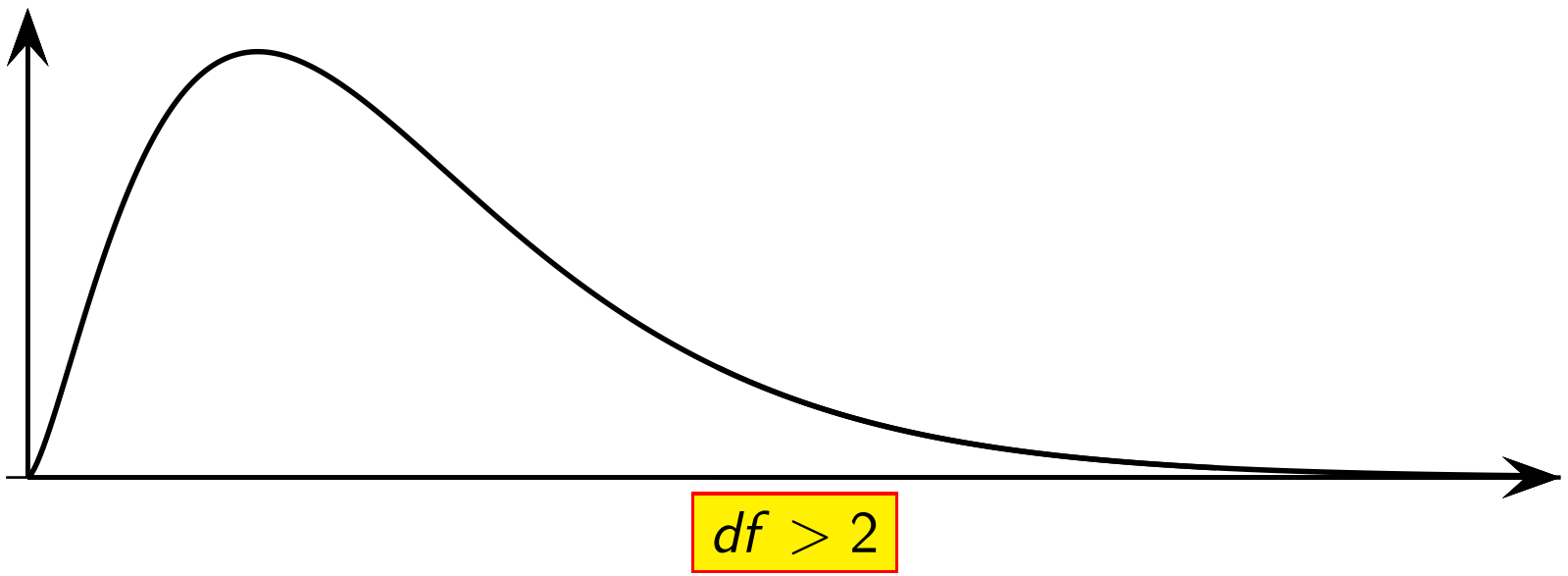
The chi-square distribution is a method to find the probability of seeing certain results when working with categorical data.

It is like we are comparing observed data to what it is expected under certain assumption.

- The density curve is not symmetric.
- The density curve is not bell-shaped.
- The density curve begins at 0 and it is skewed to the right.
- The total area under the curve is 1.
- It also comes with degrees of freedom.

It is also worth noting that the density curve may look bell-shaped as degrees of freedom increases.

