

# Unit 06: Inference for Quantitative Data: Means

Content Area:

Course(s):

Time Period: **Year**

Length: **180**

Status: **Published**

## Unit 6

<b>Unit Title:</b>	Inference for Quantitative Data: Means
<b>Suggested Duration:</b>	<b>Three weeks</b>

## Interdisciplinary Connections

Interdisciplinary Connections
<b>Reading and Writing Companion Standards for History, Social Studies, Science and Technical Subjects</b> <ul style="list-style-type: none"><li>▪ <a href="#">Grades 9-10</a></li><li>▪ <a href="#">Grades 11-12</a></li></ul>
<b>Math Practices:</b> <a href="https://www.nj.gov/education/standards/math/Index.shtml">https://www.nj.gov/education/standards/math/Index.shtml</a>
<b>Science Practices:</b> <a href="https://www.nj.gov/education/standards/science/Index.shtml">https://www.nj.gov/education/standards/science/Index.shtml</a>
Find and paste appropriate <u>Companion Standards or Practices</u> here.

Real world Data will be used as part of each of the Learning Activities. Once the basic concepts and skills are Mastered, each activity and problem will use this knowledge and these skills to connect Mathematics to another discipline.

## Technology Integration

Technology Integration
Northern supports the integration of the <a href="#">SAMR Model</a> : a framework which extends learning through the use of technology. The installation of interactive boards, the purchase of softwares and subscriptions, and the investment in 1:1 laptops and various other instructional technologies are examples of Northern's commitment to enhancing students' learning and preparing the 21st century learner for college and careers.

Extensive use of TI-84, Stapplet, Google Classroom, AP Classroom, Desmos, and Khan Academy.

## **Standard(s) Addressed**

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### **Statistical Practices:**

1. Formulate Questions: Determine an investigative question for a statistical study.
2. Collect Data: Identify and justify methods for collecting data and conducting statistical inference.
3. Analyze Data: Construct representations of data and calculate numerical statistical outputs.
4. Interpret Results: Interpret results and justify conclusions and methods.

### **Course Topics:**

- 4.2 Constructing a Confidence Interval for a Population Mean or Population Mean Difference
- 4.3 Justifying a Claim Based on a Confidence Interval for a Population Mean or Population Mean Difference
- 4.4 Setting Up a Test for a Population Mean or Population Mean Difference
- 4.5 Carrying Out a Test for a Population Mean or Population Mean Difference
- 4.7 Constructing a Confidence Interval for the Difference Between Two Population Means
- 4.8 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Means
- 4.9 Setting Up a Test for the Difference Between Two Population Means
- 4.10 Carrying Out a Test for the Difference Between Two Population Means

## **STAGE I Desired Results**

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<b>STAGE I Desired Results</b>
<b>Objective (Transfer)</b>
<i>Students will be able to independently use their learning to...</i>
<i>In this unit, students will analyze quantitative data to make inferences about population means. Students should understand that <math>t^*</math> and <math>t</math>-tests are used for inference with means when the population standard deviation, <math>\sigma</math>, is not known. Using <math>s</math> for in the formula for <math>z</math> gives a slightly different value, <math>t</math>, whose distribution, which depends on sample size, has more area in the tails than a normal distribution. The</i>

*boundaries for rejecting a null hypothesis using a t-distribution tend to be further from the mean than for a normal distribution. Students should understand how and why conditions for inference with proportions and means are similar and different.*

**Mastery**

Big Ideas/Understandings

*Students will understand that...*

**BIG IDEA 1: VARIATION AND DISTRIBUTION (VAR)**

The distribution of measures for individuals within a sample or population describes variation. The value of a statistic varies from sample to sample. How can we determine whether differences between measures represent random variation or meaningful distinctions? Statistical methods based on probabilistic reasoning provide the basis for shared understandings about variation and about the likelihood that variation between and among measures, samples, and populations is random or meaningful.

**BIG IDEA 2: PATTERNS AND UNCERTAINTY (UNC)**

Statistical tools allow us to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow us to anticipate patterns in data and to determine the likelihood of errors in inference.

**BIG IDEA 3: DATA-BASED PREDICTIONS, DECISIONS, AND CONCLUSIONS (DAT)**

Data-based regression models describe

Essential Questions

§ How do we know whether to use a t-test or a z-test for inference with means?

§ How can we make sure that samples are independent?

§ Why is it inappropriate to accept a hypothesis as true based on the results of statistical inference testing?

relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows us to make data-based decisions.

