Are You Confident?

by – Dennis Ivany

Activity overview

Problem 1 - *A Brief Review of the Normal Distribution. This is intended as a review only, and students should have had significant prior exposure to the concepts presented.*

Problem 2 *develops the meaning of a confidence interval. Included are some opportunities for students to visually explore confidence intervals. A sampling distribution of the sample mean for a known population is created and students can drag line segments representing 95%, 90%, and 99% intervals to center them over various sample means for the population, thus getting a feel for when an interval captures the population mean.*

Concepts

Normal Distribution
Random Sampling
Sampling Distribution of the Sample Mean
Confidence Intervals

Teacher preparation

It might be helpful for teachers to replicate the activity by placing a drawing of the sampling distribution of the sample mean for problem 2 on the wall. Sample means can be generated on the TI-Nspire using the ***mean(randNorm(*** *command. Dots can be placed on sticky notes and placed on the sampling distribution of the sample mean, then string of appropriate length for each confidence interval can be centered over the sample means to see whether they capture the population mean.*

Classroom management tips

It is best if students are familiar with the normal distribution prior to beginning problem 2. This would usually be accomplished in a prior course. The material in problem 1 is presented only as a refresher.

TI-Nspire Applications

Graphs and Geometry
Notes
Lists and Spreadsheets

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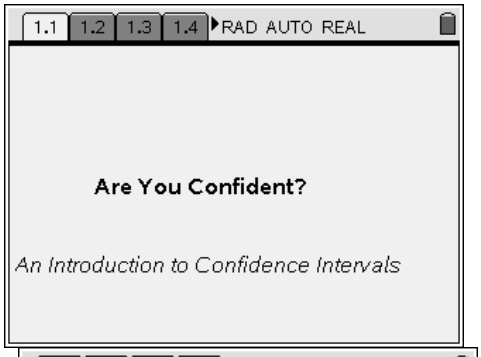
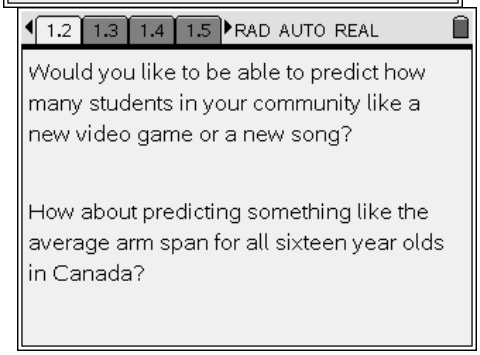
Step-by-step directions

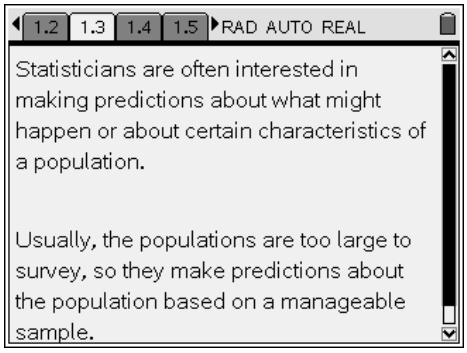
Open the document stats_Confint_Ivany.

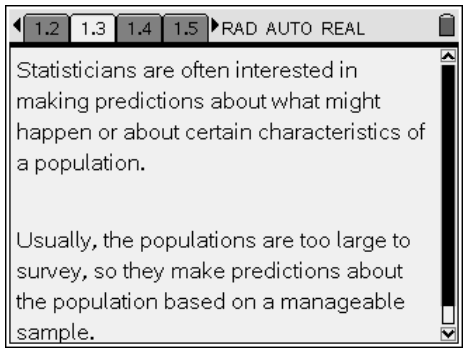
Use ctrl ▶ to move between slides.

Read the first four slides.









