

## Chapter 14 / Example 10

# Paired samples

Five candidates attended a revision course hoping to improve their chemistry grades. They were tested before the course started and again at the end of the course. The results were as follows.

Candidate	1	2	3	4	5
Score before course	64	43	29	56	61
Score after course	72	60	33	55	62

Determine at the 5% level whether the course improved the candidates' performance in their chemistry tests.

Open a new document and add a Lists & Spreadsheet page.

Type 'before' in the first cell.

Type the before scores in the first column.

Press **enter** or **▼** after each number to move to the next cell.

**Note:** 'before' is a label that will be used to calculate the  $p$ -value. You can use any letter or name to label the list.

A	before	B	C	D
=				
1	64			
2	43			
3	29			
4	56			
5	61			
A:5	61			

Type 'after' in the cell to the right of 'before'

Enter the after scores in the second column.

Use the **▲▼▶◀** keys on the touchpad to navigate the spreadsheet.

A	before	B	after	C	D
=					
1	64	72			
2	43	60			
3	29	33			
4	56	55			
5	61	62			
B:5	62				

Type 'diff' in the cell to the right of 'after'

In the cell below 'diff' type after – before and press **enter**.

The differences are shown in 'diff'.

A	before	B	after	C	diff	D
=					=after-bef	
1	64	72	8			
2	43	60	17			
3	29	33	4			
4	56	55	-1			
5	61	62	1			
C:1	=8					

$H_0: \mu_D = 0$ ,  $H_1: \mu_D > 0$

To calculate the  $p$ -value press **menu** 4:Statistics | 4:Stat Tests | 2:t Test...

Choose Input Method: Data

Press **enter**.

t Test

Data Input Method: **Data**

**OK** **Cancel**

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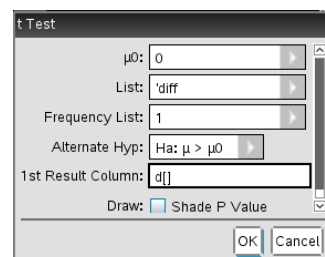
$$\mu_0 = 0$$

List: diff

Frequency List: 1

$$\mu > \mu_0$$

Press **enter**.



t Test

$\mu_0$ : 0

List: 'diff'

Frequency List: 1

Alternate Hyp:  $H_a: \mu > \mu_0$

1st Result Column: d[]

Draw: ☐ Shade P Value

OK Cancel

$p$ -value = 0.0713 > 0.05, not significant so no reason to reject  $H_0$  that the grades have not improved.

	B after	C diff	D	E
		=after-bef		=tTest(0,'
1	72	8	Title	t Test
2	60	17	Alternate...	$\mu > \mu_0$
3	33	4	t	1.82142
4	55	-1	PVal	0.071321
5	62	1	df	4.
Z1 = "t Test"				