### **Acquisition**

*Students will know . . .*

[See “essential knowledge” in each topic of College Board CED for Unit 7](#)

[Students will be skilled at . . .](#)

Unit 7 focuses on means, which has many similarities to the conditions and procedures for proportions. Since students sometimes confuse t-tests with z-tests, it will help to review the underlying rationales each time conditions come up. This will help students develop understanding through repeated practice in new situations.

Teachers can encourage students to be mindful of notation and use the formula sheet as a reference. Teachers can reinforce that inference testing requires careful selection of a procedure based on specific conditions for a given problem. Common errors include mislabeling conditions (e.g., incorrectly associating the large sample condition with independence), relying upon vague references to the normal distribution, or applying an inappropriate large sample condition. The null and alternative hypotheses must be clearly stated in terms of population parameters, not sample statistics. A formal decision compares the p-value to the level of significance.

Students should also practice providing a numerical reference to support their claim (e.g., “Because  $p < 0.05$ , we reject the null hypothesis.”) and interpreting findings within the context of the question.

## STAGE II Assessment Evidence

STAGE II Assessment Evidence	
Evaluation	Assessments
Evaluation following AP exam format (multiple choice + FRQ) on CED unit pulling from chapters 8, 9, and 10 of The Practice of Statistics	Formative assessments will be based on FRQs from previous AP exams on topics at regular intervals in the chapter/unit.
Modifications	
How are the evaluations/assessments modified/accelerated? (i.e.: alternate assessment). All courses follow a <a href="#">balanced assessment system</a> with Practice, Assessments, Evaluations.	

Modifications on 504 plans may be submitted at ([SSD](#)). prior to testing. Both exclusion **statements** and **extensions** exist for each standard to accommodate different paces.

## STAGE III Learning Plan

STAGE III Learning Plan
<b>Organize plan by weeks</b>
Part 1: Confidence Intervals for Means <a href="#">Day 1: What is a t-distribution?</a> <a href="#">Day 2: Confidence Interval for a Mean</a> Day 3: Quiz <a href="#">Day 4: Confidence Interval for a Difference of Means</a> <a href="#">Day 5: Confidence Interval for a Mean of Differences</a> Day 6: Quiz Day 7: Review Day 8: Chapter Test
Part 2: Significance Tests for Means <a href="#">Day 1: Significance Test for a Mean</a> Day 2: Quiz <a href="#">Day 3: Significance Test for a Difference of Means Intro</a> <a href="#">Day 4: Significance Test for a Difference of Means 4-step</a> <a href="#">Day 5: Significance Test for a Mean of Differences</a> Day 6: Quiz Day 7: Review Day 8: Chapter Test

## Modifications

How are the activities modified/differentiated? (i.e.: abridged text)

Modifications on 504 plans may be submitted at ([SSD](#)), prior to testing. Both exclusion **statements** and **extensions** exist for each standard to accommodate different paces.

## Specific Resources for Unit

### Specific Resources for Unit

Attached Affirmative Action Compliance Checklist

[Lesson Plans for CED Unit 7: Inference for Means](#)

[LP: AP Chapter 8 | StatsMedic](#)

[LP: AP Chapter 9 | StatsMedic](#)

[LP: AP Chapter 10 | StatsMedic](#)

[Confidence intervals | AP® Statistics | Math](#)

[Significance tests \(hypothesis testing\) | AP® Statistics](#)

[Unit: Inference comparing two groups or populations](#)

AP Classroom

## Diversity, Equity, & Inclusion

### [Diversity, Equity & Inclusion](#)

Provide a brief description of how this unit addresses DE&I.

## Career Readiness (9.2), Life Literacies and Key Skills (9.4) Standards

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.2	Attend to financial well-being.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.

- WRK.K-12.P.5 Utilize critical thinking to make sense of problems and persevere in solving them.
- WRK.K-12.P.6 Model integrity, ethical leadership and effective management.
- WRK.K-12.P.7 Plan education and career paths aligned to personal goals.
- WRK.K-12.P.8 Use technology to enhance productivity increase collaboration and communicate effectively.
- WRK.K-12.P.9 Work productively in teams while using cultural/global competence.

## Climate Change Education

ClimateChange Education	
Enduring Understandings/Core Ideas	Performance Expectations
Math and ELA- Provide a brief description of a lesson or activity that relates to Climate Change. All other Content Team copy and paste the <u>Core Idea and Performance Expectation</u> from NJDOE link above.	