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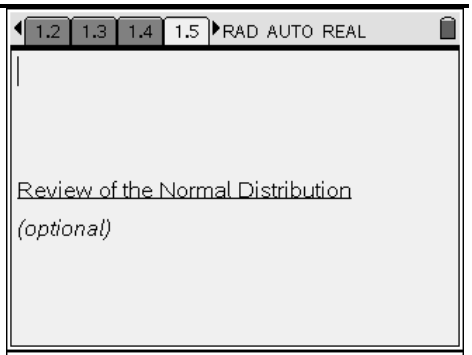
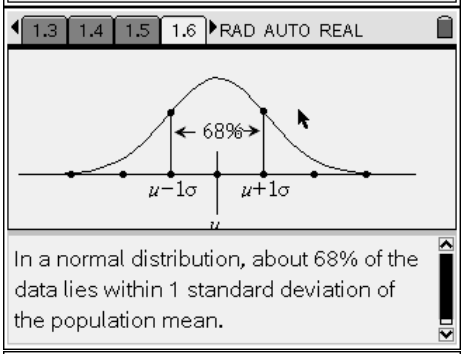
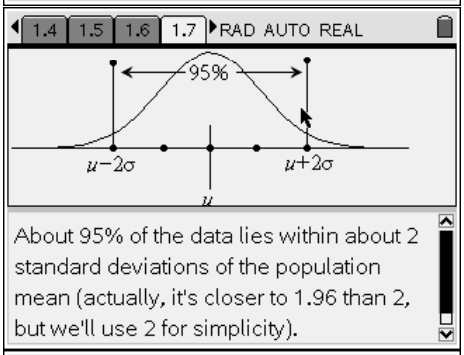
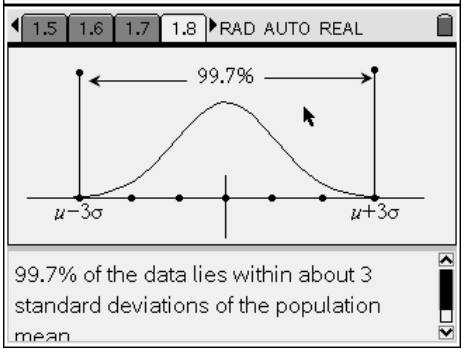
The remaining slides up to 1.18 are intended as a refresher of the normal distribution. If you do not need them, go to slide 2.1 under Problem 2.

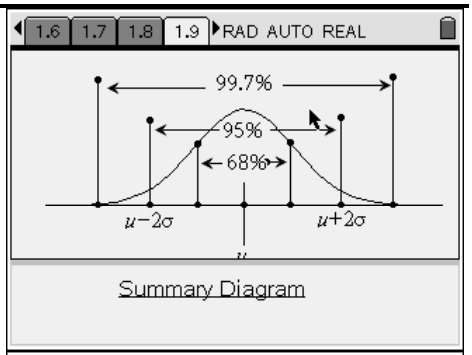




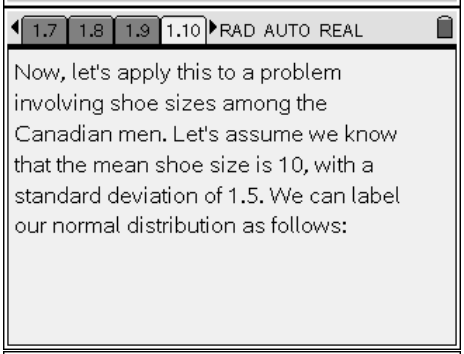




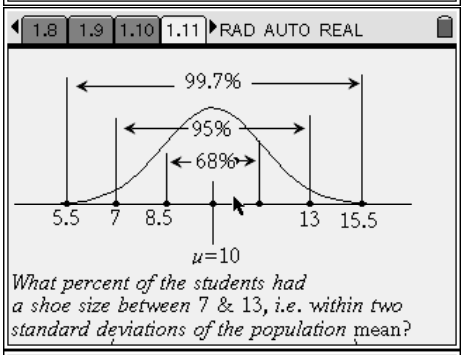
A summary of common intervals on a normal distribution.



Have students write down the mean and standard deviation before proceeding to the next slide.

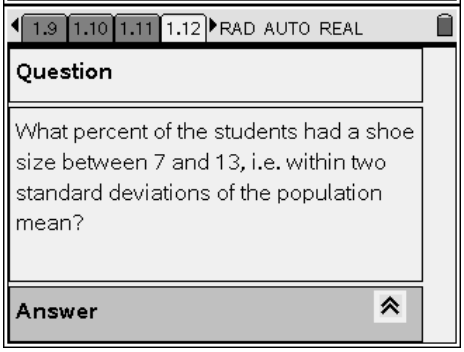


The answer for the question will be found on the next slide.



