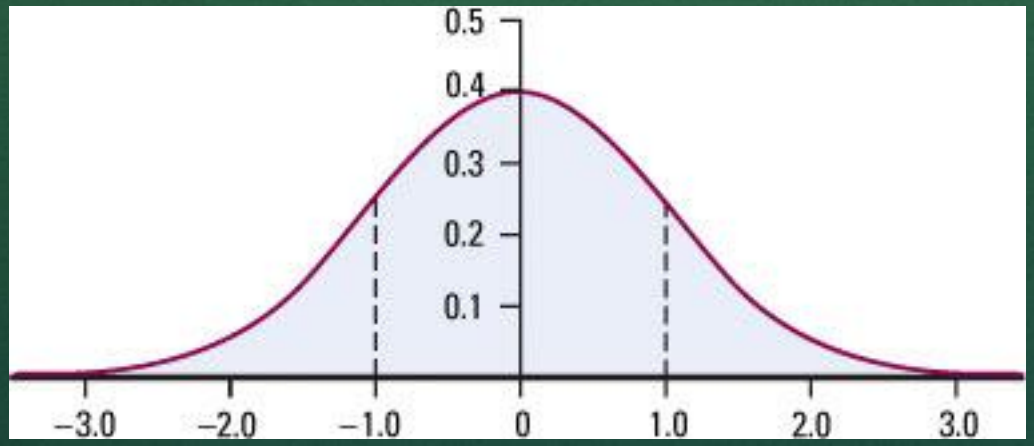
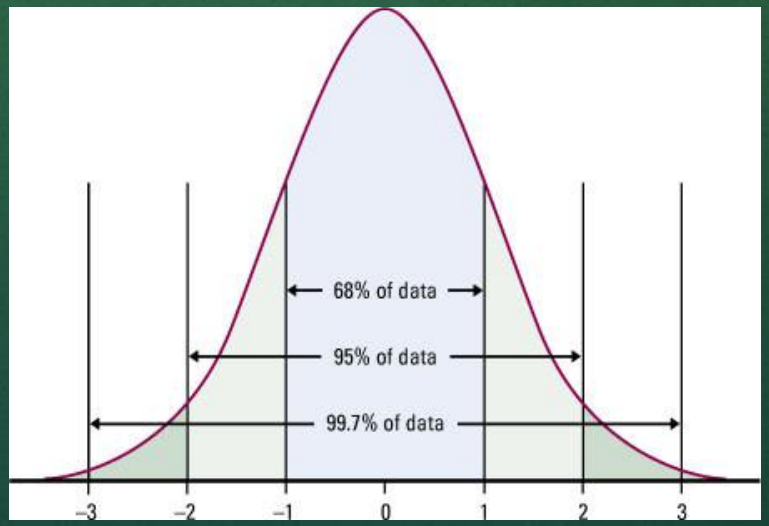
More With Normal Distributions

Section 2.2, part b

From Last Time…

- We can use the distribution of z-scores to assess percentiles **IF** the original data had a normal distribution.
- The distribution of z-scores is also normal, and is called the Standard Normal Curve.





Switchin' It Up…

- Instead of taking a value, finding it's z-score, and then a percent or percentile from Table A…

$$x \rightarrow z \rightarrow \%$$

$$z = \frac{x - m}{s}$$

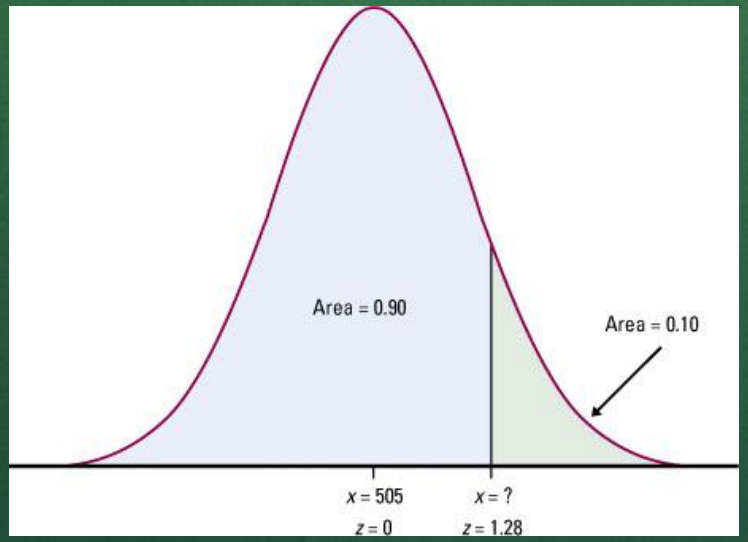
- …you also need to be able to go the other direction –

$$\% \rightarrow z \rightarrow x$$

$$x = m + zs$$

Example 2.10 – SAT Verbal Test Scores

Scores on the SAT Verbal test in recent years follow approximately the $N(505, 110)$ distribution. How high must a student score in order to place in the top 10% of all students taking the SAT?



1. State the problem and draw a picture.
   What value of x has an area of 0.10 above it in our SAT Verbal scores distribution?
2. Use Table A to find z.
   Area closest to 0.90 in Table A is 0.8997. This corresponds with $z = 1.28$.
3. Unstandardize to find x.
   $$\frac{x - 505}{110} = 1.28 \rightarrow x = 505 + (1.28)(110) = 645.8$$
4. Write a conclusion.
   You need to score at least 646 for 90th percentile.

Assessing Normality

- We need to develop some methods for determining how "Normal" a distribution is.
- METHOD 1 – Make a stemplot or histogram and check to see if it follows the 68-95-99.7 rule. (Somewhat tedious.)

Example 2.11 – Testing the Gary, IN Vocab Scores for Normality

- 68.5% of the scores (649 out of 947) are within one standard deviation of the mean.
- 95.4% (903 out of 947) are within two standard deviations.
- 99.8% (945 out of 947) are within three standard deviations.
- Note: Small data sets *rarely* follow the 68-95-99.7 rule, even if they're from a population that does follow it.

http://en.wikipedia.org/wiki/Michael_Jackson

Assessing Normality

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- METHOD 2 – Construct a Normal Probability Plot

Normal Probability Plots

- A Normal probability plot provides a good assessment of the adequacy of the Normal model for a set of data.
- How to make a Normal probability plot…
  - Arrange the observed data values from smallest to largest and figure each value's percentile ranking by counting values at or below that value.
  - Use the standard Normal distribution (Table A) to find the z-scores at these same percentiles.
  - Plot each data point x against the corresponding z. If the data distribution is close to Normal, the plotted points will lie close to some straight line.

Some Examples