TOPIC 1 OVERVIEW

Introduction to Probability

How are the key concepts of *Introduction to Probability* organized?

In *Introduction to Probability*, students conduct simple experiments and determine theoretical and experimental probabilities of simple events. They use familiar objects, such as number cubes, marbles in a bag, and spinners, to learn the terminology of probability, including *outcome*, *experiment*, *sample space*, *event*, *simple event*, *probability*, *complementary events*, and *equally likely*.

Students use probability models to organize the probabilities of outcomes in a sample space differentiating uniform and non-uniform probability models. They create models from experiments, but they also use models to calculate probabilities.

Math Representation

The number line shown represents the probabilities, from 0 to 1, of any event occurring.

You can plot the estimated probability of events occurring on the number line.

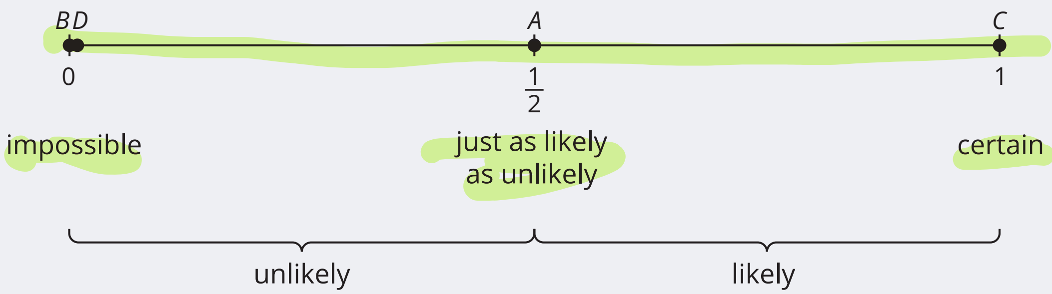
A. A card selected from a standard 52-card deck is red.

B. Your neighbors will get a pet dinosaur.

C. You will have a test in one class this month.

D. A seventh-grader is more than 6 feet tall.

probability on a # line



Students conduct probability experiments and use proportional reasoning to predict expected frequencies of favorable outcomes in larger samples and to calculate the percent error between theoretical and experimental probabilities. For real-world probability situations that require a large number of trials, students use simulation techniques, including random number tables, to simulate the results of experiments. Through simulation, students learn that as the number of trials increases, experimental probabilities approach theoretical probabilities.

Experimental & Theoretical Probabilities

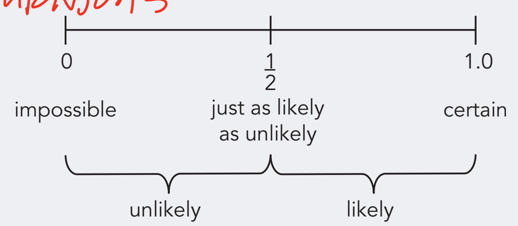
What is the entry point for students?

Although Grade 7 provides students' formal introduction to probability, students have encountered probability situations throughout their lives. The topic opens with asking students to interpret the meaning of a meteorologist's forecast. Students use their intuition of the meaning of "chance of rain" and rewrite the percent as a fraction. They perform an experiment to simulate the likelihood of guessing correct answers on a multiple choice test. They are also familiar with the tools they use to learn the basics of probability: six-sided number cubes, coins, and spinners.

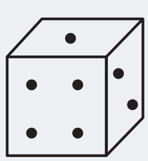
Math Representation

Probability Representations and Tools Used

- Number Lines



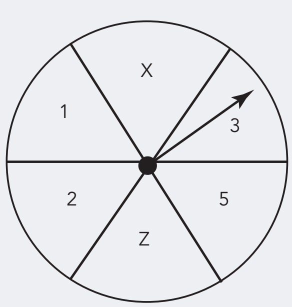
- Six-Sided Number Cubes



- Probability Models

Outcome	2	3	4	5	6	7
Probability	$\frac{1}{12}$	$\frac{3}{12}$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{1}{12}$	$\frac{1}{12}$

- Spinners



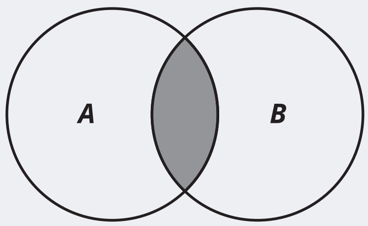
Why is *Introduction to Probability* important?

Students have already started exploring the role of probability in mathematics and statistics. Like measures of variability, probabilities can be used to make conclusions and predictions about situations. In an upcoming topic, students will use probability and ideas of randomness to explore sampling and drawing inferences about data, which is the start of the formal study of statistical inference.