Type your answer by the question.

Press tab to move to the **Answer** line and press enter to see the answer.



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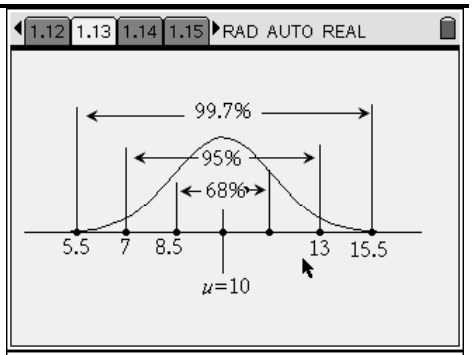
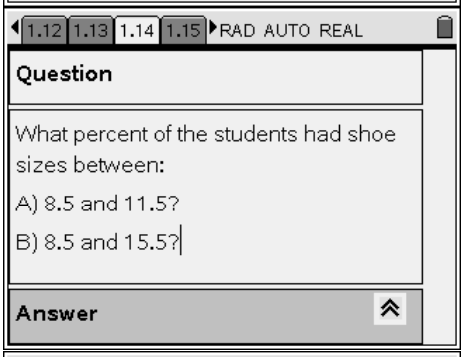
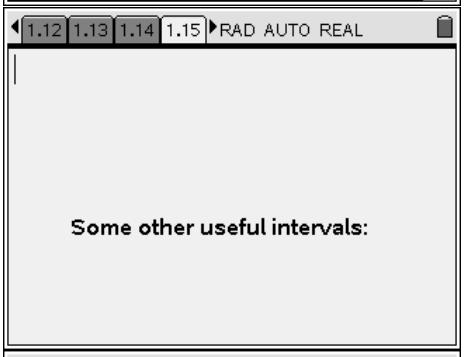
A repeat of the earlier diagram to help you with the questions on the next slide.

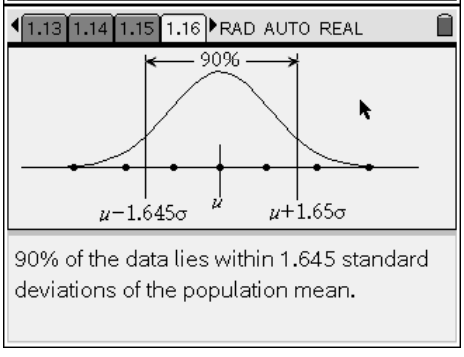


Press tab to move to the **Answer** line and press ≈ enter to see the answer.



Students should take note by copying the information on slides 1.16 and 1.17 into their notes.





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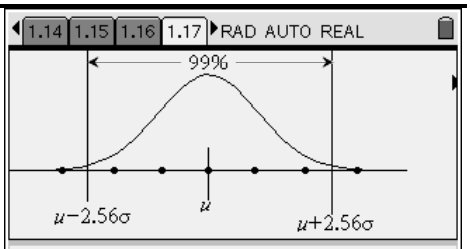
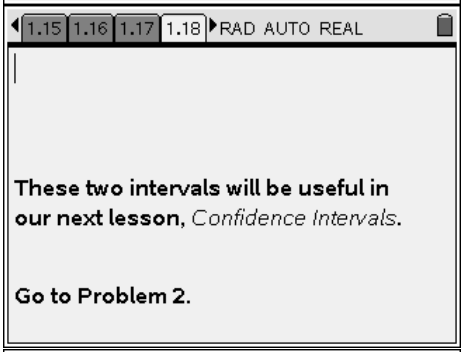
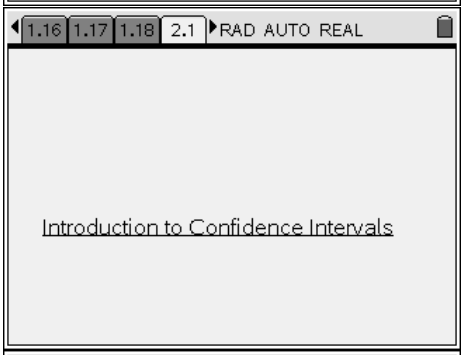


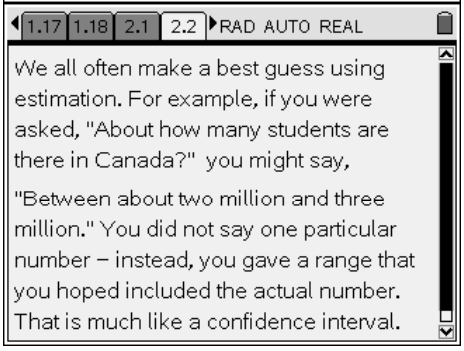
99% of the data lies within 2.56 standard deviations of the population mean.



