

---

# ANOVA & TI

## One-Way Analysis of Variance: Comparing Several Means

---

### Important Tips & Notes:

1. Use this method when comparing at least three population means in an attempt to determine if they are equal or at least one is different from the rest.
2. Preparation:
  - (a) Use  $L_1, L_2, L_3, \dots, L_k$  for the data that belong to each of the  $k$  samples.
  - (b) Find the total sample size  $n$  where  $n = n_1 + n_2 + n_3 + \dots + n_k$ .
3. Numerator degrees of freedom:  $k - 1$
4. Denominator degrees of freedom:  $n - k$
5. Use F distribution plot which is right-skewed and takes only non-negative values.
6. Always use Right-Tail Test.

---

### Hypothesis Testing For $\mu_1, \mu_2, \mu_3, \dots, \mu_k$ :

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$$
$$H_1 : \text{not all of } \mu_1, \mu_2, \mu_3, \dots, \text{ and } \mu_k \text{ are equal.}$$

1. Finding Critical Values Using TI: PRGM > FVAL > ENTER (Twice)
  - Numerator Degrees of Freedom  $\implies k - 1$
  - Denominator Degrees of Freedom  $\implies n - k$
2. Finding C.T.S. & P-Value Using TI:

$$\text{STAT} > \text{TESTS} > \text{ANOVA}( L_1, L_2, L_3, \dots, L_k ) > \text{ENTER}$$

---

---

## Guided Example:

A calculus test was given to randomly selected students from four randomly selected calculus classes. The results are given in the following table.

<b>Class A:</b>	82	83	92	97	82	75	68					
<b>Class B:</b>	75	81	85	92	88	70	70	90	92	84	100	
<b>Class C:</b>	82	83	99	93	76							
<b>Class D:</b>	71	88	79	95	89	73	60	94	72	83	75	68

Table 1:  
**Calculus Classes**

---

1. What is the value of  $k$ , the number of samples? Answer:  $k = 4$
2. What is the value of  $n$ , the total sample size? Answer:  $n = 7 + 11 + 5 + 12 = 35$
3. What is the numerator degrees of freedom  $k - 1$ ? Answer:  $Ndf = 4 - 1 = 3$
4. What is the denominator degrees of freedom  $n - k$ ? Answer:  $Ddf = 35 - 4 = 31$
5. Use **F distribution** plot and program **FVAL** to find the critical value for **right tail test** with  $\alpha = .01$ . Answer: C.V.  $F = 4.484$
6. Use **ANOVA** to find the **computed test statistic** and the **p-value**. Answer: C.T.S.  $F = 0.895$  and P-Value  $P = 0.455$
7. Determine whether the mean results for all students from all four classes are the same or at least one is different.  
Answer:  
 $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4$   
 $H_1 : \text{At least one population mean is different.}$
8. Conclusion: C.T.S. is in NCR. P-Value  $> \alpha$ .  $H_0$  is valid. All four population means are equal.