Is It Standard?

ID: 12584

Time required
15 minutes

Activity Overview

In this activity, students will test a claim about the standard deviation by comparing the χ^2 value to the critical value.

Topic: Statistical Inference

- *Chi-square distribution*
- *Hypothesis testing*

Teacher Preparation and Notes

- *This can be used as a stand alone lesson on hypothesis testing about standard deviation. Homework problems are included.*
- *Students can enter their responses directly into the TI-Nspire document or write on the accompanying worksheet. On self-check questions, students can then press (menu) and select **Check Answer** (or (ctrl) + ▲). If desired, by using the TI-Nspire Teacher Edition software, these self-check questions can be changed to exam mode so students cannot check their answer. On any question click the Teacher Tool Palette and select Question Properties. Change the Document Type from Self-Check to Exam.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "12584" in the quick search box.***

Associated Materials

- *IsItStandard_Student.doc*
- *IsItStandard.tns*
- *IsItStandard_Soln.tns*

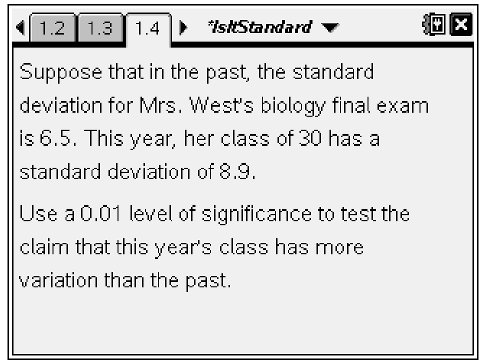
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

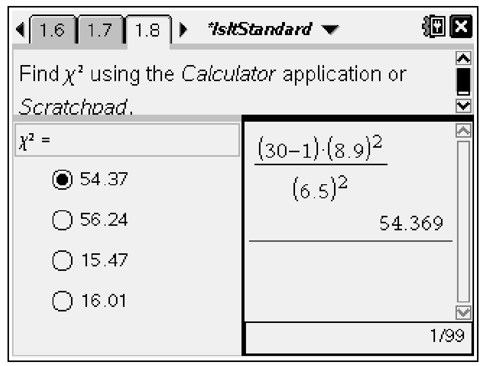
- *Claims About Two Proportions (TI-Nspire technology) — 10259*
- *Testing Claims About Proportions (TI-Nspire technology) — 10131*
- *Comparing Two Means (TI-Nspire technology) — 12626*

Problem 1 – One-tailed test

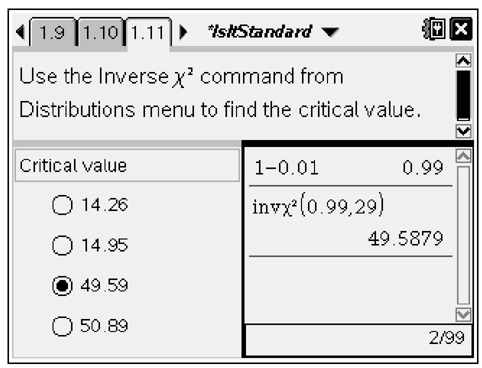
Students are reminded on pages 1.2 and 1.3 of the properties of the chi-square distribution.



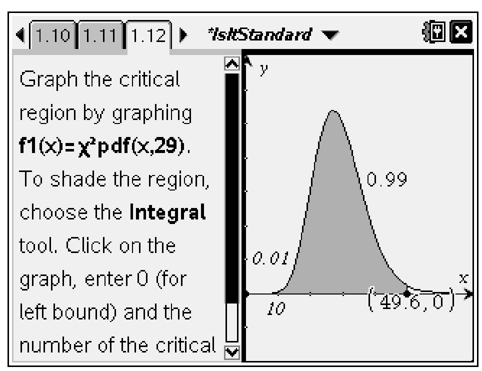
Students are led through an example, step-by-step, to test a claim. Self-check questions are used to allow students to evaluate their progress and understanding of the material. In these questions, students will determine the claim, the null and alternative hypothesis, the χ^2 value, and the critical value.



To use the **Inverse** χ^2 command, students need to enter the area to the left and then the number of degrees of freedom.



Note: To graph the chi-square distribution, the function must be copied from the catalog. It will not work if typed into the entry line. For the homework questions, students will need to adjust the graphing window to see an acceptable graph.



Student solutions:

$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$, where n is the sample size, s is the sample standard deviation, and σ is the population standard deviation.

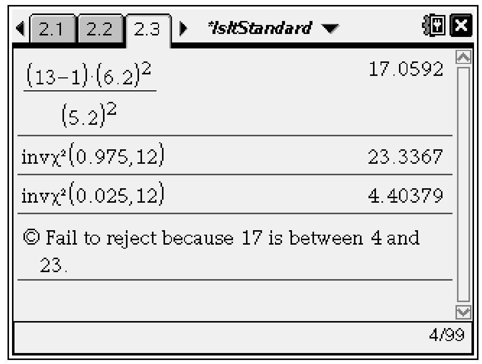
1. $\sigma > 6.5$
2. H_0: $\sigma \leq 6.5$; H_a: $\sigma > 6.5$
3. $\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(30-1)8.9^2}{6.5^2} = 54.37$
4. It is one-tailed since the null hypothesis is only one-sided.
5. invχ^2(0.99,29) = 49.59. See graph at the right.
6. 54.37 is to the right of the shaded region. So, the null hypothesis should be rejected.
7. The evidence suggests that year's biology class has more variation than classes in the past.

Homework problems

Students are given the problems on both the TI-Nspire document and the student worksheet.

Problem 1 Solution:

1. Claim: $\sigma = 5.2$
2. H_0: $\sigma = 5.2$; H_a: $\sigma \neq 5.2$
3. $\chi^2 = \dfrac{(13-1)6.2^2}{5.2^2} = 17.06$
4. It is two-tailed because the null hypothesis can be in both sides of the graph.
5. invχ^2(0.975,12) = 23.34. invχ^2(0.025,12) = 4.40.
6. The χ^2 value is within the interval so we fail to reject the null hypothesis.
7. The evidence suggests that the SU basketball team has a standard deviation that is not significantly different than the standard deviation of the Big East division.



Problem 2 Solution:

1. Claim: $\sigma < 5.2$
2. H_0: $\sigma \geq 5.2$; H_a: $\sigma < 5.2$
3. $\chi^2 = \dfrac{(25640-1)4.1^2}{5.2^2} = 15939$
4. It is left-tailed.
5. invχ^2(0.01,25639) = 25115
6. The null hypothesis should be rejected because the χ^2 value is not in the critical region.
7. The evidence suggests that the group of Mississippi test takers has less variance than the national variance.