This is where the introduction to confidence intervals really begins.



Students read the notes on slides 2.2 through 2.5.



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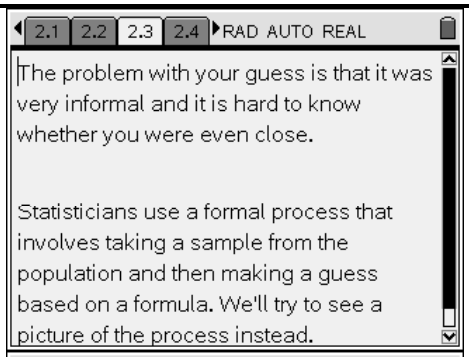
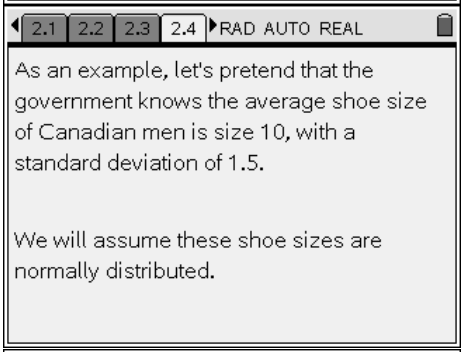
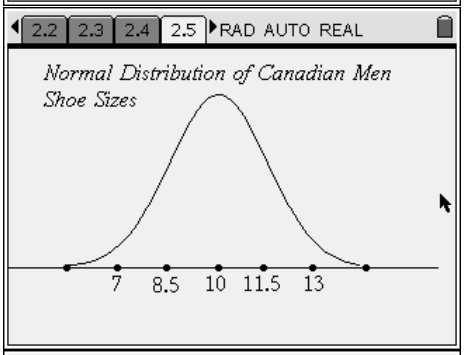
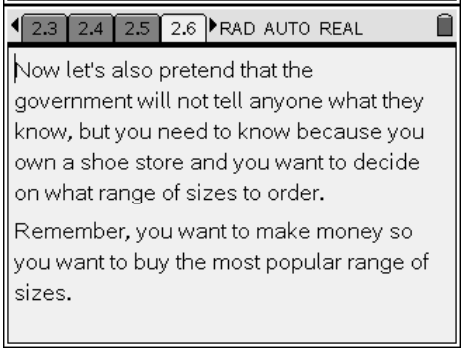






Putting the problem in context.



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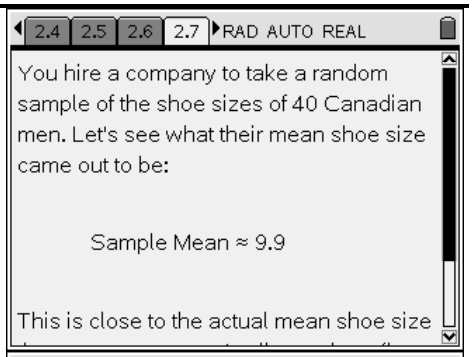
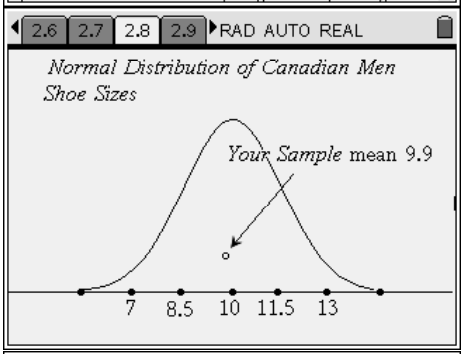
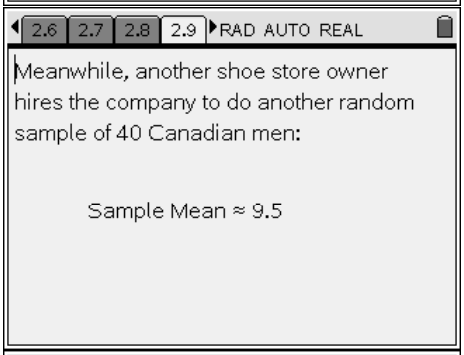
Write down this sample mean.



