LESSON MAKER PRO

Beyond the Average

Use data and the empirical rule to estimate population percentages.

HIGH SCHOOL · MT.PLUS.DATA.NORM.2

MT.PLUS.DATA.NORM.2 "Use technology to find the mean and standard deviation of a normally distributed data set and apply the empirical rule to estimate population percentages."

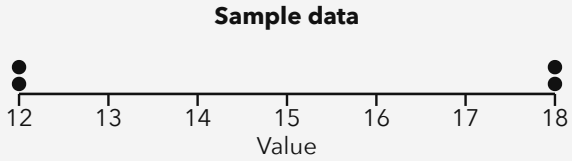
NAME _____ DATE _____

THE BIG IDEA

Find the mean by dividing the sum by the number of values. Population standard deviation (SD) is the square root of the average squared distance from the mean. For a normal model, about 68%, 95%, and 99.7% of the population is within 1, 2, and 3 SDs of the mean. A spreadsheet can check your results with AVERAGE and STDEV.P.

WORKED EXAMPLE

Use the plotted data to estimate the percent of a normal population within 1 SD of the mean.



1. Mean = (12 + 12 + 18 + 18)/4 = 15.
2. Population SD = sqrt((9 + 9 + 9 + 9)/4) = 3.
3. From 12 to 18 is within 1 SD of 15.

Answer: About 68%.

PRACTICE 4 problems

1 For 21, 21, 25, 25, find the mean and population SD.

ANSWER _____

2 For 31, 31, 37, 37, what interval is within 2 population SDs of the mean?

ANSWER _____

3 For 41, 41, 49, 49, estimate the percent of a normal population above 49.

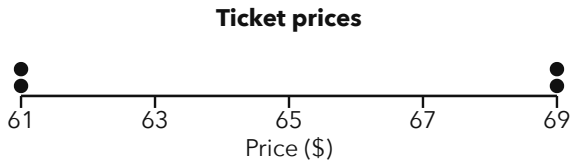
ANSWER _____

4 For 51, 51, 57, 57, estimate the percent of a normal population from 48 to 57.

ANSWER _____

APPLY IT Show your work

1 Concert ticket prices, in dollars, are plotted. If prices for all fans follow a normal model, estimate the percent who paid less than $57.



ANSWER _____

2 Four scores on a game's daily challenge are 72, 72, 82, 82. If all players' scores follow a normal model, estimate the percent above 82.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Four practice-test scores are 91, 91, 99, 99. Model all scores as normal. Of 500 students, about how many would score below 87 or above 103? Explain.

WORK SPACE AND ANSWER

Beyond the Average

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For 21, 21, 25, 25, find the mean and population SD.	**Mean = 23; population SD = 2.**
2	For 31, 31, 37, 37, what interval is within 2 population SDs of the mean?	**28 to 40.**
3	For 41, 41, 49, 49, estimate the percent of a normal population above 49.	**About 16%.**
4	For 51, 51, 57, 57, estimate the percent of a normal population from 48 to 57.	**About 81.5%.**

PART 2 · APPLY IT

1. **About 2.5%.** The mean is 65 and the population SD is 4. A price of $57 is 2 SDs below the mean, leaving about 5% outside the 2-SD interval and 2.5% below it.
2. **About 16%.** The mean is 77 and the population SD is 5, so 82 is 1 SD above the mean. Half of the 32% outside the 1-SD interval is above 82.

CHALLENGE

About 25 students. The mean is 95 and the population SD is 4, so 87 and 103 are each 2 SDs from the mean. About 5% fall outside that interval, and 5% of 500 is 25.

All percentages are empirical-rule estimates, not exact observed percentages from the small data sets. Accept equivalent interval notation and reasoning.