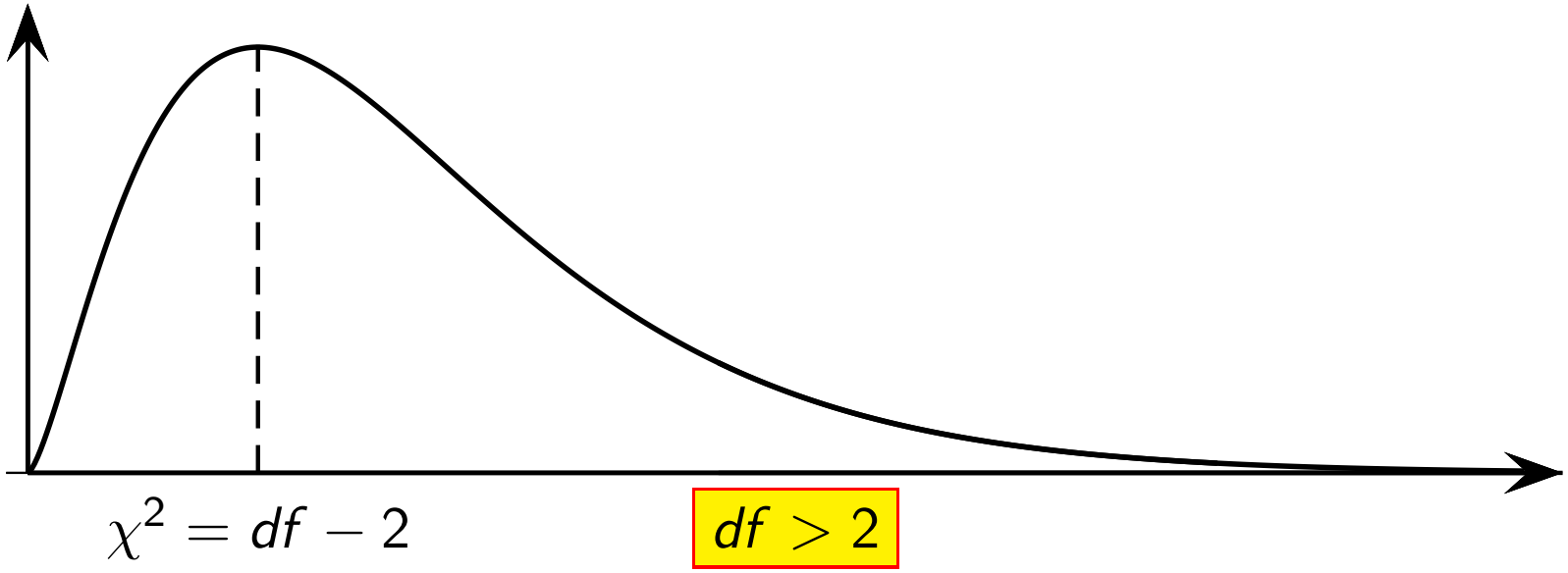
Here is how the χ^2 distribution curve look like.



Where does χ^2 **Distribution** curve peak?

- When $df \leq 2$, the χ^2 distribution curve $\to \infty$ as $\chi^2 \to 0$.
- When $Ndf > 2$, the χ^2 distribution curve has a peak point at

$$\chi^2 = df - 2$$



P Value & CTS χ^2:

Testing Type	TI Command
Right-Tail Test	$\chi^2 cdf(CTS, E99, df)$
Left-Tail Test	$\chi^2 cdf(0, CTS, df)$
Two -Tail Test	• Find the area on both sides of CTS χ^2
	• Multiply the smaller area by 2

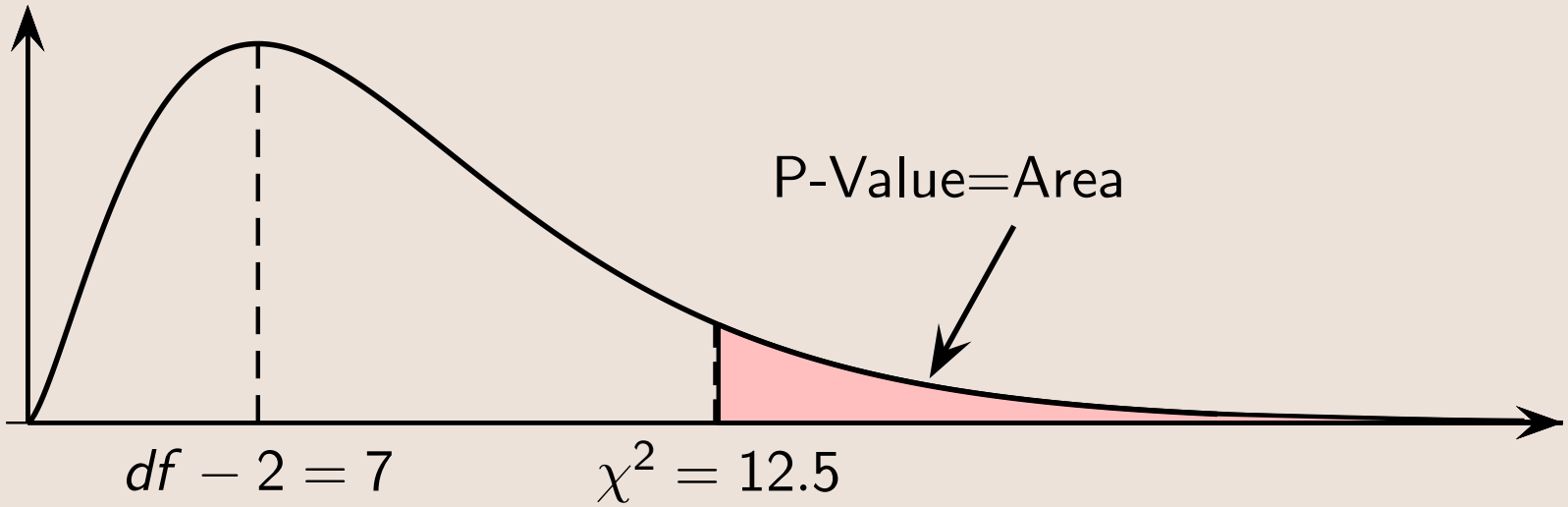
2ND , VARS , ↓ , χ^2cdf

Example:

Find the corresponding P-Value for a Right-Tail Test with $CTS\ \chi^2 = 12.5$ with $df = 9$. Round to 3-decimal places.