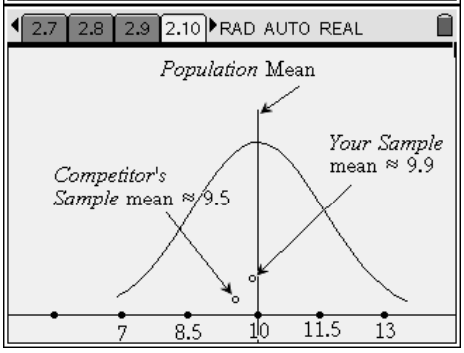
Your sample mean plotted in relation to the actual population.



Your competitor's sample mean.



In this case, both sample means are pretty close to the population mean.



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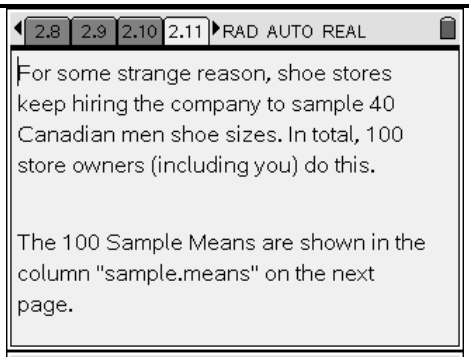
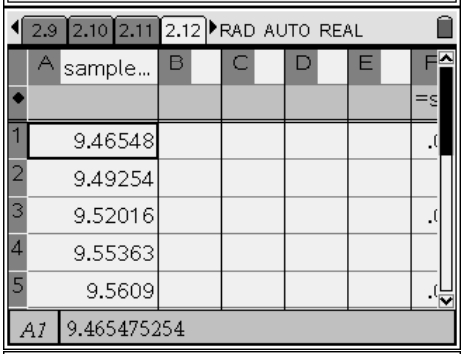
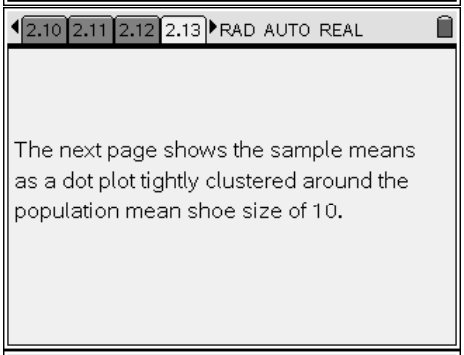
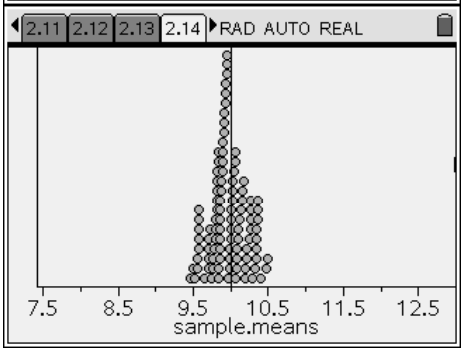


Scrolling down through this spreadsheet will reveal the sample means from the 100 stores.





Notice how this dot plot is shaped much like a normal distribution.