The ideas developed in this topic will be used in future topics, as students build on the basic ideas of experimental and theoretical probabilities and simulation techniques to analyze and explore compound events.

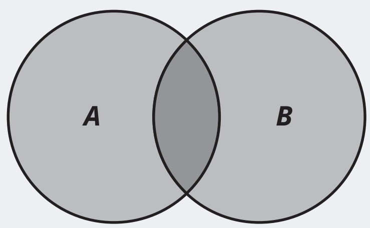
Math Representation

Determining the probability of a compound event with the word *and* is different from a compound event with *or*.



A and *B*

When determining a compound event with *and*, you determine the probability that both events occur.



A or *B*

When determining a compound event with *or*, you determine the probability that one, or the other, or both outcomes occur.

How does a student demonstrate understanding?

Students will demonstrate understanding of the standards in this topic when they can:

- Identify the sample space of an experiment.
- Recognize and explain that the probability of a chance event is a number between 0 and 1 that expresses how likely an event is to occur.
- Determine the probabilities of a simple event and its complement and describe the relationship between the two.
- Calculate experimental probability as the number of times an outcome occurs divided by the total number of times the experiment is completed.
- Calculate theoretical probability as the number of favorable outcomes in the sample space divided by the total number of outcomes in the sample space.
- Make predictions and determine solutions using experimental and theoretical probability for simple events.
- Determine experimental and theoretical probabilities related to simple events using data and sample spaces.

possible learning objectives

spanish Cognates

NEW KEY TERMS

- outcome
- experiment [experimento]
- sample space
- event [evento]
- simple event [evento simple]
- probability [probabilidad]
- complementary events [eventos complementarios]
- equally likely
- probability model [modelo probabilístico]
- uniform probability model [modelo probabilístico uniforme]
- non-uniform probability model [modelo probabilístico no uniforme]
- theoretical probability [probabilidad teórica]
- experimental probability [probabilidad experimental]
- percent error [error porcentual]
- simulation [simulación]
- random number table

- Use probability models to determine the probability of events.
- Design and use a simulation to determine experimental probabilities of simple events.

How do the activities in *Introduction to Probability* promote student expertise in the TEKS mathematical process standards?

Each topic is written with the goal of creating mathematical thinkers who are active participants in class discourse, so elements of the TEKS mathematical process standards should be evident in all lessons. Students are expected to make sense of problems and work toward solutions, reason using concrete and abstract ideas, and communicate their thinking while providing a critical ear to the thinking of others.

Novice users of probability and statistics may believe that the uncertainty and variability inherent in probability and statistics contradict the need for precision. However, precision is necessary for sampling and simulation methods; students must select appropriate tools or assignments of numbers or values in simulations (7.1C). Precision is also important as students use probabilities and proportional reasoning to make predictions and calculate percent error (7.1G). Students are expected to reason about probability concepts and use probabilities to model real-world situations while attending to precision in language, methods, and computation (7.1A).

How can you use cognates to support EB students?

EB supports

Cognates are provided for new key terms when applicable. Strategically grouping students with varying language proficiencies and factoring in group members' shared languages helps foster a collaborative learning environment. Peer discourse enables students to explain concepts to each other in both languages and build off of each other's language, enhancing understanding and language skills simultaneously.