Solution:

We start by drawing the chi-square curve, then shade and label accordingly.



Now we can use the TI command,

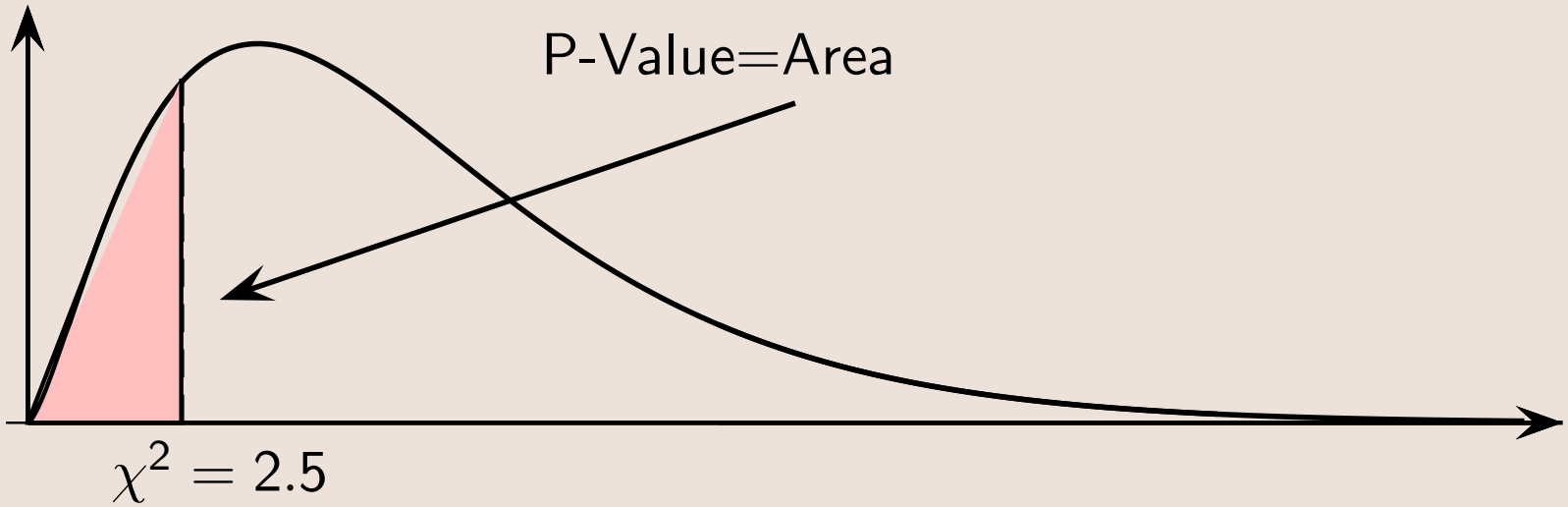
$P - Value = \chi^2 cdf(12.5, E99, 9) \approx 0.187.$

Example:

Find the corresponding P-Value for a Left-Tail Test with $CTS\ \chi^2 = 2.5$ with $df = 12$. Round to 3-decimal places.

Solution:

We start by drawing the chi-square curve, then shade and label accordingly.