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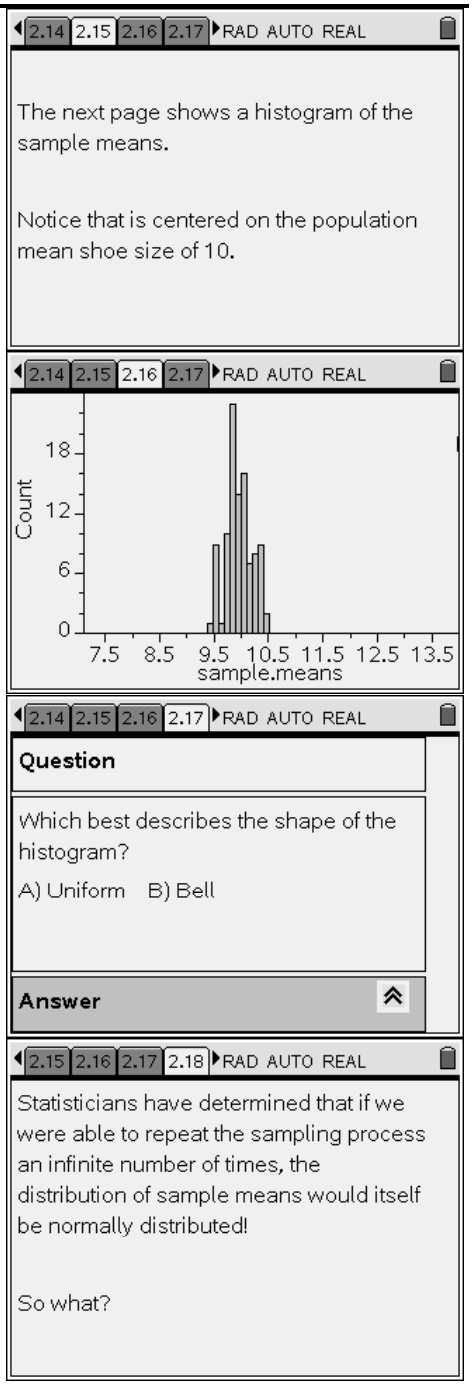
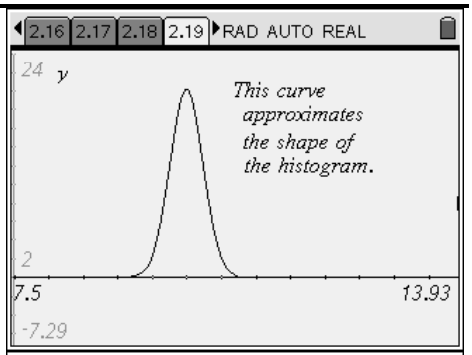
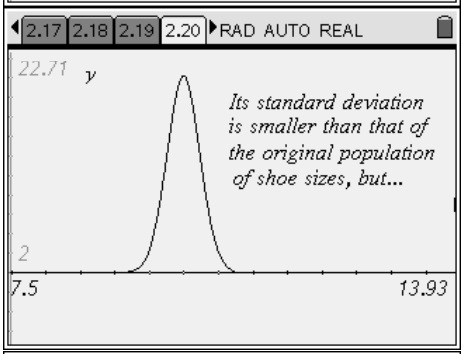
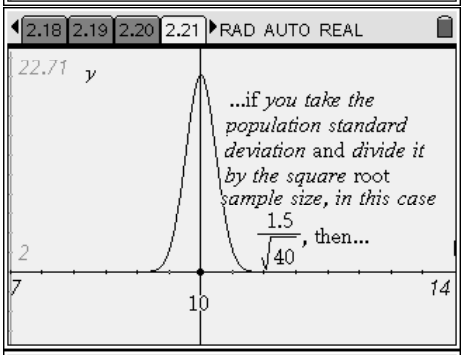
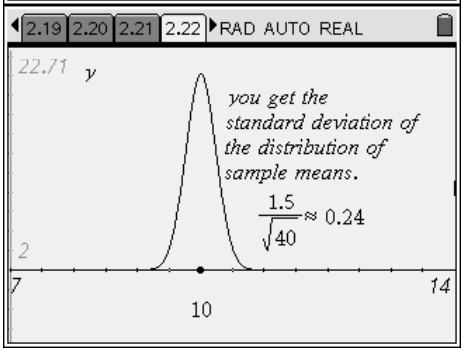


Press tab to move to the **Answer** line and press enter to see the answer.









