

Vertical Progression:

7th Grade	<p>7.SP.B Draw informal comparative inferences about two populations</p> <ul style="list-style-type: none"> ○ 7.SP.B.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. ○ 7.SP.B.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
Algebra 1	<p>ELG.MA.HS.S.1: Summarize, represent, and interpret data on a single count or measurement variable.</p> <ul style="list-style-type: none"> ○ S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). ○ S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ○ S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
Algebra 2	<p>ELG.MA.HS.S.1 Summarize, represent, and interpret data on a single count or measurement variable</p> <ul style="list-style-type: none"> ○ S-ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Students will demonstrate command of the ELG by:

- Using the 68-95-99.7 rule to estimate the percent of a normal population that falls within 1, 2, or 3 standard deviations of the mean.
- Recognizing that normal distributions are only appropriate for unimodal and symmetric shapes.
- Using spreadsheets, graphing calculators and statistical software, and tables to analyze the fit between a data set and normal distributions and estimate areas under the curve.

Vocabulary:

- areas under the curve
- mean
- normal distribution
- standard deviation
- symmetric
- unimodal

Sample Instructional/Assessment Tasks:

1) Standard(s): S-ID.4

Source: <https://www.illustrativemathematics.org/content-standards/tasks/216>

Item Prompt:

Suppose that SAT mathematics scores for a particular year are approximately normally distributed with a mean of 510 and a standard deviation of 100.

- a. What is the probability that a randomly selected score is greater than 610?
- b. Greater than 710?
- c. Between 410 and 710?
- d. If a student is known to score 750, what is the student's percentile score (the proportion of scores below 750)?

Correct Answer:

- a. The score 610 is one standard deviation above the mean, so the tail area above that is about half of 0.32 or 0.16. The calculator gives 0.1586.
- b. The score 710 is two standard deviations above the mean, so the tail area above that is about half of 0.05 or 0.025. The calculator gives 0.0227.
- c. The area under a normal curve from one standard deviation below the mean to two standard deviations above is about 0.815. The calculator gives 0.8186.
- d. Either using the normal distribution given or the standard normal (for which 750 translates to a z-score of 2.4) the calculator gives 0.9918.

2) Standard(s): S-ID.4

Source: <https://www.illustrativemathematics.org/content-standards/tasks/1020>

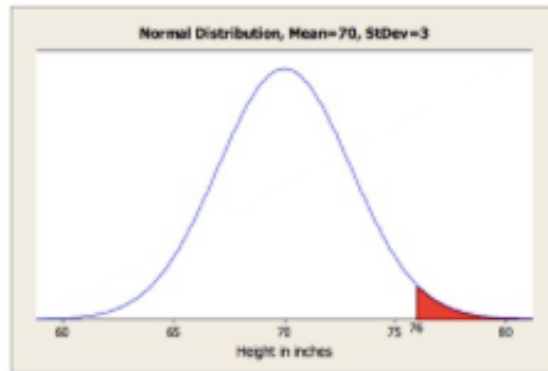
Item Prompt:

Automobile manufacturers have to design the driver's seat area so that both tall and short adults can sit comfortably, reach all the controls and pedals, and see through the windshield. Suppose a new car is designed so that these conditions are met for people from 58 inches to 76 inches tall.

The heights of adult men in the United States are approximately normally distributed with a mean of 70 inches and a standard deviation of 3 inches. Heights of adult women are approximately normally distributed with a mean of 64.5 inches and a standard deviation of 2.5 inches. What percentage of men in the United States is this car not designed to accommodate? What percentage of women in the United States is this car not designed to accommodate?

Correct Answer:

For men, we want the percentage of the normal distribution with mean 70 and standard deviation 3 that is above 76 inches or below 58 inches. Since 58 is 4 standard deviations below 70, the percentage below 58 is insignificant, so all we need is the percentage above 76, which corresponds to the shaded region in the diagram below. The area of this region is 0.0228, so about 2.3% of adult men won't fit in this car.



For women, 76 inches is $\frac{76-64.5}{2.5} = 4.6$ standard deviations above the mean, so essentially 0% of women are too tall for the car. Thus, all we need is the percentage below 58 inches, which corresponds to the shaded region in the diagram below. The area of this region is 0.00466, so about 0.5% of adult women won't fit in this car.

