$$S^2 = \frac{\sum (X_i - \bar{X})}{n-1} \qquad \sigma^2$$

assume pop. is normally distributed

n large, estimate σ^2

$$\frac{(n-1) S^2}{\sigma^2} = y \quad \text{is a random var}$$
$$\text{w/ a } \chi^2_{n-1}$$

estimate on σ^2

$\chi^2_{n-1} \qquad n \gg 0$

is normally distributed
random variable w/
mean $= n-1$
variance $= 2(n-1)$

Really if n is medium~big-ish ≈ 30

Plot: Instead of

approximating χ^2_k $k \gg 0$ w/ normal distribution, approximate a related distribution w/ a normal distribution.