TEKS Cluster: Probability

7.6 **Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships.

Representation of Probability

Supporting Standards

7.6(A) represent sample spaces for simple and compound events using lists and tree diagrams

Non-tested Standards

7.6(B) select and use different simulations to represent simple and compound events with and without technology

Determination of Probability

Readiness Standards

7.6(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

Supporting Standards

7.6(E) find the probabilities of a simple event and its complement and describe the relationship between the two

Application of Probability

Readiness Standards

7.6(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments

Supporting Standards

7.6(C) make predictions and determine solutions using experimental data for simple and compound events

7.6(D) make predictions and determine solutions using theoretical probability for simple and compound events

Non-tested Standards

7.6(F) use data from a random sample to make inferences about a population

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7.6(A) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(A) represent sample spaces for simple and compound events using lists and tree diagrams

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image*	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

compound event
outcome*
probability
probability experiment*
sample space
simple event
tree diagram

Interesting Items

7.6(A) 2021 #26
7.6(A) 2016 #3

Role in Concept Development

Supports

7.6(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

Connection/ Relevance

It is critical that students develop the conceptual understanding of representing sample spaces for simple and compound events as they move toward determining experimental and theoretical probabilities. This supporting standard provides that developmental progression from pictorial representations of lists and tree diagrams to abstract methods for determining sample spaces.

When to Teach

Before/With 7.6(I)

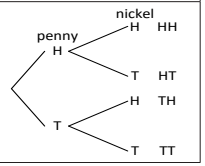
Instructional Implications

Students use lists or tree diagrams to represent sample spaces (e.g., the set of all possible outcomes in a situation such as drawing a card from a standard deck of cards). Instruction should include sample spaces for a:

- Simple event (e.g., one event such as rolling an even number on a 6-sided number cube where {2, 4, 6} are the favorable outcomes and {1, 2, 3, 4, 5, 6} is the sample space)
- Compound event (e.g., two simple events with more than one expected outcome such as rolling a 6-sided number cube and getting a "5" and then flipping a coin and it landing on "heads" where {5H} is the desired outcome and {1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T} is the sample space).

Since representing sample spaces for compound events may be confusing for some students, instruction may include a situation of tossing two coins where the two coins are different (e.g., a penny and a nickel).

The sample spaces may be represented in the form of a list or a tree diagram similar to the ones shown at right. The sample space (set of all possible outcomes) would be the set {TT, TH, HT, HH}.

List	Tree Diagram
Head – penny; Head nickel Head – penny; Tail – nickel Tail – penny; Head – nickel Tail – penny; Tail – nickel	

Learning from Mistakes

Students may make the following mistakes:

- Constructing a list or tree diagram with the outcomes from the second event paired with one outcome from the first event
- Incorrectly determining the total number of outcomes for the sample space*

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7.6(B) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(B) select and use different simulations to represent simple and compound events with and without technology

Stimulus

Word Problem	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Academic Vocabulary

compound event
dependent event
independent event
probability
simple event

Role in Concept Development

Supports

7.6(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

Connection/ Relevance

As students move toward determining experimental and theoretical probabilities with data and sample spaces, it is critical that they select and use different simulations for simple and compound events.

When to Teach

With 7.6(I)

Instructional Implications

Instruction should include a variety of situations where students select and use different simulations (a technique used for making decisions where an element of chance is involved) to represent simple and compound events. Different random devices (e.g., tossing a die, flipping a coin, spinning a spinner, random number generator, etc.) that have the same number of outcomes as the real situation must be selected and used to model the simulation (e.g., the probability of getting 7 out of 10 questions on a true or false test by guessing may be represented by flipping a coin to model if the guess is true or false).

The use of technology (e.g., random number generators or simulators of tossing a die/spinning a spinner, online or with a graphing calculator) provides the opportunity to help students generate large numbers of trials. Prior to the use of technology, students should generate trials with hands-on materials so they can experience how an experiment really works.

