



# The $t$ -test

## Student Activity

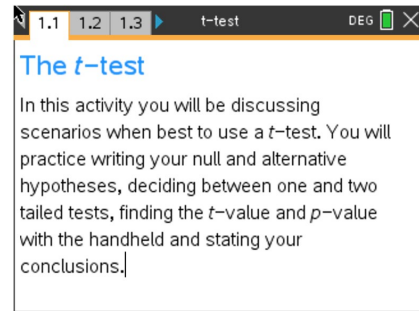


Name \_\_\_\_\_

Class \_\_\_\_\_

Open the TI-Nspire document *t-test.tns*.

The goal of this activity will be to discuss scenarios when best to use a  $t$ -test. You will practice writing your null and alternative hypotheses, deciding between one and two tailed tests, finding the  $t$ -value and  $p$ -value with the handheld and stating your conclusions.



Move to page 1.2.

The  $t$ -test was created by William Gosset. He was an employee of the Guinness brewing company tasked with improving the taste and quality of their beer. He published his work under a pen name, "Student", which is why the test is sometimes referred to as Student's  $t$ -test.

It is a method of testing hypotheses about the mean of a small sample drawn from a normally distributed population when the population standard deviation is unknown. The  $t$ -test is used for comparing two data sets that are measuring the same thing.

Move to page 1.3.

On the following pages, you will be given several examples of data. You will do the following for each example:

1. Write down the null and alternative hypotheses.
2. State whether the example is a one-tailed or a two-tailed test.
3. Using your handheld, you will find the  $t$ -value and  $p$ -value for a 2 sample  $t$ -test at the 5% significance level.
4. Write down the conclusion to the test.

Move to page 1.4.

Problem – 1 (Practice)

Your math teacher wants to compare how his 2nd and 4th period classes are doing. He gives both classes the same test on Wednesday to test their achievement levels, and the results are in the table below:



# The *t*-test

Name \_\_\_\_\_

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Class \_\_\_\_\_

Period 2	76	88	91	85	67	73	90	95	82
Period 4	94	70	79	83	71	81	89	84	77

Move to page 1.5 and follow the process of discussing this data.

1. State the Null and Alternative Hypotheses.

**H<sub>0</sub>:**  $\bar{\mu}_1 = \bar{\mu}_2$

(There is no difference between the achievement levels between periods 2 and 4)

**H<sub>a</sub>:**  $\bar{\mu}_1 \neq \bar{\mu}_2$

(There is a difference between the achievement levels between periods 2 and 4)

2. State if this is a one- or two-tailed test.

**Two-Tailed Test**

(This is a two-tailed test as you want to know whether period 2 is achieving more or less than period 4)

Move to page 1.6 to test and conclude upon this data.

3. Find the *t*-value and *p*-value.

**t-value = 0.522 and p-value = 0.609**

(on page 1.7, the data from the table from above has been entered, go to page 1.8 and press

**Menu > 6 Statistics > 7 Stat Tests > 4 2-Sample t Test**, fill in the template to find the *t*-value and *p*-value and compare, make sure that you are pooling the data)

4. Write down the conclusion.

**Since 0.609 > 0.05, the null hypothesis is not rejected:**

**There is no real difference in the achievement levels between periods 2 and 4.**

Move to page 1.9.

Problem – 2

Two different brands of batteries are being tested for their longevity (in minutes). The number of minutes are listed in the table.

Battery 1	205	198	234	251	223	237
Battery 2	222	215	241	245	228	232



# The $t$ -test

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Name \_\_\_\_\_

Class \_\_\_\_\_

- (a) Write down the null and alternative hypotheses.
  
- (b) State whether this is a one-tailed or two-tailed test.
  
- (c) Find the  $t$ -value and  $p$ -value for a test at a 5% significance level.\*
  
- (d) Write down the conclusion to the test.

**\*Use pages 1.10 and 1.11 to find the  $t$ -value and  $p$ -value.**

**Move to page 1.12.**

Problem – 3

A company is testing a new fuel that will increase distance travelled per gallon. Using one gallon of gas for each, six cars were tested with the new fuel and six cars were tested with the current fuel. The distance travelled, in miles, is listed.

Current Fuel	40	39	30	31	45	46
New Fuel	37	47	51	48	38	40

- (a) Write down the null and alternative hypotheses.
  
- (b) State whether this is a one-tailed or two-tailed test.
  
- (c) Find the  $t$ -value and  $p$ -value for a test at a 5% significance level.\*
  
- (d) Write down the conclusion to the test.

**\*Use pages 1.13 and 1.14 to find the  $t$ -value and  $p$ -value.**



Move to page 1.15.

Problem – 4

A company claims to have a new medication to lower total cholesterol. It claims that those on the drug will lower their cholesterol more than those not taking the drug. 16 people are tested, then half will receive the new drug and half will receive a placebo. After one month, their cholesterol is checked again. The changes, in mg/dl, are below.

New Drug	20	35	18	7	15	9	3	16
Placebo	2	7	4	0	8	10	1	4

- Write down the null and alternative hypotheses.
- State whether this is a one-tailed or two-tailed test.
- Find the  $t$ -value and  $p$ -value for a test at a 5% significance level.\*
- Write down the conclusion to the test.

**\*Use pages 1.16 and 1.17 to find the  $t$ -value and  $p$ -value.**

### Extension

- In each of the problems of this activity, an assumption is being made about the given scenario, state the assumption.
- With your classmates, list four examples where using a  $t$ -test would be applicable in real life.