Claim 1: Concepts and Procedures
Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Content Domain: **Statistics and Probability**

Target I [s]: Investigate chance processes and develop, use, and evaluate probability models. (DOK Levels 1, 2)

Tasks for this target will ask students to find probabilities of events, including compound events, with some focusing specifically on understanding the likelihood of an event as a probability between 0 and 1. Some tasks will target comparisons between predicted and observed relative frequencies.

Standards: 7.SP.C, 7.SP.C.5, 7.SP.C.6, 7.SP.C.7, 7.SP.C.8	**7.SP.C Investigate chance processes and develop, use, and evaluate probability models.** **7.SP.C.5** Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. **7.SP.C.6** Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.* **7.SP.C.7** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. *a.* Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* *b.* Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?* **7.SP.C.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.

	c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 6.SP.B, 6.SP.B.4, 6.SP.B.5	**Related Grade 6 standards** **Summarize and describe distributions.** **6.SP.B Summarize and describe distributions.** **6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **6.SP.B.5** Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. **Related Grade 8 Standards** No related standards above.
DOK Levels:	1, 2
Achievement Level Descriptors:	
RANGE Achievement Level Descriptor (Range ALD) Target I: Investigate chance processes and develop, use, and evaluate probability models.	**Level 1** Students should be able to determine the theoretical probability of a simple event; understand that probabilities are numbers between 0 (impossible) and 1 (always) and that a probability around ½ indicates an event that is neither unlikely nor likely.
	Level 2 Students should be able to approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long run relative frequency. They should be able to predict the approximate relative frequency given the probability.
	Level 3 Students should be able to find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. They should be able to compare theoretical and experimental results from a probability experiment.
	Level 4 Students should be able to design, describe, and construct a simulation experiment to generate frequencies for compound events. They should be able to explain what might account for differences between theoretical and experimental results and evaluate the associated probability model.
Evidence Required:	1. The student understands the likelihood of an event as a probability between 0 and 1. 2. The student finds probabilities of simple events.

	3. The student compares predicted probabilities to observed frequencies. 4. The student finds probabilities of compound events.
Allowable Response Types:	Multiple Choice single correct response, Equation/Numeric, Matching Tables
Allowable Stimulus Materials:	tables, lists, tree diagrams, probability line
Construct-Relevant Vocabulary:	single event, compound event, probability model, tree diagram, outcome, frequencies
Allowable Tools:	Calculator
Target-Specific Attributes:	
Non-Targeted Constructs:	
Accessibility Guidance:	Item writers should consider the following Language and Visual Element/Design guidelines[1] when developing items. Language Key Considerations: • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references Visual Elements/Design Key Considerations: • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics Items are selected for a student's test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.[2]
Development Notes:	7.SP.C.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy will be assessed in Claims 2 and 3.

[1] For more information, refer to the General Accessibility Guidelines at: http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf

[2] For more information about student accessibility resources and policies, refer to http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

Task Model 1

Response Type: Matching Tables

DOK Level 1

7.SP.C.5
Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

Evidence Required:
1. The student understands the likelihood of an event as a probability between 0 and 1.

Tools: Calculator

Prompt Features: The student is prompted to identify the likelihood of an event based on a uniform probability model.

Stimulus Guidelines:

- Context should be familiar to students 12–14 years old.
- Item difficulty can be adjusted via these example methods:
  - Event with a probability of either 0 or 1.
  - Event with a probability between 0 and 1.

TM1
Stimulus: The student is presented with a description of an event.

Example Stem: A deck of 12 cards labeled 1 through 12 is shuffled. One card is selected at random.

Determine whether each statement correctly describes the likelihood of an event based on the given deck of cards. Select True or False for each statement.

Statement	True	False
It is impossible that a card with a number greater than 13 is selected.		
It is likely that a card with a number greater than 2 is selected.		
It is certain that a card with an odd or even number is selected.		
It is unlikely that a card with a number less than 7 is selected.		

