

Name: Key

Date: 5/22/18

CC ALGEBRA 2

TROICI

LESSON #8: MARGIN OF ERROR

Do Now: **Exercise #1:** A school is trying to determine the proportion of students who own cell phones. They do a survey of all juniors and find that 168 out of 236 of have cell phones. They then take a **sample** of freshmen and find that 30 out of 52 freshmen in the sample own cell phones.

(a) Calculate the population proportion, p , of juniors who own cell phones. Round to the nearest hundredth.

$$\frac{168}{236} = .7119$$

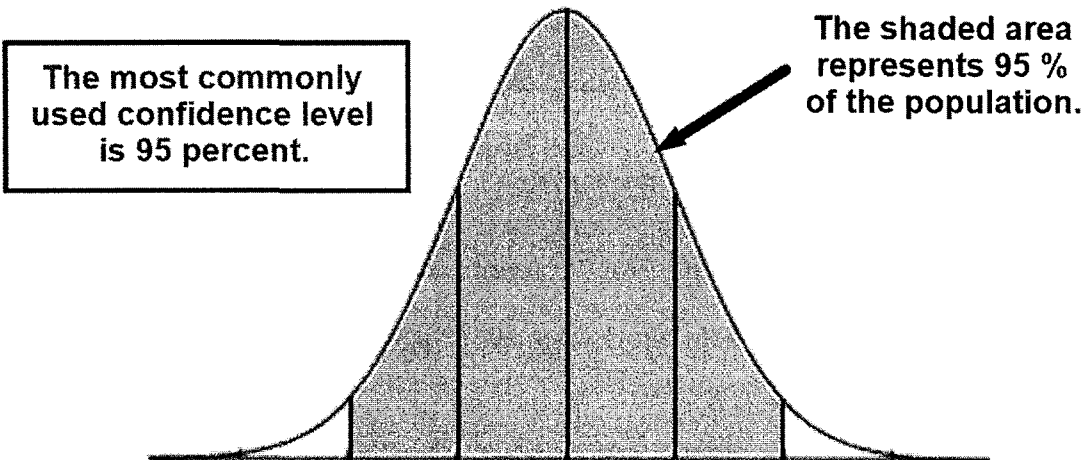
$$= \boxed{.71}$$

(b) Calculate the sample proportion, \hat{p} , of freshmen who own cell phones. Round to the nearest hundredth.

$$\frac{30}{52} = \boxed{.58}$$

VOCABULARY

WORD	DEFINITION
Confidence	How likely a sample could have come from a given population
Confidence Interval	The level of uncertainty associated with a sampling method. 95% confidence interval means 95% of estimates represent the population (2 STANDARD DEVIATIONS)
Margin of Error = 2 standard deviations	Represents the interval that would not contain any proportions.



Confidence Interval = sample statistic \pm Margin of error
 mean \pm 2 standard deviations

EXAMPLES:

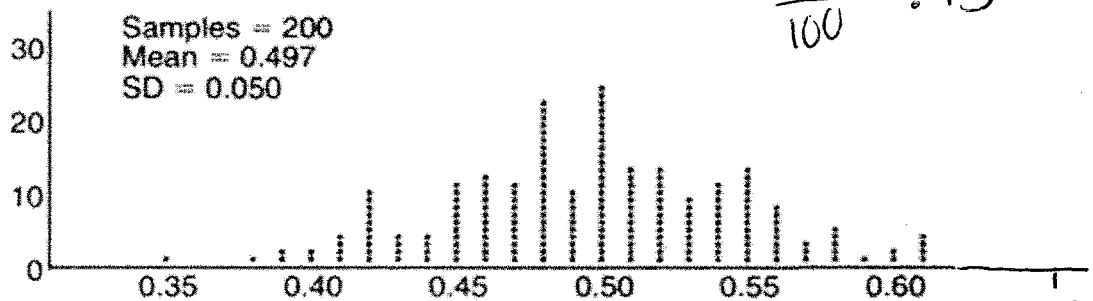
1. An ecologist wants to know what percent of the 10,000 fish in a lake are cod. She conducts a study in which 500 samples of 50 fish are randomly caught. The average for these samplings is 0.24 with a standard deviation of 0.06.

Using this data, with a 95% confidence interval, we can determine that the percent of fish in the lake that are cod is which of the following?

- (a) Between 0.12 and 0.36 (b) Between 0.20 and 0.28
 (c) Between 0.14 and 0.34 (d) Exactly 0.24

$0.24 + 0.06 + 0.06 = 0.36$
 $0.24 - 0.06 - 0.06 = 0.12$

2. Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.



$\frac{73}{100} = 0.73$

Given the results of her coin flips and of her computer simulation, which statement is the most accurate?

- a. 73 of the computer's next 100 coin flips will be heads
 b. 50 of her next 100 coin flips will be heads
 (c) Her coin is not fair
 d. Her coin is fair

NOT IN THE CONFIDENCE INTERVAL!

