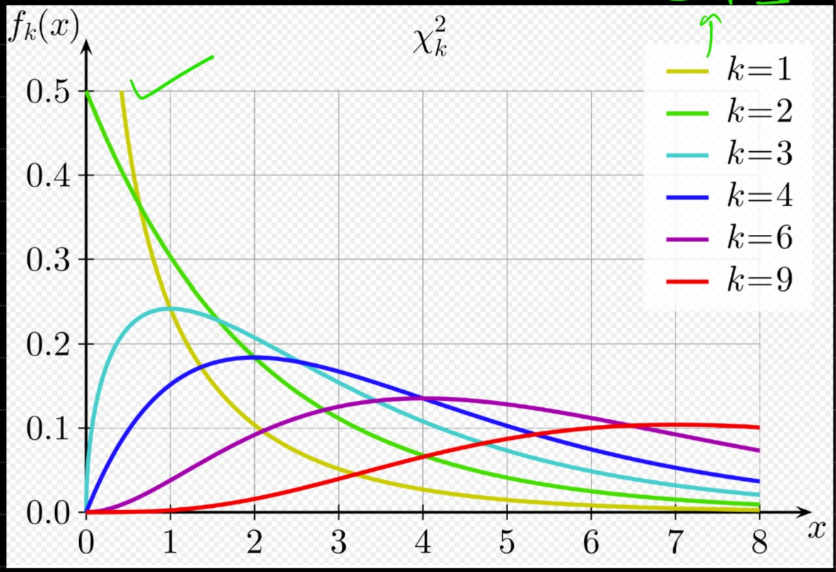
Chi-square distribution and introdution to Chi-square test

* The chi square distribution is a probability distribution that describes the distribution of a sum of square of k random varibable.

→ degree of freedom (k) = n-1

Sample-2



What is chi-square distn

S_1	S_2	S_3
5	2	5
8	3	6
6		8
2		
3		

dof = 5-1   dof = 2-1   dof = 3-1

(5,3) → 5^2+3^2
(6,3) → 6^2+3^2
(2,5) → 2^2+3^2
⇒ Chisquare distn

→ if you square the no of any sample it will closely follow chi-square distribution.

Observations

→ Chi-square distribution shape is determined by 'k'.
→ Non-negative distribution
→ right skewed distribution.

* Chi-square test (χ^2 test)

→ follows chi-square distribution
→ goodness of fit test. → Used to compare observed & expected categorical data.
* Test of independence → To determine the relationship b/w two categorical variables.

→ It tests the claims about population proportions
↓ Categorical.

→ χ^2 square test is non-parametric test.

↓ Many articles says χ^2 distribution is parametric but in true sense, it is not assuming anything about population. (only depends dof)

Parametric test → some assumption about population.

$$\left\{\begin{array}{l} ND = (\mu = \mu, \sigma = \sigma) \\ SND = (\mu = 0, \sigma = 1) \end{array}\right\} \rightarrow \text{assumptions of population}$$

→

Types of car	Expected (theoretical)	(Observed) Sample
Sports Car	1/3	22
SUV	1/3	17
Sedan.	1/3	59

Categorical data

↑ theoretical Categorical distribution

↑ observed Categorical distn

⇒ Using this observed sample distn, you have to verify if the theoretical distribution is true or not

⇒ goodness of fit

→ Independence of Categorical Variable.

Ex - In a class of 75 students, 11 are left handed.

Theoretically :- 12 % of people are left handed.

12% of 75

$\frac{12}{100} \times 75 = 9$

	O	E
left handed	11	9.
Right handed	64	66

$$\chi^2 \text{ statistics} = \sum \frac{(\text{observed} - \text{Expected})^2}{\text{Expected}}$$

$$= \frac{(11-9)^2}{9} + \frac{(64-66)^2}{66}$$

left → $\frac{(11-9)^2}{9}$

$\frac{(64-66)^2}{66}$ → right handed.