LESSON MAKER PRO

Means in Motion

Assume independent random draws from populations with no extreme skew.

HIGH SCHOOL · MM.D3D.C.19.c

MM.D3D.C.19.c "Use the central limit theorem to construct a normal sampling distribution for the sample mean when conditions are met."

NAME _____ DATE _____

THE BIG IDEA

For a large sample, the sampling distribution of the sample mean, $\bar{x}$, is approximately normal. Its mean is μ, and its standard deviation is $\sigma/\sqrt{n}$. A common large-sample rule is $n \geq 30$.

WORKED EXAMPLE

Use the table to construct the approximate normal sampling distribution of $\bar{x}$.

Measure	Value
Population mean, μ	72
Population SD, σ	18
Sample size, n	81

1. $81 \geq 30$, so use an approximate normal model.
2. Mean of $\bar{x} = \mu = 72$.
3. SD of $\bar{x} = \sigma/\sqrt{n} = 18/\sqrt{81} = 2$.

Answer: Approximately normal, with mean 72 and SD 2.

PRACTICE 4 problems

1 For $\mu = 40$, $\sigma = 12$, and $n = 36$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.

ANSWER _____

2 For $\mu = 55$, $\sigma = 28$, and $n = 49$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.

ANSWER _____

3 For $\mu = 9$, $\sigma = 35$, and $n = 100$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.

ANSWER _____

4 For $\mu = 120$, $\sigma = 45$, and $n = 225$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.

ANSWER _____

APPLY IT Show your work

1 Daily listening time on a music app has μ = 48 minutes and σ = 16 minutes. For a sample of 64 users, give the shape, mean, and SD of the sampling distribution of the mean listening time.

WORK SPACE

ANSWER _____

2 Match length in a school esports league has μ = 34 minutes and σ = 21 minutes. For a sample of 49 matches, give the shape, mean, and SD of the sampling distribution of the mean match length.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A population has μ = 32 and σ = 24. Use the table. Which sample meets the n ≥ 30 rule? Give the mean and SD of its approximate normal sampling distribution.

SAMPLE SIZES

Sample	Size, n
A	16
B	144

WORK SPACE AND ANSWER

Means in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $\mu = 40$, $\sigma = 12$, and $n = 36$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.	**Mean 40; SD 2.**
2	For $\mu = 55$, $\sigma = 28$, and $n = 49$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.	**Mean 55; SD 4.**
3	For $\mu = 9$, $\sigma = 35$, and $n = 100$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.	**Mean 9; SD 7/2.**
4	For $\mu = 120$, $\sigma = 45$, and $n = 225$, give the mean and SD of the approximate normal sampling distribution of $\bar{x}$.	**Mean 120; SD 3.**

PART 2 · APPLY IT

1. **Approximately normal, with mean 48 minutes and SD 2 minutes.** Since $64 \geq 30$, use an approximate normal model. The SD is $16/\sqrt{64} = 2$ minutes.
2. **Approximately normal, with mean 34 minutes and SD 3 minutes.** Since $49 \geq 30$, use an approximate normal model. The SD is $21/\sqrt{49} = 3$ minutes.

CHALLENGE

Sample B. Its sampling distribution is approximately normal, with mean 32 and SD $24/\sqrt{144} = 2$.

Accept equivalent fractions or decimals for SD. The $n \geq 30$ rule supports a normal approximation for sample B, not sample A.