LESSON MAKER PRO

Means in Motion

Predict how much sample means vary.

HIGH SCHOOL · A2S.DSP.H.31.b

A2S.DSP.H.31.b "Demonstrate that the standard deviation of each simulated sampling distribution is the known standard deviation of the population divided by the square root of the sample size."

NAME _____ DATE _____

THE BIG IDEA

For random samples of size n, the standard deviation of the sample means is the population standard deviation divided by sqrt(n). Find sqrt(n), then divide. A simulated sampling distribution should be close to this prediction, but a finite simulation may not match it exactly.

WORKED EXAMPLE

Backpack weights have a population standard deviation of 35 ounces. A simulation uses samples of 49 backpacks and records each sample mean. Predict the standard deviation of the simulated distribution of sample means.

1. Write the rule: population SD / sqrt(n).
2. Find sqrt(49) = 7.
3. Divide: 35 / 7 = 5.

Answer: 5 ounces

PRACTICE 6 problems

1 A population has a standard deviation of 12. Predict the standard deviation of the sample means when n = 4.

ANSWER _____

2 A population has a standard deviation of 30. Predict the standard deviation of the sample means when n = 25.

ANSWER _____

3 A population has a standard deviation of 48. Predict the standard deviation of the sample means when n = 16.

ANSWER _____

4 A population has a standard deviation of 42. Predict the standard deviation of the sample means when n = 36.

ANSWER _____

5 A population has a standard deviation of 20. What sample size makes the standard deviation of the sample means equal to 2?

ANSWER _____

6 A population has a standard deviation of 36. Predict the standard deviation of the sample means for n = 9 and for n = 144.

ANSWER _____

APPLY IT Show your work

1 A student tracks bus travel times to school. The population standard deviation is 16 minutes. A simulation takes many random samples of 64 rides and records each sample mean. Predict the standard deviation of those sample means.

WORK SPACE

ANSWER _____

2 A game studio tracks how long a level takes to load. The population standard deviation is 45 seconds. A simulation takes random samples of 25 load times and records each mean. Predict the standard deviation of the sample means.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A population has a standard deviation of 32 seconds. The table shows results from two simulations of sample means. Find the predicted standard deviation for each sample size. Explain why the observed values need not match the predictions exactly. What happens to the predicted standard deviation when the sample size is multiplied by 4?

SIMULATED SAMPLE MEANS

Sample size n	Observed SD (seconds)
16	7.8
64	4.2

WORK SPACE AND ANSWER

ANSWER KEY

Means in Motion

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A population has a standard deviation of 12. Predict the standard deviation of the sample means when n = 4.	**6**
2	A population has a standard deviation of 30. Predict the standard deviation of the sample means when n = 25.	**6**
3	A population has a standard deviation of 48. Predict the standard deviation of the sample means when n = 16.	**12**
4	A population has a standard deviation of 42. Predict the standard deviation of the sample means when n = 36.	**7**
5	A population has a standard deviation of 20. What sample size makes the standard deviation of the sample means equal to 2?	**100**
6	A population has a standard deviation of 36. Predict the standard deviation of the sample means for n = 9 and for n = 144.	**For n = 9: 12. For n = 144: 3.**

PART 2 · APPLY IT

1. **2 minutes** Divide the population standard deviation by sqrt(64): 16 / 8 = 2 minutes.
2. **9 seconds** Divide the population standard deviation by sqrt(25): 45 / 5 = 9 seconds.

CHALLENGE

For n = 16, the prediction is 32 / sqrt(16) = 8 seconds. For n = 64, it is 32 / sqrt(64) = 4 seconds. A finite simulation can vary from the prediction. Multiplying the sample size by 4 halves the predicted standard deviation.

Accept equivalent calculations and correct units where given. In the challenge, accept an explanation that simulation results can vary by chance.