When working with probability, students need to be able to distinguish between:

- Independent compound events (at least two simple events where the outcome of the first event does not affect the outcome of the second event, such as determining the probability of drawing a red tile from a bag of color tiles and replacing the tile after the first draw)
- Dependent compound events (at least two simple events where the outcome of the first event affects the outcome of future events, such as determining the probability of drawing a red tile from a bag of color tiles, not replacing the tile, and then drawing a green tile from the same bag)

Learning from Mistakes

Students may make the following mistakes:

- Incorrectly determining the probability of a simple event
- Not using a simulation with the same number of outcomes as the simple or compound event (e.g., rolling a die to determine a day of the week is not appropriate because there are 6 sides on a die and 7 days in a week)

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7.6(I) Readiness

TEKS Scaffold

TEKS	Student Expectation
7.6(I)	**7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to: **(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces**
7.6(E)	find the probabilities of a simple event and its complement and describe the relationship between the two (S)
7.6(B)	select and use different simulations to represent simple and compound events with and without technology (S)
7.6(A)	represent sample spaces for simple and compound events using lists and tree diagrams (S)

Stimulus

Word Problem*	Verbal Description	Chart/Table*	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

compound event
dependent event
experimental probability*
independent event
probability*
random*/randomly*
sample space
simple event
theoretical probability

Interesting Items

7.6(I) 2024 #13
7.6(I) 2023 #30
7.6(I) 2022 #26
7.6(I) 2021 #8
7.6(I) 2018 #25
7.6(I) 2017 #11
7.6(I) 2016 #10

Content Builder (see Appendix for Tree Diagram)

- Determine experimental probability related to simple events
- Determine experimental probability related to compound events
- Determine theoretical probability related to simple events
- Determine theoretical probability related to compound events

Instructional Implications

Students should use data and sample spaces to determine:

- Experimental probability (a ratio that measures the number of observed outcome to the total number of attempts in the experiment; e.g., number of observed occurrences of the event/total number of trials = $\frac{18}{100}$, if the number 6 occurred 18 times after rolling a die 100 times)
- Theoretical probability (a ratio that measures the number of desired outcomes to all possible outcomes; e.g., number of favorable outcomes in the event/number of possible outcomes = $\frac{1}{6}$ since there is one 6 on a die and there are six possible outcomes, 1, 2, 3, 4, 5, or 6).

Instruction should include simple events (one event such as rolling an even number on a 6-sided number cube) and compound events (two simple events with more than one expected outcome such as rolling a 6-sided number cube and getting a "5" and then flipping a coin and it landing on "heads").

When working with probability, students need to distinguish between:

- Independent compound events (at least two simple events where the outcome of the first event does not affect the outcome of the second event, such as determining the probability of drawing a red tile from a bag of color tiles and replacing the tile after the first draw)
- Dependent compound events (at least two simple events where the outcome of the first event affects the outcome of future events, such as determining the probability of drawing a red tile from a bag of color tiles, not replacing the tile, and then drawing a green tile from the same bag)

Instruction should include students using correct probability notation for events (e.g., P(6), P(red and blue), etc.). Students should also find the complements to any simple or compound event to reinforce that the sum of the probabilities of events may not exceed 1 or 100%.

Learning from Mistakes

Students may make the following mistakes:

- When calculating the probability of compound events, adding probabilities instead of multiplying*
- Using "1" as the numerator when calculating the probability of an outcome, even though more than one of the outcomes are present in the situation*
- Having difficulty identifying the total number of outcomes when only the desired number of outcomes are given within a problem
- Representing probability as a part-to-part ratio instead of a part-to-whole ratio*
- Confusing theoretical and experimental probability results (e.g., when students are asked to determine the experimental probability for flipping a coin for a given set of data, students identify the theoretical probability of $\frac{1}{2}$ instead of the probability of the given data)

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7.6(E) Supporting

Subcluster: Determination of Probability

7.6(E) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(E) find the probabilities of a simple event and its complement and describe the relationship between the two

Stimulus

Word Problem	Verbal Description*	Chart/Table*	Graph
Equation/ Expression	Manipulatives	Diagram/Image*	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

complement
experimental probability
probability*
random*/randomly*
simple event
theoretical probability

Interesting Items

7.6(E) 2021 #17
7.6(E) 2016 #40

Role in Concept Development

Supports

- 7.6(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments
- 7.6(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

Connection/ Relevance

As students move toward using qualitative and quantitative descriptions to describe proportional relationships within probability and statistics, it is critical that they find probabilities and their complements. This standard also supports the developmental progression as students determine the experimental and theoretical probabilities using data and sample spaces.

