

6.1.1: Exercises

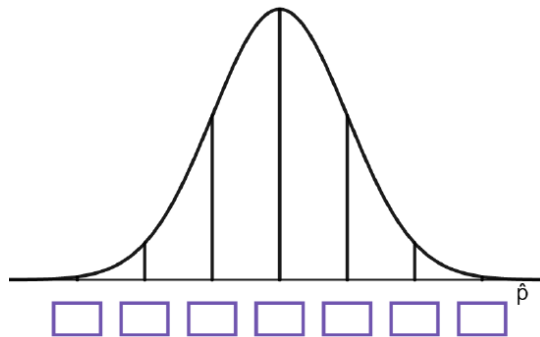
1. In 2022, a study reported that 55% of Americans support cancellation of up to \$10,000 per borrower in federal student loans. The study was based on data from a national random survey of 1250 Americans. The sample was representative of all Americans, so researchers used this study to describe characteristics of all Americans.
 - a. In this study, what is the sample?
 - b. In this study, what is the sample statistic?
 - c. In this study, what is the population?
 - d. In this study, what is the population parameter that the sample statistic is estimating?
2. In 2022, 74% of student loan borrowers who borrowed for their own education reported having a student loan debt balance of more than \$10,000. Go to [this sampling distribution applet](#) to complete the following problems. Enter 0.74 in the Population Proportion, p , field. You can use the QR code below to access the applet.



- a. Reduce the sample size (n) to 20, click generate samples. Describe the center, shape, and spread of the distribution.
- b. Increase the sample size (n) to 50, click generate samples. Describe the center, shape, and spread of the distribution.
- c. Increase the sample size (n) to 1000, click generate samples, and check the Show Normal Curve box. Describe the center, shape, and spread of the distribution.
- d. Which feature(s) of the simulated sampling distributions change when you increase the sample size? How do they change?
- e. The sampling distribution contains frequencies of all possible sample proportions from a sample of a fixed size. It has mean, $\mu_{\hat{p}} = p$, and standard error, $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$. Compute the mean and standard error (rounded to three decimal places) for a sample of size 50.

3. As Brazilians head to the polls Sunday to vote to elect their next legislature and president, 67% of Brazilians are not confident in the honesty of their country's elections, according to Gallup. Let's assume this value represents the population proportion. Imagine that a researcher surveys a random sample of 100 adults in Brazil, asking if they are confident in the honesty of their country's elections. The researcher wants to know whether people's opinions have changed. We will use the Central Limit Theorem to think about the possible results.
- a. If samples of size 100 are taken, find the mean and standard error (rounded to three decimal places) of the resulting sampling distribution of sample proportions. Assume the population proportion is $p = 0.67$, the proportion of Brazilians who are not confident in the honesty of their country's elections.
- b. A sampling distribution is a description of all possible values of a statistic. What does this sampling distribution represent?
- c. Is this sampling distribution approximately normal? Explain why or why not.

- d. The boxes under the normal distribution below are one standard error apart, with the center box located under the mean. Use the mean and standard error you calculated in a. to label the horizontal axis.



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- e. Use the empirical rule to find the interval centered at p that contains approximately 95% of all sample proportions.
- f. What sample proportions would you consider unusual?
- g. In a random sample of 100 adults in Brazil, 74 say they are not confident in the honesty of their country's elections. What is the sample proportion, \hat{p} ?
- h. Find the Z-score for this sample proportion. Round to two decimal places.
- i. Use desmos to find the probability that in a random sample of 100 adults in Brazil, 74 or more will say that they do not have confidence in the honesty of their country's elections. Round the probability to four decimal places.

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