Objective: To test if a course/program/treatment/medication is effective as it promises? Simply put it if the promise makes a **difference** as it promises.

Examples: Super Course to **increase** the self confidence
Weight loss program to **reduce** weight
Pain relief medications to **reduce** pain
SAT prep. Class to **increase** score
New medication is **not** effective (**no change at all**)

The difference for **one person** who participates in the course/program/treatment/medication

d = A-B = Score **A**fter **–** Score **B**efore

μ_d = Average difference for all people who may participate in the course/program/treatment/medication

B = Before		**A = A**fter	**SC**
	Higher results after		
	Super Course to increase the self confidence		$\mu_d > 0$
	SAT prep. Class to increase the scores		$\mu_d > 0$
	New medicine to increase blood flow		$\mu_d > 0$
	New treatment to increase body metabolism		$\mu_d > 0$
	Lower results after		
	Weight reduction program		$\mu_d < 0$
	Pain relief medications		$\mu_d < 0$
	New drug to reduce blood pressure		$\mu_d < 0$
	difference or no difference in results		
	New drug is not effective		$\mu_d = 0$
	New drug is effective		$\mu_d \neq 0$

1) SC : μ_d
OC: μ_d

2) $H_0 : \mu_d$
$H_1 : \mu_d$

3) To find critical value based on df = n -1
Use **Table 2**

4) Test Statistics = $t = \dfrac{\sqrt{n}(\bar{d} - \mu_d)}{s_d}$

5) Conclusions **6)** Comment **7)** P-value

Paired Samples

Example 1. A course is intended ***to increase*** the average sales of salespersons, a random sample of six salespersons and their corresponding sales before and after the course is tabulated as such:

Before	12	18	25	9	14	16	
After	18	24	24	14	19	20	
d=A - B	**6**	**6**	**-1**	**5**	**5**	**4**	$\Sigma d = 25 \quad \bar{d} = 25/6 = 4.17 \quad s_d = 2.64$

At $\alpha = 1\%$, can you conclude that attending this course increases the sales?

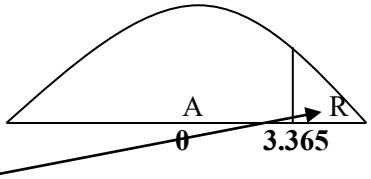
μ_d = Average difference in sales after taking the course.

SC: After the course the sales is higher $\mu_d > 0$ $H_0 : \mu_d \le 0$

OC: After the course the sales is same or lower $\mu_d \le 0$ $H_1 : \mu_d > 0$

When **α = .01**, n < 30 and one –tailed test then by using **5th** row of page of **Table 2**

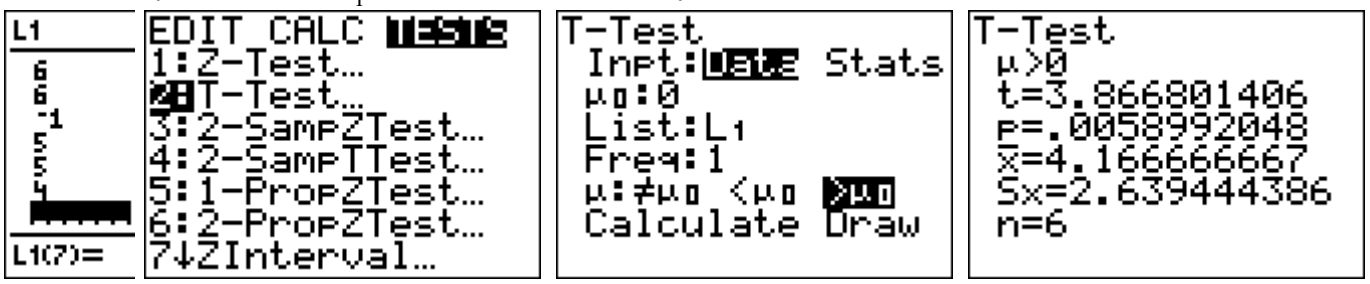
Critical value = CV= **t = 3.365**



$$t = \frac{\sqrt{n}(\bar{d} - \mu_d)}{s_d} = \frac{\sqrt{6}(4.17 - 0)}{2.64} = 3.87$$

Falls inside CR

TI-83/84 Input d values in L_1 → *stat* → *test* → *Option 2* → *data*



Conclusion: Accept or reject **H₀**? Inside ***CR*** then reject **Ho**

Comment: Accept or reject **SC**? **Accept** that attending this course increases the sales.

P-value: 0 .005899 less than **α = 0.01** reject **Ho**

Example 2: A new medication claims that it reduces the pain of arthritis. The following table gives the pain reduction measurement score of eight patients before and after the medication is administrated.

Before	97	72	93	110	78	69	115	72	
After	93	75	89	91	65	70	90	64	
d=A - B	**-4**	**3**	**-4**	**-19**	**-13**	**1**	**-25**	**- 8**	$\Sigma d = -69 \quad \bar{d} = -69/8 = -8.625 \quad s_d = 9.75$

At $\alpha = 5\%$, can you conclude that new medication reduces arthritis pain?

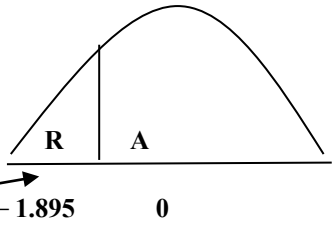
μ_d = Average difference in pain after taking the medication

SC: After the new medication the pain is lower $\mu_d < 0$ $H_0 : \mu_d \geq 0$

OC: After the new medication the pain is same or higher: $\mu_d \geq 0$ $H_1 : \mu_d < 0$

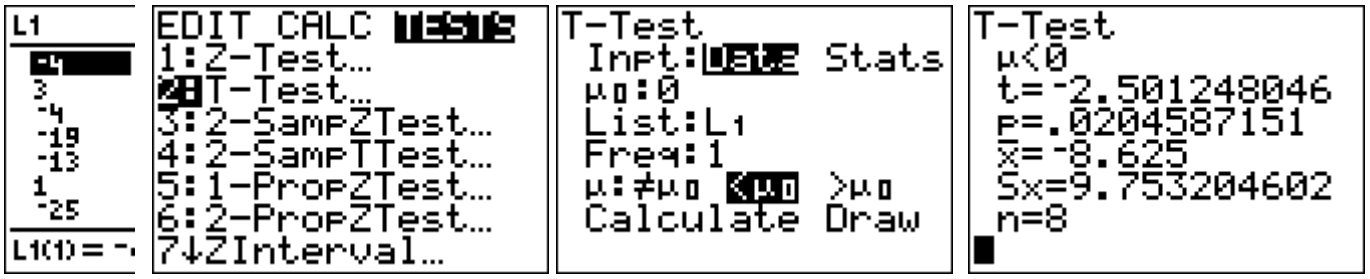
When **α = .05**, n < 30 and one –tailed test then by using **7th** row of page of **Table 2.**

Critical value = CV= **t = – 1.895**



$$t = \frac{\sqrt{n}(\bar{d} - \mu_d)}{s_d} = \frac{\sqrt{8}(-8.625 - 0)}{9.75} = -2.5$$

Falls inside CR



Conclusion: Accept or reject **H₀**? Inside ***CR*** then reject **Ho**

Comment: Accept or reject **SC**? Accept that after the new medication reduces of arthritis pain.

P-value: 0 .020459 less than **α = 0.05** reject **Ho**