When to Teach

With 7.6(I), 7.6(H)

Instructional Implications

Students find the probability of a simple event and its complement (the probability of "not that event"). Instruction should include opportunities for students to describe the relationship between the probability of a simple event and its complement. Complementary events are events that cannot happen at the same time and together comprise the entire sample space (e.g., getting a 3 and not getting a 3: 1, 2, 4, 5, or 6, are complementary events for rolling a die). Therefore, the relationship between the probability of a simple event and its complement is: 1 – the probability of the simple event = its complement (e.g., the probability of rolling a 3 on a die is $\frac{1}{6}$ and its complement is $1 - \frac{1}{6}$ or $\frac{5}{6}$).

Instruction should include the outcomes for a probability and its complement to be shown as a decimal or a percent (e.g., the probability of $\frac{1}{5}$ could be represented as the decimal 0.2 or the percent 20%).

Students should understand that the complement of a simple event may be a composite event (e.g., not rolling a 3 on a die is P(1, 2, 4, 5, or 6)).

Learning from Mistakes

Students may make the following mistakes:

- Incorrectly determining the probability of a simple event*
- Not realizing the probability of a simple event and its complement can be represented with various equations (e.g., P(event) + P(complement) = 1; 1 – P(event) = P(complement); or 1 – P(complement) = P(event))

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7.6(H) Readiness

TEKS Scaffold

TEKS	Student Expectation
7.6(H)	**7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to: **(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments**
7.6(F)*	use data from a random sample to make inferences about a population (NT)
7.6(D)*	make predictions and determine solutions using theoretical probability for simple and compound events (S)
7.6(C)*	make predictions and determine solutions using experimental data for simple and compound events (S)

Stimulus

Word Problem*	Verbal Description*	Chart/Table*	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

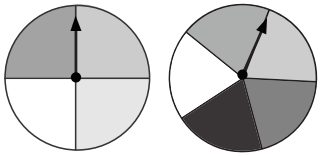
Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Content Builder (see Appendix for Tree Diagram)

- Solve problems using qualitative predictions from simple experiments
- Solve problems using qualitative comparisons from simple experiments
- Solve problems using quantitative predictions from simple experiments
- Solve problems using quantitative comparisons from simple experiments

Instructional Implications



Spinner A Spinner B

Students should be able to determine qualitative predictions [e.g., referencing spinner A, P(white) = $\frac{1}{4}$; referencing spinner B, P(white) = $\frac{1}{5}$] and quantitative predictions (e.g., the likelihood of landing on white on spinner A is more likely than spinner B).

Instruction should include the use of "and" and "or" situations [e.g., referencing spinner A, P(white or light gray) = $\frac{2}{4}$ or $\frac{1}{2}$); referencing spinner A & B, P(white on the first spinner and black on second spinner) = $\frac{1}{4}$ x $\frac{1}{5}$ = $\frac{1}{20}$).

Students may also be apply probabilities to predict other theoretical probability (e.g., the number of times a spinner would land on white from each spinner if it was spun 200 times).

Learning from Mistakes

Students may make the following mistakes:

- Not correctly identifying the probability of the simple experiment before making the prediction or comparison*
- Confusing the application of "more/less likely" when comparing probability outcomes*
- Not correctly applying a proportional relationship when making predictions*

Academic Vocabulary

equally likely*
less likely*
more likely*

Interesting Items

7.6(H) 2023 #15
7.6(H) 2019 #16
7.6(H) 2018 #15
7.6(H) 2016 #22

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7.6(C) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(C) make predictions and determine solutions using experimental data for simple and compound events

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

compound event
dependent event
experimental data
independent event
outcome*
simple event

Interesting Items

7.6(C) 2019 #7
7.6(C) 2017 #31

Role in Concept Development

Supports

7.6(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments

Connection/ Relevance

It is critical for students to make predictions and determine solutions for simple and compound events as they move toward using qualitative and quantitative descriptions to describe proportional relationships within probability and statistics.

When to Teach

With 7.6(H)

Instructional Implications

Instruction should emphasize the experimental data (number of observed occurrences of the event/total number of trials) collected from a simple event or compound event.

It is also important for students to understand that probability for compound events requires the multiplication of each separate probability. Compound events may be independent or dependent. Students should understand that collected data is used for experimental probabilities, and sample spaces are used for theoretical probabilities.