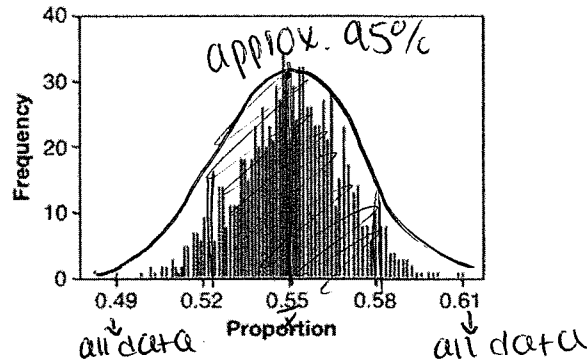
3. Elizabeth waited for 6 minutes at the drive thru at her favorite fast-food restaurant the last time she visited. She was upset about having to wait that long and notified the manager. The manager assured her that her experience was very unusual and that it would not happen again.

A study of customers commissioned by this restaurant found an approximately normal distribution of results. The mean wait time was 226 seconds and the standard deviation was 38 seconds. Given these data, and using a 95% level of confidence, was Elizabeth's wait time unusual? Justify your answer.

$38 - 38 - 226 + 38 + 38$
 $\downarrow \qquad \qquad \qquad \downarrow$
 $150 \qquad \qquad \qquad 302$
 300

yes, her wait time was unusual b/c 360 sec is outside of CI is outside a 95% confidence interval.

4. A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The output of the simulation is shown in the diagram below.



Given this output, and assuming a 95% confidence level, the margin of error for the poll is closest to

- a. 0.01
- b. 0.03
- c. 0.06
- d. 0.12

$$\begin{array}{c}
 .52 - .55 - .58 \\
 .03 \quad .03 \\
 \downarrow \\
 \text{margin of error}
 \end{array}$$

5. Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy drink, and each student in group 2 drank one cola drink. Ten minutes later, their times were recorded for reading the same paragraph of a novel. The results of the experiment are shown below.

Energy Drink

Group 1 (seconds)	Group 2 (seconds)
17.4	23.3
18.1	18.8
18.2	22.1
19.6	12.7
18.6	16.9
16.2	24.4
16.1	21.2
15.3	21.2
17.8	16.3
19.7	14.5
Mean = 17.7	Mean = 19.1

Cola

→ only a difference of -1.4 NOT SIGNIFICANT!

- a. Ava thinks drinking energy drinks makes students read faster. Using information from the experimental design or the results, explain why Ava's hypothesis may be incorrect.
 - Her groups are too small
 - There could have been better readers when she randomized the groups

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LESSON #8: EXIT TICKET

1. An Algebra 2 class conducts a survey of a random sample of 50 students to determine what percent of the student body lives in a household where the annual income is over \$60,000. According to their survey, 42% of the students live in such a household. The students conduct a series of simulations to determine a margin of error for this sample proportion. The results of the simulations lead the students to conclude that the actual percent of students who live in families with an income of over \$60,000 is 42% \pm 8%. Based on this margin of error, what percent is least likely for students to live in households that earn over \$60,000 per year?

- (1) 33%
- (2) 48%
- (3) 42%
- (4) 50%

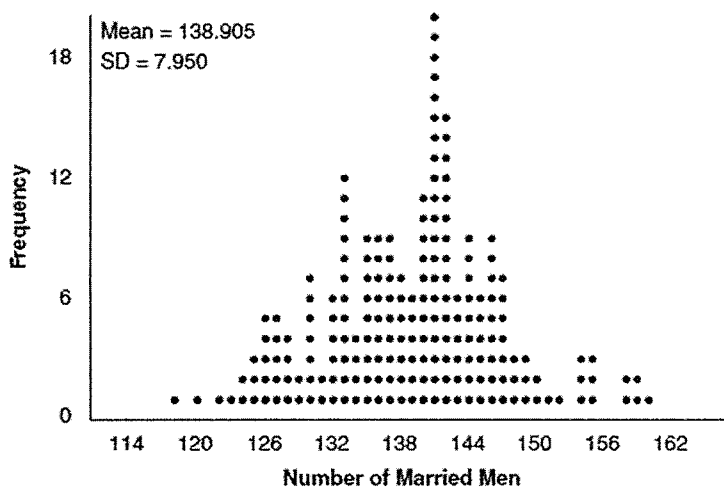
out side \swarrow
 $34\% = 42\% - 8\% = 34\%$
 $34\% = 8 - 42 + 8 = 50\%$

2. On the last test, the mean score for the class was a $\frac{92.8}{2}$ with a standard deviation of $\frac{2.7}{2}$. What is the margin of error?

- (1) 2.7
- (2) 5.4
- (3) 95.5
- (4) 98.2

$2.7(2) = 5.4$

3. In a random sample of 250 men in the United States, age 21 or older, 139 are married. The graph below simulated samples of 250 men, 200 times, assuming that 139 of the men are married.



a) Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the nearest integer.

$2(7.950) - 138.905 + 2(7.950)$
 $123.005 \quad - \quad 154.805$
 $123 - 155$

b) A study claims, "50 percent of men 21 and older in the United States are married" Do your results from part a contradict this claim? Explain.

$50 \times 250 = 125$ men
 \hookrightarrow NO b/c 125 falls WITH 95% confidence interval

