

z-Scores

Reporting Category Statistics

Topic Calculating and interpreting z-scores

Primary SOL A.9 The student, given a set of data, will interpret variation in real-world contexts and calculate and interpret mean absolute deviation, standard deviation, and z-scores.

Related SOL

Materials

- Graphing calculators
- Heights of Basketball Players activity sheet (attached)

Vocabulary

mean (earlier grades)

dispersion, standard deviation, z-score (A.9)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Review standard deviation by asking students, “What is standard deviation? How can you find it? What does it measure? When might you use it?”
2. Distribute copies of the Heights of Basketball Players activity sheet, and have students complete it in pairs or small groups. You may need to review how to construct a line plot.
3. After students have completed the activity sheets, lead a class discussion of the solutions. Focus on explanations of finding out how many elements were within one standard deviation of the mean and what percent of the data was more than one standard deviation *above* the mean. As you discuss the second matter, some students may have just stated that the element of 67 inches is more than one standard deviation below the mean. If no one found the exact number of standard deviations, ask questions to prompt students to find a more precise answer. It is fine if the z-score is a positive value at this point.
4. Explain to students that a z-score is the number of standard deviations an element is from the mean. Give students the following formula, and have them explain how the formula makes it possible to find the precise number of standard deviations from the mean.

$$z\text{-score}(z) = \frac{x - \mu}{\sigma}, \text{ where } x \text{ represents an element of the data set, } \mu \text{ represents the mean of the data set, and } \sigma \text{ represents the standard deviation of the data set.}$$

5. Have students calculate the z-scores for the elements 69 and 78, using the formula. Ask why one z-score is positive and one is negative. If students used a positive z-score for the last question on the activity sheet, go back and address this now.

6. Have students look at the data and determine how many z-scores would be positive and how many would be negative. Have them explain why this makes sense.
7. Ask students whether they could figure out an element of a data set if they knew only its z-score. Ask what additional information they would need. Help them see how to use the formula and solve for x .

Assessment

- **Questions**
 - What does a z-score tell you about the position of an element with respect to the mean?
 - Why are some z-scores negative?
 - If an element in a data set has a z-score of 1.25, explain how you would find the value of that element. Does this z-score represent an element in the given data set?
- **Journal/Writing Prompts**
 - Given the standard deviation, the mean, and the value of an element of a data set, explain how you would find the associated z-score.
 - How does a z-score relate to its associated element's value?
- **Other**
 - Have students find z-scores of other data sets with which they have worked.

Extensions and Connections (for all students)

- Give students the mean and standard deviation of a data set in addition to a z-score, and ask them to find the element associated with the z-score.

Strategies for Differentiation

- Have students create a graphic organizer to summarize the important ideas for calculating and using z-scores.
- Have students label the mean and z-score for each of the values in their line plot on the Heights of Basketball Players activity sheets. This will help them see that z-scores to the left of the mean are negative and z-scores to the right of the mean are positive. Relate this to their prior knowledge of a number line, but be sure they understand that in this case, the mean represents zero.
- Once a line plot is made and standard deviation is computed, have students measure one standard deviation, using the same scale as their line plot. Students can cut out the length of the standard deviation from an index card or sticky note and then physically measure the number of standard deviations, in addition to mathematically computing it.

Heights of Basketball Players

Name _____ Date _____

The following are the heights in inches of the Greenwood High basketball team members.

72, 66, 67, 69, 73, 74, 72, 71, 75, 69, 72, 70, 78, 70, 71, 73

1. Construct a line plot of the data.
2. Calculate the mean and standard deviation of this data set.
3. How many elements are above the mean? _____ How many are below the mean? _____
4. How many elements are within one standard deviation of the mean? _____ Explain how you arrived at your solution.
5. What percent of the data is more than one standard deviation above the mean? _____
6. How many standard deviations from the mean is the player with a height of 67 inches? _____ Explain how you arrived at your solution.