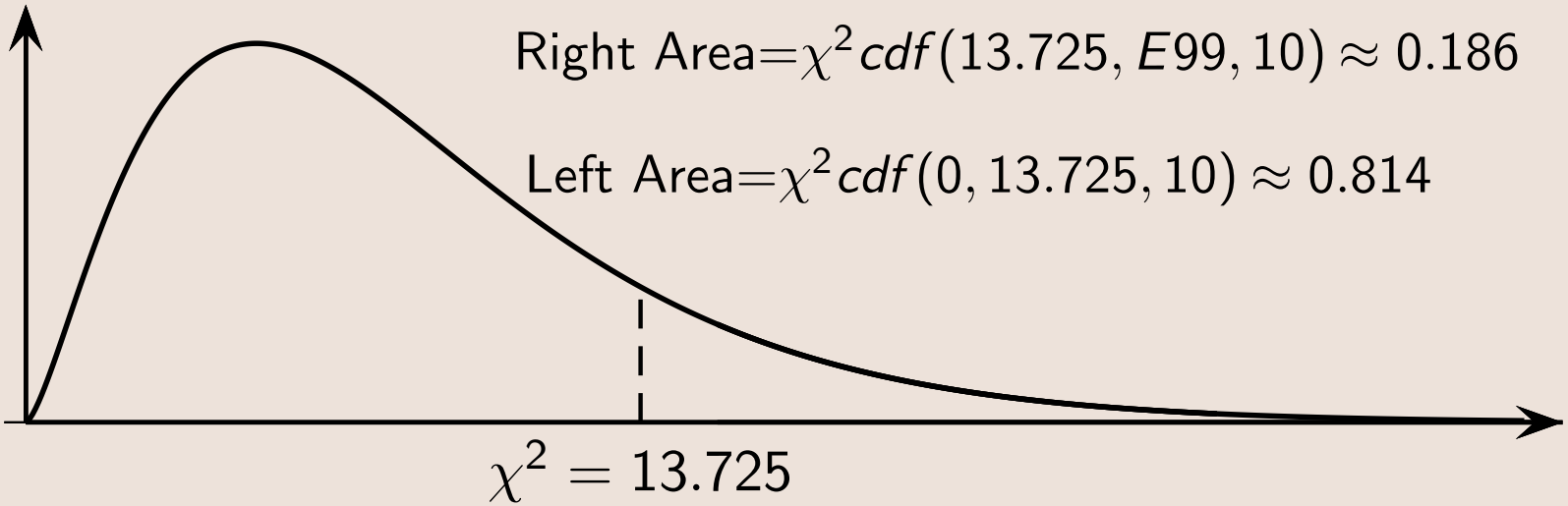
Now we can use the TI command,
$P - Value = \chi^2 cdf\,(0, 2.5, 12) \approx 0.002$.

Example:

Find the corresponding P-Value for a Two-Tail Test with $CTS\ \chi^2 = 13.725$ with $df = 10$. Round to 3-decimal places.

Solution:

We start by drawing the chi-square curve.



Now we can use the TI command,

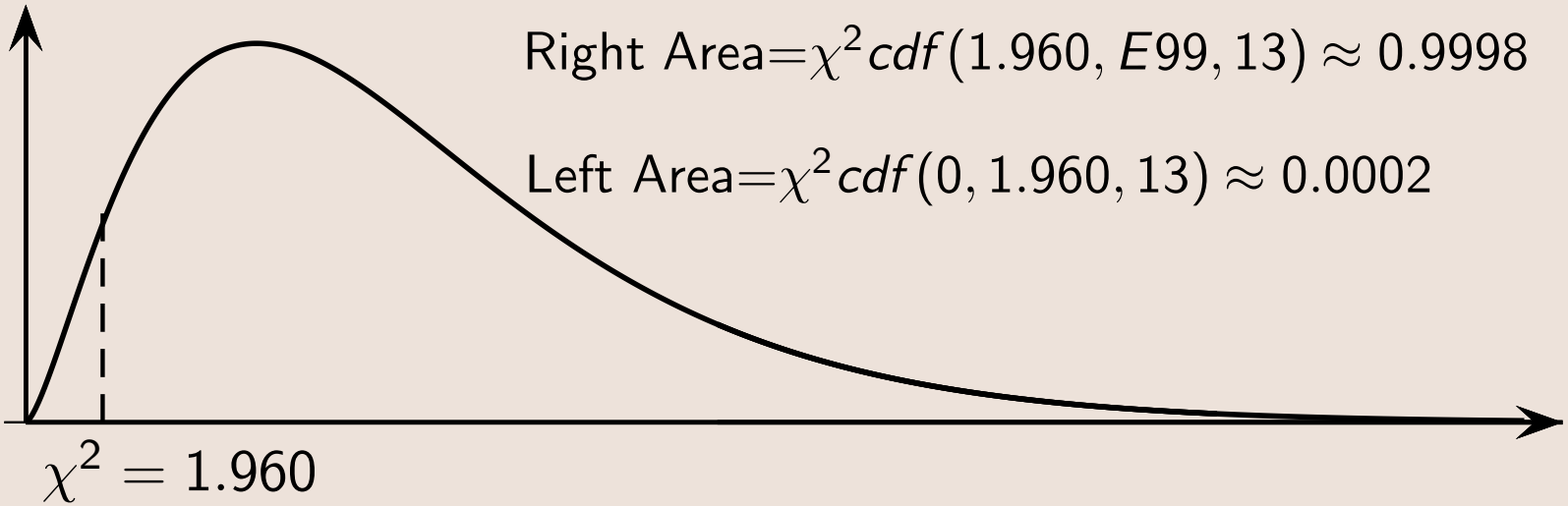
$P - Value = 2 \cdot$ **Smaller Area** $\approx 2 \cdot 0.186 \approx 0.372$

Example:

Find the corresponding P-Value for a Two-Tail Test with $CTS\ \chi^2 = 1.960$ with $df = 13$.

Solution:

We start by drawing the chi-square curve.



Now we can use the TI command,

$P - Value = 2 \cdot$ **Smaller Area** $\approx 2 \cdot 0.0002 \approx 0.0004$