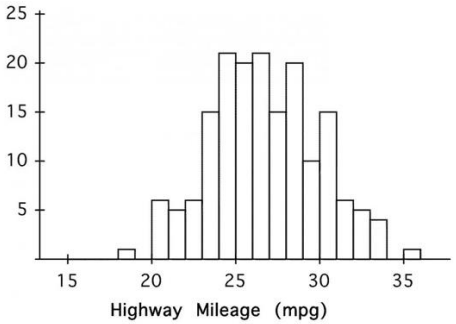
AA9-3 Investigation Name _____Period_____

Z-scores and the Normal Model

The histogram below shows the average highway fuel economy of a sample of 171 compact SUV's from 2017.

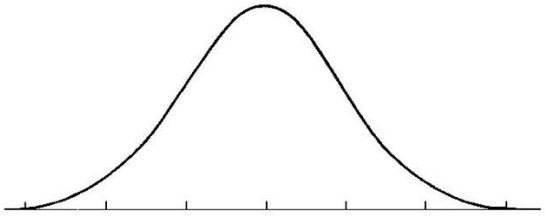


1. If you purchased a compact SUV in 2017, would you be surprised if it gets 30 miles per gallon? Why or why not?

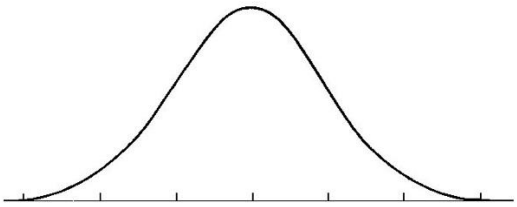
2. What is the highest gas mileage you would expect to get if you drive a compact SUV? Why?

Data that is **unimodal** (has one clear peak) and **symmetric** (roughly the same on both sides) can be approximated by the **Normal Model**. Data is *approximately* Normal when it closely follows the 68-95-99.7 Rule. This states that approximately 68% of the data lies within _____ standard deviation of the mean, approximately 95% of the data lies within _____ standard deviations of the mean, approximately 99.7% of the data falls within _____standard deviations of the mean, and almost nothing falls outside of ± 3 standard deviations.

$\mu = mean$
$\sigma = standard\ deviation$



3. The Chapter 6 test had a mean score of 70 points and a standard deviation of 10 points. Label the model below accordingly.



4. Use the model to approximate the percentages.

a. What percentage of students got an A on the test (90 or above)?

b. What percentage of students got between a 60 and 80?

c. What percentage of students passed (greater than 60)?

d. What percentage of student got a B (between 80 and 90)?

A **z-score** is a measure of the number of standard deviations a value is from the mean (average). It is used to standardize data.

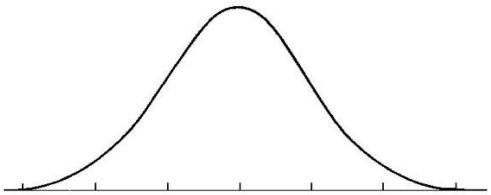
It is calculated by: $z = \frac{observed\ value - mean}{standard\ deviation}$

5. Given the Chapter 6 data on the front side, what would the z-score be for a person who got 85 points?

We use z-scores and the calculator (or z-table) to find more precise estimations of percentiles when z-scores are not exactly $\pm 1, 2, or\ 3$ (meaning they are in between 1 and 2 SD's, etc.). Here is the process on the calculator:
- Step 1: Press 2ND VARS and scroll down to 2: normalcdf(
- Step 2: Enter your left bound, then comma, then right bound, then close your parentheses

~ For finding percentages below a certain z score, use -99 as your left bound, and the z-score as your right bound.
~ For finding percentages above a certain z-score, use the z-score as your left bound, and 99 as your right bound.
~ For percentages between two z-scores, use your lower z-score as your left bound and your higher z-score as the right bound.

6. Some IQ tests are standardized to a Normal model with a mean of 100 and a standard deviation of 16. Label that information on the model below.



a. If you got 108 on the IQ test, what is your percentile (the percent scoring less than you)?

b. What is the z-score and percentile for someone who scored 136 points?

c. Would you expect more people to score greater than 125 or less than 96?

d. Z-scores are also used to standardize scores so that unlike data can be compared. If you scored a 98 on the Chapter 6 test, and a 117 on the IQ test, which should you be more impressed by?