MODULE 4, TOPIC 1 PACING GUIDE

~~165-Day Pacing~~

150 Day Pacing

4 Analyzing Populations and Probabilities

TOPIC 1: Introduction to Probability

1 DAY PACING = 45-MINUTE SESSION

TEKS Mathematical Process Standards: 7.1A, 7.1B, 7.1C, 7.1D, 7.1E, 7.1F, 7.1G

ELPS: 1.E, 2.C, 2.G, 3.D, 3.F, 3.G, 4.B, 4.C, 4.K, 5.B

Topic Pacing: 14 Days

Lesson	Lesson Title	Highlights	TEKS*	Pacing
1	Defining and Representing Probability	Students conduct an experiment that involves rolling a one six-sided number cube. The terms *outcome*, *experiment*, *sample space*, *event*, *simple event*, *probability*, *complementary events*, and *equally likely* are defined. Students calculate probabilities rolling number cubes, using spinners, and drawing marbles from a bag. **Materials Needed:** Number Cubes	7.6E **7.6H** **7.6I**	3
2	Probability Models	The terms *probability model*, *uniform probability model*, and *non-uniform probability model* are defined in this lesson. Students will develop a probability model for an experiment and use it to determine probabilities of events. They will construct and interpret uniform and non-uniform probability models. **Materials Needed:** None	**7.6I**	2
3	Determining Experimental Probability of Simple Events	Students flip a coin multiple times to determine the probabilities of heads and tails based on the results of the experiment. The terms *theoretical probability* and *experimental probability* are defined in this lesson. Students conduct trials in an experiment to estimate probabilities of the three outcomes. They also conduct trials of a spinner game to calculate experimental probabilities using data. Students use those experimental probabilities to predict the number of outcomes for a given number of trials. They then compare the experimental probabilities to the theoretical probabilities using *percent error*. **Materials Needed:** Coins, Paper or Plastic Cups, Paper Clips	7.6C 7.6D **7.6H** **7.6I**	2
4	Simulating Simple Experiments	The term *simulation* is defined in this lesson. A coin toss serves as a simulation to determine the experimental probability of the percent of female chickens hatched. Students note that as the number of trials increases, the experimental probability approaches the theoretical probability. Other situations used in this lesson are a five-question multiple-choice test, a ten-question true or false test, a number cube game, and a card game. Students describe simulation models that fit each situation. **Materials Needed:** Coins, Paper Clips, Number Cubes, Technology to Simulate a Spinner, Note Cards, Problem-Solving Graphic Organizer	7.6B 7.6C 7.6D	2
End of Topic Assessment				1
Learning Individually with Skills Practice *Schedule these days strategically throughout the topic to support student learning.*				4

*Bold TEKS = Readiness Standard

MODULE 4, TOPIC 1 PACING GUIDE

165-Day Pacing

1 DAY PACING = 45-MINUTE SESSION

Day 1	Day 2	Day 3	Day 4	Day 5
TEKS: 7.6E, **7.6H, 7.6I** **LESSON 1** Defining and Representing Probability **GETTING STARTED** **ACTIVITY 1**	**LESSON 1** continued **ACTIVITY 2** **ACTIVITY 3**	**LESSON 1** continued **ACTIVITY 4** **ACTIVITY 5** **TALK THE TALK**	**LEARNING INDIVIDUALLY** **Skills Practice** *This is a suggested placement. Move based on student data and individual needs.*	TEKS: **7.6I** **LESSON 2** Probability Models **GETTING STARTED** **ACTIVITY 1**
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
LESSON 2 continued **ACTIVITY 2** **ACTIVITY 3** **TALK THE TALK**	**LEARNING INDIVIDUALLY** **Skills Practice** *This is a suggested placement. Move based on student data and individual needs.*	TEKS: 7.6C, 7.6D, **7.6H, 7.6I** **LESSON 3** Determining Experimental Probability of Simple Events **GETTING STARTED** **ACTIVITY 1** **ACTIVITY 2**	**LESSON 3** continued **ACTIVITY 2** **ACTIVITY 3** **TALK THE TALK**	**LEARNING INDIVIDUALLY** **Skills Practice** *This is a suggested placement. Move based on student data and individual needs.*
Day 11	**Day 12**	**Day 13**	**Day 14**	
TEKS: 7.6B, 7.6C, 7.6D **LESSON 4** Simulating Simple Experiments **GETTING STARTED** **ACTIVITY 1** **ACTIVITY 2**	**LESSON 4** continued **ACTIVITY 3** **TALK THE TALK**	**LEARNING INDIVIDUALLY** **Skills Practice** *This is a suggested placement. Move based on student data and individual needs.*	**END OF TOPIC ASSESSMENT**	

*Bold TEKS = Readiness Standard

How can you incorporate Skills Practice with students?

There are four Learning Individually days scheduled within this topic. The placement of these days within the topic is flexible. The intent is to distribute spaced and interleaved practice throughout a topic and throughout the year. It is not necessary for students to complete all Skills Practice for the topic and different students may complete different problem sets. You should use data to strategically assign problem sets aligned to individual student needs. You should analyze student responses from the following embedded assessment opportunities to help assess individual needs: Essential Questions, Talk the Talks, Student Self-Reflections, and End of Topic Assessments. For students who are building their proficiency, you can assign problem sets can be assigned to target specific skills. For students who have demonstrated proficiency, there are extension problems of varied levels of challenge.

How can you identify whether students are ready for new learning?

The Prepare section of the Lesson Assignments and the Spaced Practice sets of Skills Practice can serve as diagnostic tools. Depending on available time, you can assign the Prepare section of the Lesson Assignments as homework or as a warm-up to identify students' prior knowledge for the upcoming lesson's activities. You can also use the Spaced Practice sets of Skills Practice to analyze individual students' level of proficiency on standards from previous topics.