Lesson 8.1.2

8-10. a. Tobiah noticed that $\frac{90}{120}$ shots is only 75%, so he does not believe her 80% claim. Aliah, however, is saying that just because she got $\frac{90}{120}$ shots this time around does not mean she would not average at least 80% in the long run.

b. Aliah's: $p \geq 0.8$. Tobiah's: $p < 0.8$

8-11. a. p is a parameter, with a single fixed value. You cannot assume it is an entire range of numbers.

b. $\hat{p} = 0.75$, which is less than 0.8

c. Either Aliah actually is less than an 80% shooter (the alternative is true) OR she got $\frac{90}{120}$ shots by chance alone.

d. $\mu_{\hat{p}} = p = 0.8$, $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.8(0.2)}{120}} \approx 0.0365$

e. Use z = $\frac{0.75-0.8}{0.0365} = -1.37$.

f. The sample proportion is 1.37 standard deviations below the null hypothesis of $p = 0.8$, assuming the null hypothesis is true.

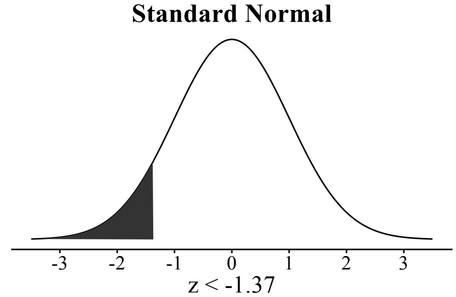
g. No. A z-score of -1.37 is unusual, but not surprisingly so.

h. Since students are looking for their sample proportion's place in comparison to other sample proportions, their sample proportion $\hat{p}$ is the value, the mean is the mean of the sampling distribution, p and the standard deviation is the standard deviation of the sampling distribution, $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$.

8-12. a. Only those less than or equal to -1.37 should be considered as or more extreme in this case.

b. p-value = 0.085. Though it is possible to sketch the curve in terms of $\hat{p}$ directly, it is a better idea to use the standard distribution when possible, as at right.

Standard Normal



8-13. a. Answers may vary.

b. No. Since p-value > 0.05 you should not reject the null hypothesis at this significance level. It is reasonable that Aliah could still be an 80% shooter.

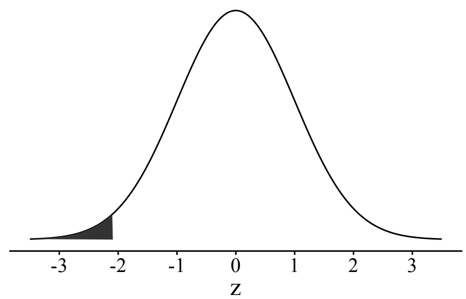
8-14. The confidence interval is 68.5% to 81.5%. Since there are values in the confidence interval matching both claims, neither claim can be accepted nor rejected; this matches the result from the hypothesis test.

8-15. a. MekDee's claim: $p \geq 0.75$, H_0: $p = 0.75$, H_A: $p < 0.75$. Sample evidence for H_A: $\hat{p} = 0.71$. p is the proportion of Americans that have eaten a MekDee's burger.

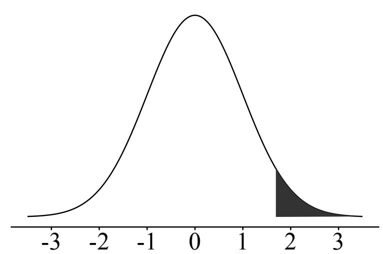
b. Random selection, to avoid bias: The sample is a simple random sample from the population. Large counts, sampling distribution ≈ normal: $np = 528(0.75) = 396$ and $n(1 - p) = 528(0.25) = 132$, both > 10. Independent trials, for an accurate $\sigma_{\hat{p}}$: The population of Americans is very large compared to the sample size, more than 10 times bigger.

c. $\hat{p}$ has a z-score of –2.11 and the p-value is 0.017. Assuming the null hypothesis is true, the probability of this few (or fewer) members of the sample eating a MekDee's burger is only 1.7%. See diagram at right.

d. Since the p-value is well less than α, you have sufficient evidence to conclude that less than 75% of Americans have eaten a MekDee's burger in the past year.

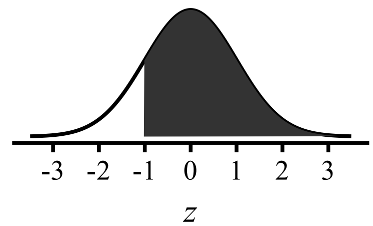


8-16. a. Identify: one-sample proportion test. Hypotheses already named. Sample evidence for H_A: $\hat{p} = 0.56$.
Check conditions: Large counts, sampling distribution ≈ normal: expected successes and failures both 200(0.5) = 100 > 10. Random selection, to avoid bias: survey is described as random. Independent trials for an accurate $\sigma_{\hat{p}}$: population of parents in the district is presumably larger than $10 \cdot 200 = 2000$.
Calculate: $\sigma_{\hat{p}} = \sqrt{\frac{0.5(0.5)}{200}} \approx 0.0354$, so under the null hypothesis the test statistic is $z = \frac{0.06}{0.0354} = 1.70$. The p-value, $P(z > 1.69)$, is about 0.045. See diagram at right.
Conclude: Since the p-value is less than 0.05, there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis. It is reasonable to believe that more than 50% of parents will approve this plan and the school board can implement the policy.



b. Using a confidence interval to estimate the proportion of parents who support the decision, the interval is $0.56 \pm 1.645\sqrt{\frac{0.56(0.44)}{200}} \approx 0.56 \pm 0.058$ or (0.502, 0.618). Since every value in the interval is greater than 0.5, it is reasonable to accept the claim that the proportion of supportive parents is greater than 50%. Same result!

8-17. $E(p) = 0.04$, $\sigma = \sqrt{\frac{(0.04)(0.96)}{400}} \approx 0.0098$,
$z = \frac{0.03-0.04}{0.0098} \approx -1.02$,
$P(z > -1.02)$ = normalcdf(–1.02, 10^99, 0, 1) =
$P(p > 0.03) = 0.846$. See diagram at right.



8-18. a. Approximately 1.45 grams.

b. About the 89th percentile.

c. One possible answer is that the scale for ants goes from 1 to 3.8 grams. The "left half" of ants goes from 1 to 1.45 grams (looking at the median). The "right half" would span 1.45 to 3.8 grams—much more spread out.