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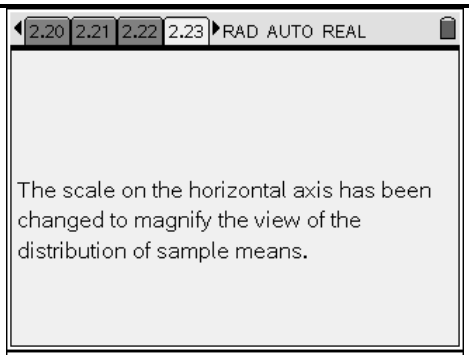
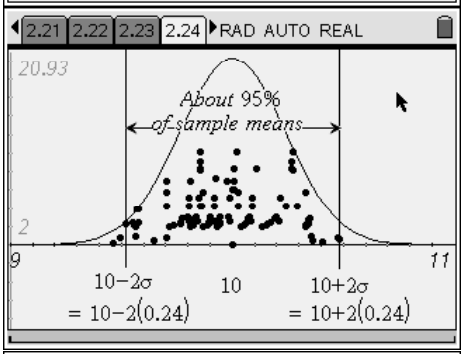
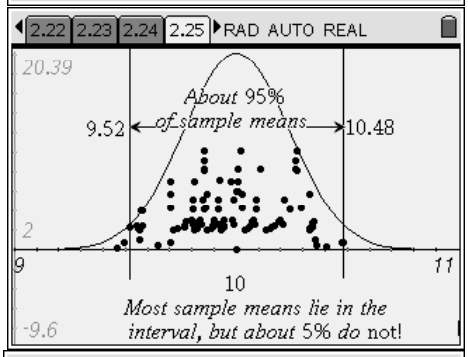
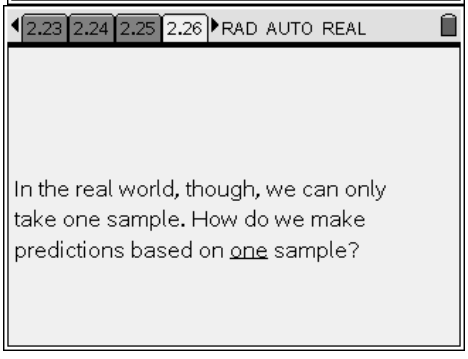
Note: The height of a point above the x-axis has no relevance and has been randomly assigned.









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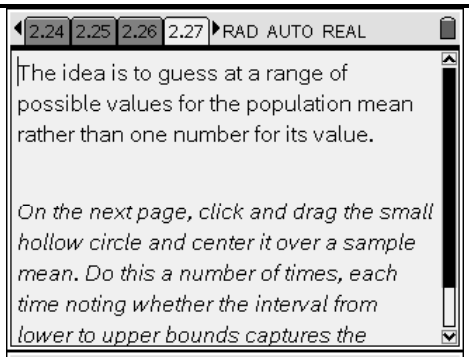
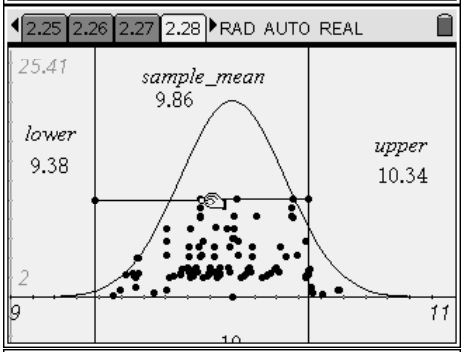
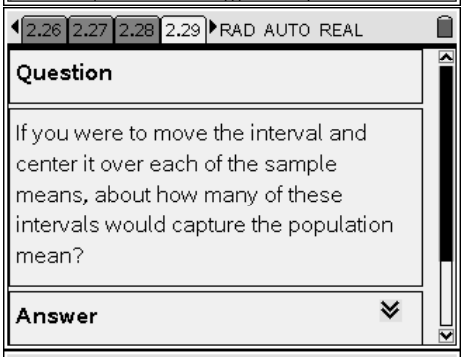


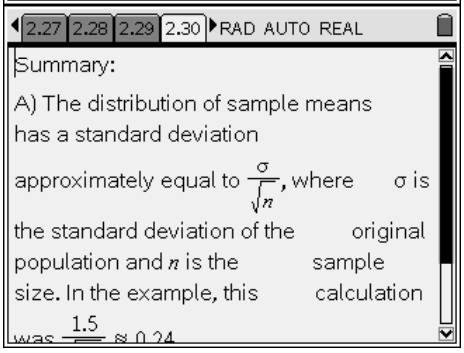
Place the hand on the line segment or on the open circle then press ctrl and drag the line segment around.

Center it over a sample mean. Is the population mean of 10 captured within the interval between the lower and upper bounds of the line segment? Try to find all the sample means where the interval does NOT capture the population mean.



Press tab to move to the **Answer** line and press enter to see the answer.





