LESSON MAKER PRO

Normal Curve Estimates

Use the empirical rule to estimate percentages.

HIGH SCHOOL · S.DA.2

S.DA.2 "Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Use calculators, computers, or tables to estimate areas under the normal curve..."

NAME _____ DATE _____

THE EMPIRICAL RULE

For data that are roughly bell-shaped, about 68% of values lie within 1 standard deviation of the mean, 95% lie within 2, and 99.7% lie within 3. The curve is symmetric, so you can split these percentages in half or subtract them to find other areas. Do not use this rule when the data are not roughly bell-shaped.

WORKED EXAMPLE

A roughly normal data set has a mean of 125 and a standard deviation of 7. Estimate the percent of values from 111 to 139.

1. 125 - 2(7) = 111, so 111 is 2 standard deviations below the mean.
2. 125 + 2(7) = 139, so 139 is 2 standard deviations above the mean.
3. About 95% of values lie within 2 standard deviations of the mean.

Answer: About 95%

PRACTICE 6 problems

1 A roughly normal data set has a mean of 50 and a standard deviation of 5. Estimate the percent of values from 45 to 55.

ANSWER _____

2 A roughly normal data set has a mean of 70 and a standard deviation of 8. Estimate the percent of values from 54 to 86.

ANSWER _____

3 A roughly normal data set has a mean of 40 and a standard deviation of 4. Estimate the percent of values above 44.

ANSWER _____

4 A roughly normal data set has a mean of 200 and a standard deviation of 20. Estimate the percent of values below 160.

ANSWER _____

5 A roughly normal data set has a mean of 90 and a standard deviation of 10. Estimate the percent of values from 90 to 110.

ANSWER _____

6 A roughly normal data set has a mean of 30 and a standard deviation of 3. Estimate the percent of values from 33 to 36.

ANSWER _____

APPLY IT Show your work

1 The lengths of songs on a playlist are roughly normally distributed, with a mean of 4 minutes and a standard deviation of 1 minute. About what percent of songs are between 3 and 6 minutes long?

WORK SPACE

ANSWER _____

2 The battery life of a model of wireless earbuds is roughly normally distributed, with a mean of 10 hours and a standard deviation of 1 hour. Of 400 pairs, about how many would last more than 12 hours?

WORK SPACE

ANSWER _____

CHALLENGE One step up

This histogram shows how many minutes 40 students practiced a game yesterday. Would a normal curve be a good way to estimate the percent who practiced for 10 to 29 minutes? Explain in one sentence.



WORK SPACE AND ANSWER

ANSWER KEY

Normal Curve Estimates

HIGH SCHOOL · S.DA.2

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A roughly normal data set has a mean of 50 and a standard deviation of 5. Estimate the percent of values from 45 to 55.	**About 68%**
2	A roughly normal data set has a mean of 70 and a standard deviation of 8. Estimate the percent of values from 54 to 86.	**About 95%**
3	A roughly normal data set has a mean of 40 and a standard deviation of 4. Estimate the percent of values above 44.	**About 16%**
4	A roughly normal data set has a mean of 200 and a standard deviation of 20. Estimate the percent of values below 160.	**About 2.5%**
5	A roughly normal data set has a mean of 90 and a standard deviation of 10. Estimate the percent of values from 90 to 110.	**About 47.5%**
6	A roughly normal data set has a mean of 30 and a standard deviation of 3. Estimate the percent of values from 33 to 36.	**About 13.5%**

PART 2 · APPLY IT

1. **About 81.5%** The interval runs from 1 standard deviation below the mean to 2 above it. Add 68% and half of 95% - 68%, giving 68% + 13.5% = 81.5%.
2. **About 10 pairs** Twelve hours is 2 standard deviations above the mean, so about (100% - 95%)/2 = 2.5% last longer. Then 2.5% of 400 is 10.

CHALLENGE

No, because the histogram has tall bars at both ends and low bars in the middle, so it is not roughly bell-shaped.

Accept percentages marked as approximate and equivalent explanations using symmetry or subtraction. For the challenge, accept any one-sentence explanation that identifies the non-bell-shaped distribution.