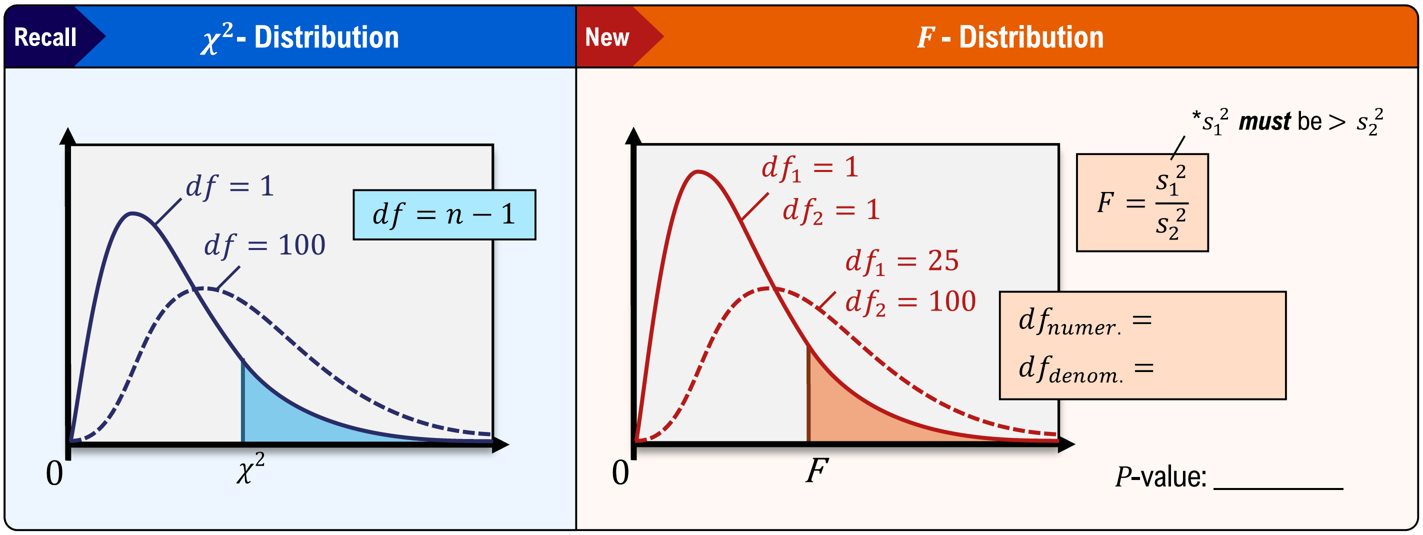
TOPIC: F-DISTRIBUTION AND TWO VARIANCES

F-Distribution

- The F-dist is asymmetric like χ^2, but has ___ degrees of freedom, because it's used to analyze 2 sets of data.
  - To find P-values for the F-dist on a TI-84, 2nd → VARS (`distr`) & use the `0:Fcdf()` function.
    - For **lower**, use given F statistic. For **upper**, use 1E99

EXAMPLE Find the P-value for a hypothesis test with $F = 1.5$, $n_1 = 11$, $n_2 = 12$



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PRACTICE Which statement about the F-distribution is ***always*** true?

A) It is symmetric like the normal distribution.

B) It is centered at 0.

C) It is always right-skewed and takes only positive values.

D) It becomes negative when the denominator variance is very small.

PRACTICE

Two machines produce metal rods. You take independent random samples of their lengths (shown below) as part of a hypothesis test. Calculate the F statistic for this test.

Sample A: $s^2 = 2.1, \ n = 10$

Sample B: $s^2 = 4.2, \ n = 12$

EXAMPLE

In a two-sample hypothesis test comparing the variances of two suppliers' shipments by weight, you obtain the following data about the two independent, random samples $s_A^2 = 16, \ s_B^2 = 9, \ n_A = 12, \ n_B = 8$. Using a graphing calculator, find the P-value for the F-statistic.

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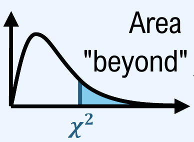
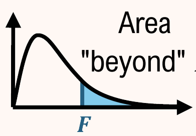
Performing Hypothesis Tests for Two Variances

◆ Like proportions and means, we can use the same steps to perform a hypothesis test for 2 variances or std. devs.

► First, determine which sample to label s_1^2 and n_1.

EXAMPLE

A manufacturer wants to know if Supplier A has greater variance in resistor values than Supplier B. They collect independent normal samples from each & find $n = 22$, $s^2 = 0.017$, $n = 20$, $s^2 = 0.009$ from Supplies A & B, respectively. Use $\alpha = 0.05$ to test this claim.

	Recall ► 1 Variance	New ► Hypothesis Tests for 2 Variances
1) Hyp	H_0: $\sigma^2 = \#$ H_a: σ^2 < | > | ≠ #	H_0: $\sigma_A^2 =$ ______ H_a: σ_A^2 **[< | > | ≠]** ______
2) Test Stat	$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$	*$s_1^2 > s_2^2$ $F = \frac{s_1^2}{s_2^2}$ $s_1^2 =$ ______ $s_2^2 =$ ______ $F =$ (always > 1)
3) P-Value		 $n_1 =$ ______ $df_1 = n_1 - 1 =$ ______ $n_2 =$ ______ $df_2 = n_2 - 1 =$ ______ P-value: ________
4) Conclusion	Because P-val…	Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0. There is **[ENOUGH | NOT ENOUGH]** evidence to suggest…
Criteria	Random sample? ☐ Data is normal? ☐	For EACH sample: Random sample? ☐ Data is normal? ☐

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PRACTICE In a two-sample Hypothesis Test for Variance, what does an F-statistic near 1 indicate?

A) Both populations have zero variance.

B) We reject the null hypothesis H_0.

C) The numerator variance is smaller than the denominator variance.

D) The two sample variances are approximately equal.

EXAMPLE

A bakery wants more consistent cookies, so they test the weights (in grams) of cookies made in two different ovens. Oven A produced 16 cookies with a standard deviation of 2.45, Oven B produced 11 cookies with a standard deviation of 1.26. Use $\alpha = 0.05$ to test the claim that the variation in cookie weights from Oven A is different than Oven B.

H_0: __________ H_a: __________

$s_1 =$ _____ $n_1 =$ _____ $df_1 = n_1 - 1 =$ _____

$s_2 =$ _____ $n_2 =$ _____ $df_2 = n_2 - 1 =$ _____

F-statistic: _______

P-value: _______

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0,
there is **[ENOUGH | NOT ENOUGH]** evidence to suggest…