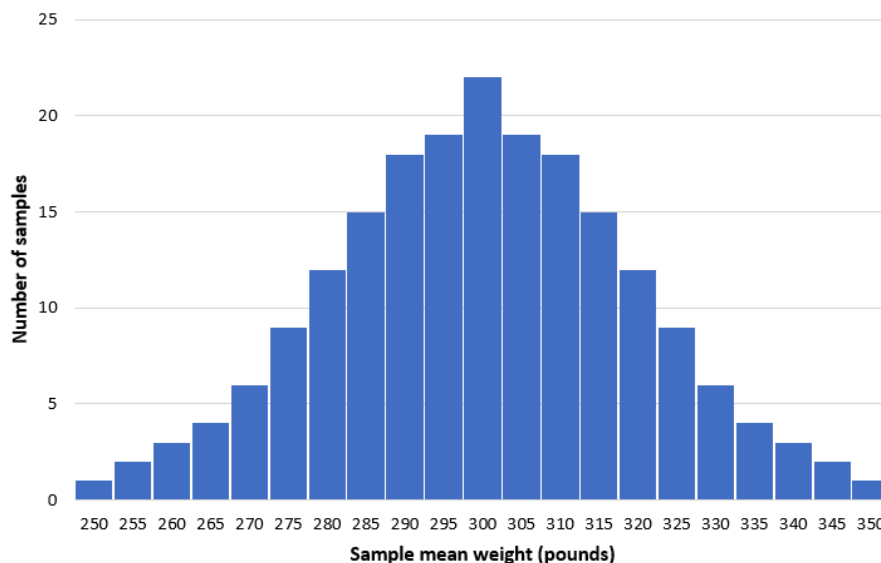# Sampling Distributions

This unit applies probabilistic reasoning to sampling, introducing students to sampling distributions of statistics they will use when performing inference in Units 6 and 7. Students should understand that sample statistics can be used to estimate corresponding population parameters and that measures of center (mean) and variability (standard deviation) for these sampling distributions can be determined directly from the population parameters when certain sampling criteria are met. For large enough samples from any population, these sampling distributions can be approximated by a normal distribution. Simulating sampling distributions helps students to understand how the values of statistics vary in repeated random sampling from populations with known parameters.

Unit Priority Standards

- VAR-1 Given that variation may be random or not, conclusions are uncertain.
- VAR-6 The normal distribution may be used to model variation.
- UNC-3 Probabilistic reasoning allows us to anticipate patterns in data.

Unit Transfer Goals

- Use a problem-solving model that incorporates analyzing the information given, determining a plan or strategy, solving the problem, justifying the solution, and checking for reasonableness of the answer.
- Apply mathematics to problems arise in everyday life, society, and the workplace;
- Communicate and organize mathematical ideas, reasoning, and their implications using multiple representations

Unit Essential questions
1. *What makes a good estimator?*   2. *How likely is it to get a value this large just by chance?*   3. *How can we anticipate patterns in the values of a statistic from one sample to another?*
Acquisition of Knowledge Skill

Students will know…	*Students will be skilled at……*
1. The area under a normal curve over a given interval represents the probability that a particular value lies in that interval. 2. When estimating a population parameter, an estimator is unbiased if, on average, the value of the estimator is equal to the population parameter.	1. Interpreting statistical calculations and findings to assign meaning or assess a claim. 2. Determining parameters for probability distributions. 3. Describing probability distributions

Unit Plan

Week 21: 6th - 12th February	**Focus: What is a sampling distribution?** How likely is it to get a value this large just by chance?
Learning Target(s):	L1: Intro to sampling distributions L2: Describing Sampling Distributions: Bias and Variability
Acquired Knowledge and skills:	☐ Distinguish between a parameter and a statistic. ☐ Create a sampling distribution using all possible samples from a small population. ☐ Use the sampling distribution of a statistic to evaluate a claim about a parameter. ☐ Distinguish among the distribution of a population, the distribution of a sample, and the sampling distribution of a statistic. ☐ Determine if a statistic is an unbiased estimator of a population parameter. ☐ Describe the relationship between sample size and the variability of a statistic.
Activities:	Desmos Activity Chapter 7 Textbook
Due Dates and Assessments:	Check-in Chapter 7.1 - Lesson 3

Week 22: 13th - 19th February	**Focus: Sampling Distribution for a Proportion** What makes a good estimator? How can we anticipate patterns in the values of a statistic from one sample to another?
Learning Target(s):	L3: Sampling Distribution of a Sample Proportion L4: Sampling Distribution of the Difference Between Two Sample Proportions L5: Sampling Distribution of a Sample Mean
Acquired Knowledge and skills:	☐ Calculate the mean and standard deviation of the sampling distribution of a sample proportion and interpret the standard deviation. ☐ Determine if the sampling distribution is approximately Normal. ☐ Calculate the mean and standard deviation of the sampling distribution of a difference in sample proportions and interpret the standard deviation.

	☐ Determine if the sampling distribution of $\hat{p}_1 - \hat{p}_2$ is approximately Normal. ☐ Use a Normal distribution to calculate probabilities involving $p_1 - p_2$. ☐ Calculate the mean and standard deviation of the sampling distribution of a sample mean and interpret the standard deviation. ☐ Use a Normal distribution to calculate probabilities involving $\bar{x}$.
Activities:	Desmos Activity Chapter 7 Textbook AP Classroom FRAPPY Questions
Due Dates and Assessments:	Check-in Chapter 7.2 - Lesson 6

Week 23: 20th - 26th February	**Focus: Central Limit Theorem** What makes a good estimator? How can we anticipate patterns in the values of a statistic from one sample to another?
Learning Target(s):	L6: Sampling Distribution of a Difference Between Two Sample Means L7: Review L8: New Unit Lesson
Acquired Knowledge and skills:	☐ Explain how the shape of the sampling distribution of $\bar{x}$ is affected by the shape of the population distribution and the sample size. ☐ Calculate the mean and standard deviation of the sampling distribution of the difference in sample means $\bar{x}_1 - \bar{x}_2$ and interpret the standard deviation. ☐ Determine if the sampling distribution of $\bar{x}_1 - \bar{x}_2$ is approximately Normal. ☐ If appropriate, use a Normal distribution to calculate probabilities involving $\bar{x}_1 - \bar{x}_2$.
Activities:	Desmos Activity Chapter 7 Textbook AP Classroom Unit Study Guide FRAPPY Questions
Due Dates and Assessments:	Check-in 7.3 Lesson 3 Cumulative Test Lesson 1 next week

Assessment Details

Evidence
I will check students' understanding throughout the unit by...

Summative	**Formative**
Cumulative Test ● Assesses skills and knowledge learnt over the course. Majority of the test will consist of the most recent unit of study, however, past units will also appear in the test.The test will also include a reflective piece requiring students to reflect on their learning for the unit of study. Check-In ● Gives students focused feedback on their progress in acquiring skills and knowledge. Students are able to retake Check-ins once to improve their grade.	Desmos Activities ● Non-graded activities will provide information about student understanding. These will also be used as discussion points in class. Q&A ● Questions asked randomly to students will help with review and reinforce knowledge. Discussion ● Small group and class discussions provide information about students ability to communicate understandings and inferences. Video Surveys ● Gives teacher feedback on students understandings and questions about a topic

Extended Learning Opportunities

Website Description	Website
Khan Academy: videos & exercises to practice	Khan Academy
AP Classroom Review Videos	AP Classroom
Albert IO – Practice Questions	Albert IO