

# Should We Send Out a Certificate?

## Task

Test scores on a statewide standardized test for a large population of students are normally distributed with mean = 9.44 and standard deviation = 1.75.

- a. Approximately what percentage of the scores are between 7.69 and 11.19?
- b. Certificates are given to students who score in the top 2.5% of those who took the test. Fred, a student who took the test, finds out that he earned a score of 13.1 on the test. He wonders if he should have received a certificate in the mail by now. He contacts the company that administers the test and asks if his score was high enough to earn a certificate.

Imagine that you work for this company that administers the test, and your supervisor (Chris) asks you to look into the matter. Complete the following note to Chris that **clearly states if Fred is to receive a certificate** and **includes a brief summary of your analysis that led you to that conclusion**. Assume that your supervisor, Chris, is familiar with z-scores, probabilities, normal curves, etc.

*Chris:*

*Regarding your request about Fred's test score, ...*

## Commentary

The purpose of this task is to have students complete normal distribution calculations and to use properties of normal distributions to draw conclusions. The task is designed to encourage students to communicate their findings in a narrative/report form in context – not just simply as a computed number.

Part (b) of this task might work well if implemented as a small group task, where students could discuss how they might respond. You might also want to ask students to come up with more than one way to justify whether or not Fred should receive a certificate.



## Solution

- a. The boundary values occur one standard deviation above and below the mean respectively. Therefore, it would be acceptable for students to answer “68%” based on the Empirical Rule and given that the term “approximately” appears in the question. Also, students could use technology to obtain a more precise value of .6827 or a standard normal table to obtain an answer of .6826. If the table method is used, students would need to recognize that the boundary values have z-scores of -1 and 1 respectively.
- b. Somewhere in the body of the memo, it should be clearly stated that yes, Fred should get a certificate. Multiple analysis methods to support this are available; the student need only present one in a clear fashion.

Supportive analysis statements include:

By Empirical Rule, the top 2.5% of this normal distribution would be scores above 12.94 (2 standard deviations above the mean). Fred's score is greater than 12.94, thus he is in the top 2.5% and should get a certificate.

For the given normal distribution, the top 2.5% would be scores above 12.87 (1.96 standard deviations above the mean). Fred's score is greater than 12.87, thus he is in the top 2.5% and should get a certificate.

Fred's score of 13.1 is 2.09 standard deviations above the mean. The top 2.5% of scores are any scores that are at least 1.96 standard deviations above the mean, thus he is in the top 2.5% and should get a certificate.

Fred's score of 13.1 is 2.09 standard deviations above the mean. That puts him in the top 1.8% of scores, so yes, he should get a certificate.

