LESSON MAKER PRO

Sample Size Shift

Predict how much sample means vary.

HIGH SCHOOL · A2S.DSP.H

A2S.DSP.H "The larger the sample size, the less the expected variability in the sampling distribution of a sample statistic."

NAME _____ DATE _____

THE SAMPLING RULE

For independent random samples, the standard deviation of sample means is the population standard deviation divided by sqrt(n), where n is the sample size. Multiplying the sample size by 4 cuts the standard deviation of sample means in half.

WORKED EXAMPLE

The population standard deviation is 30. Find the standard deviation of sample means for samples of size 25.

1. Use population standard deviation / sqrt(n).
2. sqrt(25) = 5.
3. 30 / 5 = 6.

Answer: 6

PRACTICE 6 problems

1 The population standard deviation is 12. Find the standard deviation of sample means for samples of size 16.

ANSWER _____

2 The population standard deviation is 20. Find the standard deviation of sample means for samples of size 100.

ANSWER _____

3 The population standard deviation is 15. Find the standard deviation of sample means for samples of size 9.

ANSWER _____

4 The population standard deviation is 24. Find the standard deviation of sample means for samples of size 64.

ANSWER _____

5 The population standard deviation is 8. Find the standard deviation of sample means for samples of size 4 and for samples of size 16.

ANSWER _____

6 The population standard deviation is 28. What sample size gives a standard deviation of sample means of 4?

ANSWER _____

APPLY IT Show your work

1 Song lengths on a streaming service have a population standard deviation of 40 seconds. You take independent random samples of 16 songs and of 64 songs. Find the standard deviation of sample means for each size. How does the larger sample change it?

WORK SPACE

ANSWER _____

2 The amount students would spend on a concert ticket has a population standard deviation of $32. You take independent random samples of 16 students and of 256 students. Find the standard deviation of sample means for each size. What fraction of the first value is the second?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A survey team takes independent random samples of 16 students. It wants the standard deviation of sample means to be 1/3 of its current value. What new sample size should the team use? Explain why.

WORK SPACE AND ANSWER

ANSWER KEY

Sample Size Shift

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The population standard deviation is 12. Find the standard deviation of sample means for samples of size 16.	**3**
2	The population standard deviation is 20. Find the standard deviation of sample means for samples of size 100.	**2**
3	The population standard deviation is 15. Find the standard deviation of sample means for samples of size 9.	**5**
4	The population standard deviation is 24. Find the standard deviation of sample means for samples of size 64.	**3**
5	The population standard deviation is 8. Find the standard deviation of sample means for samples of size 4 and for samples of size 16.	**Size 4: 4; size 16: 2.**
6	The population standard deviation is 28. What sample size gives a standard deviation of sample means of 4?	**49**

PART 2 · APPLY IT

1. **Size 16: 10 seconds; size 64: 5 seconds. The larger sample cuts it in half.** Divide 40 by sqrt(16) and by sqrt(64). The results are 10 seconds and 5 seconds.
2. **Size 16: $8; size 256: $2. The second is 1/4 of the first.** Divide $32 by sqrt(16) and by sqrt(256) to get $8 and $2. Then $2 / $8 = 1/4.

CHALLENGE

The team should use samples of 144 students. To divide the standard deviation by 3, it must multiply the sample size by $3^2 = 9$, and $16 \times 9 = 144$.

Accept equivalent wording for comparisons. In the challenge, the explanation must connect the threefold decrease in standard deviation to a ninefold increase in sample size.