

Empirical Rule Review

Empirical rule only works for bell-shaped, symmetric data.

** Approximately 68% of the values will lie within one standard deviation of the mean*

** Approximately 95% of the values will lie within two standard deviations of the mean*

** Approximately 99.7% of the data will lie within three standard deviations of the mean*

The Empirical rule is sometimes called the "68-95-99.7 Rule".

1. The 2022 US Open statistician reported that the mean serve speed of the best women tennis players was 100 miles per hour (mph) and the standard deviation was 10 mph.

a) Assume that the statistician also gave us the information that the distribution of serve speeds was **mound shaped and symmetric**.

What proportion of serves was between **90 mph** and **130 mph**?

b) Suppose that the statistician indicated that the serve speed distribution was **skewed to the right**. Which of the following values is most likely the value of the **median** serve speed?

- a. 105 mph b. 95 mph c. 100 mph d. 108 mph

2. Suppose the average height and standard deviation of 50 students in a class are 66 inch and 3 inches respectively.

a) If the heights have a **mound shaped and symmetric** histogram, what proportion of the observations will be **less than 57** inch?

b) If the heights have a **mound shaped and symmetric** histogram, what proportion of the observations will be **less than 60 and more than 69** inches?

3. Suppose a light bulb manufacturer claims that the mean lifetime of its bulbs is 35 hours. Assume you have prior knowledge that the bulb lifetimes have mound shaped distribution with a standard deviation of 5 hours.

a.) If the manufacturer's claim is true, what percent of light bulbs will burn out in less than 20 hours?

b.) Suppose you randomly select one of the bulbs and it burns out in less than 20 hours. Do you suspect the manufacturer's claim is incorrect? EXPLAIN.

c.) What percentage of bulbs can be expected to burn out between 30 and 45 hours?

4. A professor believes that if a class is allowed to work on an examination as long as desired, the times spent by the students would be approximately mound shaped with a mean of 40 minutes and a standard deviation of 6 minutes. Approximately how long should be allotted for the examination if the professor wants almost all, say 97.5% of the class to finish?

5. Suppose the mean and SD are 74 and 10, respectively. **If we assume that the distribution is mound-shaped and symmetric, what percentage of the data will be between 54 and 84?**

6. **Suppose, at FIU the μ and σ of all students' cumulative GPAs, are 2.5 and 0.5, respectively. The president of FIU wishes to graduate the top 2.5% of the students with cum laude honors and the top .15% with summa cum laude honors. Assume that distribution for the GPAs scores is mound shaped and symmetric.**

Where should the limits be set in terms of GPAs?

In terms of percentile scores?

8. **Time to take standardized Exam is known to have mound shaped and symmetric distribution with $\sigma = 10$ min and $P_{2.5} = 55$ min.**

How much time will it take for 50% of the entire class to finish this Exam?

How much time will it take for 97.5% of the entire class to finish this Exam?

9. **The time to complete a Test have a mound – shaped distribution with mean of 52 min and SD = 4 min.**

- What percentage of students will complete the exam in less than 48 min?
- How much time should be allowed, if I need to be sure that 97.5% of entire class finished the test?
- What percentage of students will complete the exam between 44 and 64 min?

10. You want to buy a fuel-efficient hybrid, but you do not know if the new technology is reliable yet. A Consumer Report article list the average repair cost over five years of ownership as \$658 with a standard deviation of \$85. If you decide that the maximum amount of money that you can afford to spend over the five years on repairs is \$1000, is the hybrid a safe buy? Explain.

11. The average of a set of data points is 13.5, and the median of the same data set is 8.2. Is the distribution skewed? If so, is it right or left skewed?

12. The average human can run at a maximum short distance speed of 22 miles per hour with a standard deviation of 2 miles per hour. A runner from Kenya was recently clocked at a speed of 28 while running the 100-yard dash. Is this speed considered unusually fast for a human being? Explain your answer.

14. Which test result is relatively better: an 85 on a psychology exam or a 45 on an economics exam? The psychology exam has a mean of 90 and a standard deviation of 10, and the economics exam has a mean of 55 and a standard deviation of 5.