Let 
$$X_1, X_2 ... X_n$$
: Dample from  $N(y_1, \sigma^2)$ 

Sample variance:  $S^2 = \frac{1}{n-1} \cdot \sum_{i=1}^{n} (X_i - X_i)^2$ 

Then the fest stat:  $(n-1) \cdot S^2 \sim \chi^2(n-1)$ 

1/Standardization
$$X_{i} \sim N(N_{i} \sigma^{2}) = 72_{i} = X_{i} - N$$

$$X_{i} \sim N(y_{i} \sigma^{2}) = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{X_{i} - y_{j}}{\sigma}$$

$$\begin{cases} N(\sigma_{i} 1) \\ \sum_{i=1}^{n} Z_{i} = \sum_{i=1}^{n} \left(\frac{X_{i} - y_{j}}{\sigma}\right) \sim \sum_{i=1}^{n} \sum_{j=1}^{n} \left(\frac{X_{i} - y_{j}}{\sigma}\right) \end{cases}$$
Hen 
$$\sum_{i=1}^{n} Z_{i} = \sum_{i=1}^{n} \left(\frac{X_{i} - y_{j}}{\sigma}\right) \sim \sum_{i=1}^{n} \left(\frac{X_{i} - y_{j}}{\sigma}\right) \sim$$

$$\sum_{i=1}^{n} (X_{i} - X) = \sum_{i=1}^{n} (X_{i} - X) + h(X - X)$$

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because 
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$$\sum_{i=1}^{N} (X_i - X_i)^2 = (N-1) \cdot 5^2$$

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Chi- 2 quared with of = n-1

$$2\left(\sum_{i=1}^{n} (Y_{i} - y)^{2} = \sum_{i=1}^{n} (Y_{i} - \overline{X})^{2} + n(\overline{X} - y)\right)$$

$$\sum_{i=1}^{n} (\frac{Y_{i} - y}{\sigma}) = \sum_{i=1}^{n} (\frac{X_{i} - \overline{X}}{\sigma})^{2} + n(\overline{X} - y)$$

$$3\left(\frac{\overline{X} - y}{\sigma}\right)$$