

AP Statistics Assign 2.1B Practice Questions on Percentiles and Z-score

1. **Shoes.** How many pairs of shoes do students have? Do girls have more shoes than boys? Here are data from a random sample of 20 female and 20 male students at a large high school:

Female	50	26	26	31	57	19	24	22	23	38
	13	50	13	34	23	30	49	13	15	51
Male	14	7	6	5	12	38	8	7	10	10
	10	11	4	5	22	7	5	10	35	7

- Find and interpret the percentile in the female distribution for the girl with 22 pairs of shoes
- Find and interpret the percentile in the male distribution for the boy with 22 pairs of shoes
- Who is more unusual: the girl with 22 pairs of shoes or the boy with 22 pairs of shoes? Explain.

2. **Speed Limits.** According to the *Los Angeles Times*, speed limits on California highways are set at the 85th percentile of vehicle speeds on those stretches of road. Explain what that means to someone who knows little statistics.

3. **WPM.** The average reading speed of students completing a speed-reading course is 450 words per minute (wpm). If the standard deviation is 70 wpm, find the z-scores associated with each of the following reading speeds.

- 320 wpm
- 475 wpm
- 610 wpm

4. **SAT vs. ACT.** Eleanor scores 680 on the SAT mathematics test. The distribution of SAT scores is symmetric and single peaked, with a mean of 500 and standard deviation of 100. Gerald takes the American College Testing (ACT) Mathematics test and scores 27. ACT scores also follow a symmetric, single-peaked distribution- but with mean 18 and standard deviation 6. Find the standardized scores (z-scores) for both students. Assuming that both tests measure the same kind of ability, who has the higher score?

5. Comparing batting averages. Three landmarks of baseball achievement are Ty Cobb's batting average of .420 in 1911, Ted Williams's .406 in 1941 and George Brett's .390 in 1980. These batting averages cannot be compared directly because the distribution of major league batting averages has changed over the years. The distributions follow a Normal curve, except for outliers such as Cobb, Williams and Brett. While the men's batting average has been held roughly constant by rule changes and the balance between hitting and pitching, the standard deviation has dropped over time. Here are the facts:

Decade	Mean	Standard Deviation
1910s	0.266	0.0371
1940s	0.267	0.0326
1970s	0.261	0.0317

Compute the standardized batting averages (z-scores) for Cobb, Williams, and Brett to compare how far each stood above his peers.

6. Multiple Choice. Jorge's score on Exam 1 in his statistics class was at the 64th percentile of the scores for all students. His score falls

- a) between the minimum and the first quartile
- b) between the first quartile and the median
- c) between the median and the third quartile
- d) between the third quartile and the maximum
- e) at the mean score for all students

7. Multiple Choice. Scores on the ACT college entrance exam follow a Normal distribution with a mean 18 and a standard deviation 6. Wayne's standardized score (z-score) on the ACT was -0.7. What was Wayne's actual ACT score?

- a) 4.2
- b) -4.2
- c) 13.8
- d) 17.3
- e) 22.2

8. Men's Heights. The distribution of heights of adult American men is approximately Normal with mean 69 inches and standard deviation 2.5 inches. Use the Empirical Rule to answer the following questions.

- a) What percent of men are taller than 74 inches?
- b) Between what heights do the middle 95% of men fall?
- c) What percent of men are between 64 and 66.5 inches tall?
- d) A height of 71.5 inches corresponds to what percentile of adult male American heights?

9. Midterm Exams. Suppose that your chemistry professor returned your first midterm exam with only a z-score written on it. She told you that a histogram of the scores was closely described by a normal curve. How would you interpret each of the following z-scores?

- a) 2.2
- b) -0.4
- c) -1.8
- d) 1.0
- e) 0

10. A normal distribution of scores has a standard deviation of 10. Find the z-scores corresponding to each of the following values:

- a) A score of 60, where the mean score of the sample data values is 40.
- b) A score that is 30 points below the mean 40.
- c) A score of 80, where the mean score of the sample data values is 30.
- d) A score of 20, where the mean score of the sample data values is 50.

11. IQ scores have a mean of 100 and a standard deviation of 16. Albert Einstein reportedly had an IQ of 160.

- a. What is the difference between Einstein's IQ and the mean?
- b. Convert Einstein's IQ score to a z score.
- c. If we consider "usual IQ scores to be those that convert z scores between -2 and 2, is Einstein's IQ usual or unusual?

12. Three students take equivalent stress tests. Which is the highest relative score (meaning which has the largest z score value)?

- a. A score of 144 on a test with a mean of 128 and a standard deviation of 34.
- b. A score of 90 on a test with a mean of 86 and a standard deviation of 18.
- c. A score of 18 on a test with a mean of 15 and a standard deviation of 5.