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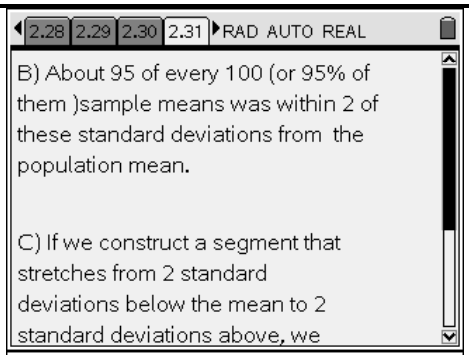

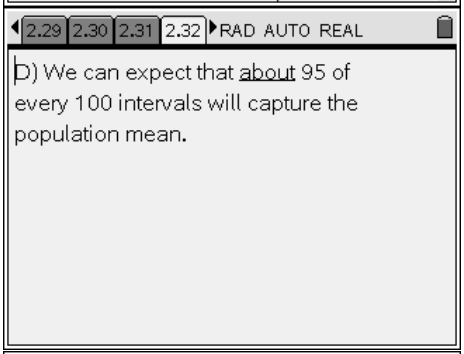

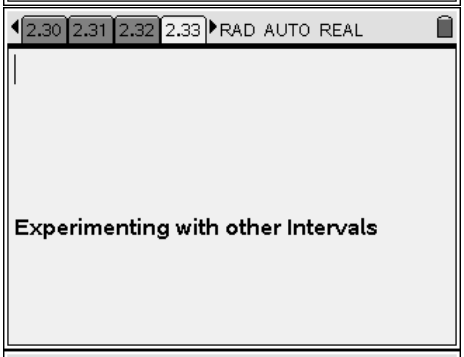

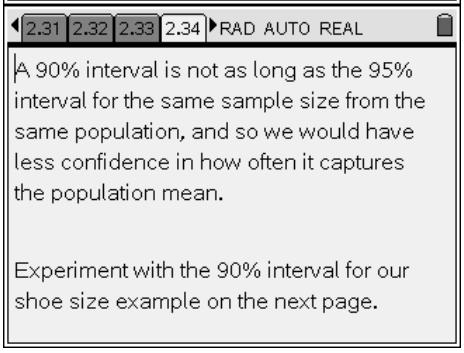

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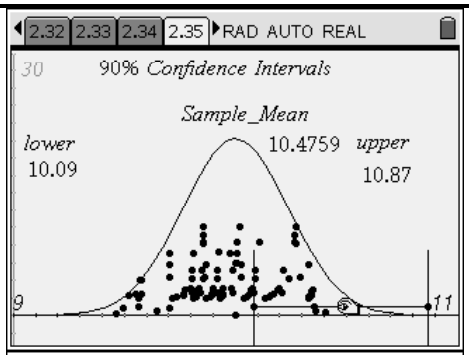
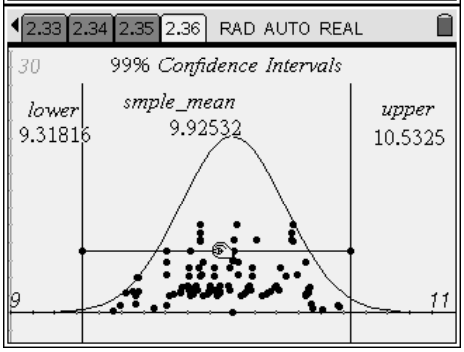
Notice how the 90% interval is shorter. We can expect that fewer intervals will capture the population mean than when we used 95% intervals.

Again, drag the line segment around. Take note of the locations where the interval does not capture the population mean.



The 99% interval is longer. It should capture the population mean when centered on 99 of every 100 sample means.



Assessment and evaluation

- *Journal entry explaining what a confidence interval is.*
- *Use an "exit slip" – ask students to identify one or two key points they really understood or are still confused about. Each student must write about her/his key points on a slip of paper, or a form provided by the teacher, and pass it in before permission is granted to leave the classroom for the day.*
- *Have each student find ten of the 95% confidence intervals in the activity (each student should determine her/his own particular ten and not deliberately try to use the same 10 as someone else), and write down the number of intervals that capture the population mean. Have the class find the average number intervals that capture the population mean. What percent of the time does an interval capture the population mean? (The answer should be close to 95%).*

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