When working with probability, students need to be able to distinguish between:

- Independent compound events (at least two simple events where the outcome of the first event does not affect the outcome of the second event, such as determining the probability of drawing a red tile from a bag of color tiles and replacing the tile after the first draw)
- Dependent compound events (at least two simple events where the outcome of the first event affects the outcome of future events, such as determining the probability of drawing a red tile from a bag of color tiles, not replacing the tile, and then drawing a green tile from the same bag)

Learning from Mistakes

Students may make the following mistakes:

- Not correctly identifying the probability of the simple experiment before making the prediction or comparison*
- Not correctly applying a proportional relationship when making predictions*

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7.6(D) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(D) make predictions and determine solutions using theoretical probability for simple and compound events

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image*	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

compound event
dependent event
independent event
probability*
simple event
theoretical probability

Interesting Items

7.6(D) 2017 #17
7.6(D) 2016 #26

Role in Concept Development

Supports

7.6(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments

Connection/ Relevance

As students move toward using qualitative and quantitative descriptions to describe proportional relationships within probability and statistics, it is critical that they select and use different simulations for simple and compound events.

When to Teach

Before/With 7.6(H)

Instructional Implications

Instruction should emphasize using theoretical probability (a ratio that measures the number of desired outcomes to all possible outcomes) for simple or compound events to make predictions and determine solutions to various problems. It is important students understand probability is a number between 0 and 1 that measures the likelihood of an event (e.g., for a simple event, the probability of rolling a die and getting a 3 is $\frac{1}{6}$ since there is one 3 out of six possible outcomes (1, 2, 3, 4, 5, 6), or the probability of rolling a die and getting a prime number is $\frac{3}{6}$ since there are three prime numbers (2, 3, 5) out of six possible outcomes (1, 2, 3, 4, 5, 6)).

It is also important for students to understand that probability for compound events requires the multiplication of each separate probability. Compound events may be independent or dependent. Students should understand that collected data is used for experimental probabilities, and sample spaces are used for theoretical probabilities.

When working with probability, students need to be able to distinguish between:

- Independent compound events (at least two simple events where the outcome of the first event does not affect the outcome of the second event, such as determining the probability of drawing a red tile from a bag of color tiles and replacing the tile after the first draw)
- Dependent compound events (at least two simple events where the outcome of the first event affects the outcome of future events, such as determining the probability of drawing a red tile from a bag of color tiles, not replacing the tile, and then drawing a green tile from the same bag)

Learning from Mistakes

Students may make the following mistakes:

- Not correctly identifying the probability of the simple experiment before making the prediction or comparison*
- Not correctly applying a proportional relationship when making predictions*

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7.6(F) **7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(F) use data from a random sample to make inferences about a population

Stimulus

Word Problem	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Academic Vocabulary

random sample

Role in Concept Development

Supports

- 7.6(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments
- 7.6(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

Connection/ Relevance

It is critical for students to develop the concept that qualitative and quantitative descriptions, along with experimental and theoretical probabilities, allows them to make valid inferences about a population.

When to Teach

With/After 7.6(H), 7.6(I)

Instructional Implications

Instruction should focus on the use of data from random samples (e.g., data collected from a selected group that is representative of the data from the whole group, such as asking at least one-third of the seventh grade students to respond to a survey) to make inferences about a population (e.g., the whole group, such as all seventh grade students from each school in a Texas county).

It is important that students understand it is sometimes impossible to gather data from an entire population, so the purpose of gathering and using data from random samples of the population is to use proportional reasoning to make inferences and predictions that apply beyond the available set of data (e.g., of 300 seventh graders surveyed, 265 of them stated that pizza was their favorite lunch selection; as almost 70% of seventh graders preferred pizza, one would infer that pizza is a popular lunch choice).

When gathering data for a sample, it is imperative to incorporate randomness into the sample selection process in order to produce samples that are representative of the population (a sample in which there are distinct subsets of the population that are proportionally representative of the populations). Students need to realize that the sample size must be large enough in order to be confident that the statistics for the sample are essentially the same as for the entire population.

Instruction should also include students evaluating inferences to determine if they are accurate about a population.

Learning from Mistakes

Students may make the following mistakes:

- Not correctly applying a proportional relationship when making inferences
- Thinking that any type of sample, other than random, is representative of a population

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