

12.4 Standard Deviation

Measures of Variation:

are used to describe how the data are spread out.

- ① Range: Highest value - Lowest value
- ② Interquartile Range: $Q3 - Q1$
- ③ Standard Deviation: a measure of how much the values in the data, vary or deviate, from the mean.

σ Greek letter sigma ~~X~~

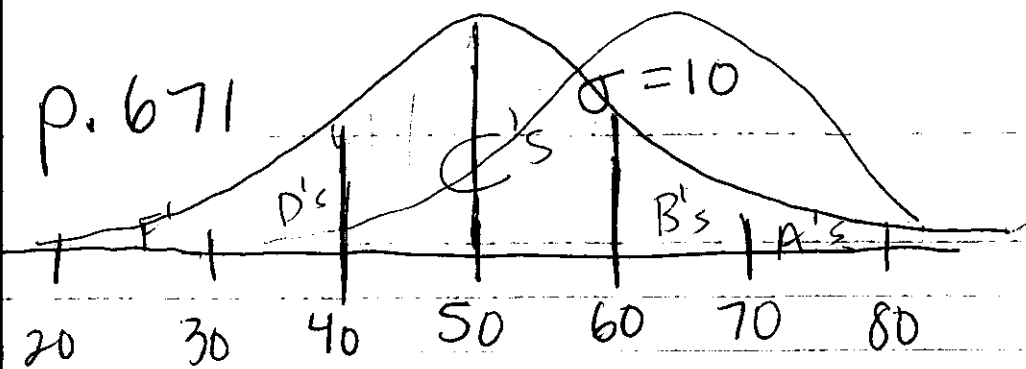
Find the standard deviation.

x	$\bar{x} \leftarrow \text{mean}$	$x - \bar{x}$	$(x - \bar{x})^2$
50	80	$50 - 80 = -30$	$(-30)^2 = 900$
60	80	$60 - 80 = -20$	$(-20)^2 = 400$
70	80	$70 - 80 = -10$	$(-10)^2 = 100$
80	80	$80 - 80 = 0$	$0^2 = 0$
90	80	$90 - 80 = 10$	$10^2 = 100$
100	80	20	$20^2 = 400$
110	80	30	$30^2 = 900$

total: 2800

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{\frac{2800}{7}}$$

$$\sigma = \sqrt{400} = 20$$



p. 672

$$z\text{-score} = \frac{\text{value} - \text{mean}}{\text{Standard deviation}}$$

$$z\text{-score} = \frac{X - \bar{X}}{\sigma}$$

Quick v#5

mean = 85 = \bar{X} $\sigma = 6$

z-score of 2.5

$$2.5 = \frac{X - 85}{6}$$

$$15 = X - 85$$

$$100 = X$$

100 is 6 st. deviations away from the mean.

p. 672

$$\textcircled{3} \text{ range: } \frac{\text{max} - \text{min}}{891 - 187} = \textcircled{704}$$

$$\begin{aligned} \text{Interquartile range: } Q3 - Q1 \\ = 773 - 312 \\ = \textcircled{461} \end{aligned}$$

$$\textcircled{11} \text{ mean} = 25 \quad X = 18 \\ \sigma = 5$$

$$z\text{-score} = \frac{(18 - 25)}{5} = \boxed{-1.4}$$

Practice 12-4

Standard Deviation

Find the mean and the standard deviation for each set of values. Round to the nearest tenth.

1. 232 254 264 274 287 298 312 342 398 _____
2. 26 27 28 28 28 29 30 30 32 35 35 36 _____
3. 2.2 2.2 2.3 2.4 2.4 2.4 2.5 2.5 2.5 2.6 _____
4. 75 73 77 79 79 74 81 74 70 68 70 72 _____
5. 87 21 90 43 54 23 123 110 90 44 50 _____

Find the range, mean, and interquartile range of each set of values.

6. 10 12 13 10 9 5 6 11 _____
7. 23 56 59 60 123 164 180 212 _____
8. 524 526 532 531 534 539 530 535 _____
9. 1.4 1.6 1.9 2.2 2.6 2.7 2.9 3.1 _____
10. 45 48 46 47 45 48 46 49 46 47 _____
11. 97 102 99 105 100 101 99 101 _____

Determine the number of standard deviations that includes all data values.

12. The mean test score on a standardized test is 216; the standard deviation is 52.
127 98 236 192 267 335 217 365 472 177 _____
13. The mean age of students in a school is 16.4 years; the standard deviation is 1.5.
13 17 18 15 16 14 15 18 17 16 15 16 13 _____
14. The average rainfall for the month of April for several Eastern cities is as follows:
3.0 3.4 4.3 3.6 3.6 2.9 2.8 3.9 2.8 2.9 4.5 3.8 4.2 3.6 4.0 2.9 3.1
 - a. Find the mean of the data. _____
 - b. Find the standard deviation of the data. _____
 - c. Find the range of the data. _____
 - d. Within how many standard deviations is a rainfall of 2.8 in.? 4.0 in.? _____

15. The test scores on a college algebra test are as follows:

67 69 71 75 78 78 83 85 85 85 85 86 87 89 92 95 98 98 98 100
100 100 100 100 100

- a. Find the range of the data. _____
- b. Find the interquartile range. _____
- c. Find the mean of the data. _____
- d. Find the standard deviation. _____
- e. Within how many standard deviations of the mean is a score of 65?

- f. Within how many standard deviations of the mean is a score of 100?

16. A set of values has a mean of 67 and a standard deviation of 8. Find the z-score of the value 70.

17. A set of values has a mean of 102 and a standard deviation of 12. Find the z-score of the value 135.