Rubric: (1 point) Student selects True for all correct statements and False for all incorrect statements (e.g., T, T, T, F). False statements will show little or no understand of the likelihood of an event occurring. Any false statement that is within 0.1 of equally likely should not be used as unlikely (0.4–0.5) or likely (0.5–0.6).

Response Type: Matching Tables

Task Model 2

Response Type: Multiple choice, single correct response

DOK Level 2

7.SP.C.6
Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*

Evidence Required:
2. The student finds probabilities of simple events.

Tools: Calculator

Version 3 Update:
Changed response type for TM2a from Equation/numeric to Multiple choice, single correct response.

Prompt Features: The student is prompted to predict the relative frequency of an event based on data generated from a chance process.

Stimulus Guidelines:

- Context should be familiar to students 12–14 years old.
- Item difficulty can be adjusted via these example methods:
  - Single- to three-category event.
  - Three or more outcomes in sample space.

TM2a
Stimulus: The student is presented with data generated from a chance process.

Example Stem: This table shows outcomes of a spinner with 3 equal sections colored orange, blue, and white.

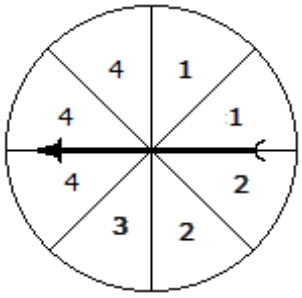
Section	Outcomes
Orange	30
Blue	34
White	36

Based on the outcomes, which number is the **best** prediction for the number of times the arrow is expected to land on the orange section if it is spun 20 times?

A. 3
B. 6
C. 30
D. 60

Rubric: (1 point) Student enters the correct prediction (e.g., B).

Response Type: Multiple choice, single correct response

Task Model 2 **Response Type: Equation / Numeric** **DOK Level 1** **7.SP.C.7a** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* **Evidence Required:** 2. The student finds probabilities of simple events. **Tools:** Calculator	**Prompt Features:** The student is prompted to determine the probability of an event occurring based on a uniform probability model. **Stimulus Guidelines:** • Context should be familiar to students 12–14 years old. • Item difficulty can be adjusted via these example methods: o Single- to three-category event. o Three or more outcomes in sample space. **TM2b** **Stimulus:** The student is presented with a problem situation that can be modeled by a uniform probability model. **Example Stem:** This spinner is divided into 8 equal-sized sections.  Enter the probability of the arrow landing on a section labeled 2 on the first spin. **Rubric:** (1 point) Student enters the correct probability, which is a rational number within 0–1 (e.g., 0.25 or equivalent numbers). **Response Type:** Equation/Numeric

Task Model 2

Response Type: Equation / Numeric

DOK Level 1

7.SP.C.7b
Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

Evidence Required:
2. The student finds probabilities of simple events.

Tools: Calculator

Prompt Features: The student is prompted to determine the probability of an event occurring based on data generated from a chance process.

Stimulus Guidelines:

- Context should be familiar to students 12–14 years old.
- Table should be clearly labeled.
- Item difficulty can be adjusted via these example methods:
  - Single- to three-category event.
  - Three or more outcomes in sample space.

TM2c
Stimulus: The student is presented with data generated from a chance process.

Example Stem: This table shows the results of randomly selecting colored marbles from a bag 20 times.

	Red	Yellow	Blue	Orange	Purple	Green
Number of Times Selected	7	4	3	1	0	5

Based on these results, enter the expected probability of selecting a red marble from the bag in one attempt.

Rubric: (1 point) Student enters the correct probability, which is a rational number within 0–1 (e.g., 0.35 or equivalent numbers).

Response Type: Equation/Numeric

Task Model 3 **Response Type: Multiple Choice, single correct response** **DOK Level 2** **7.SP.C.7** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. **Evidence Required:** 3. The student compares predicted probabilities to observed frequencies. **Tools:** Calculator **Version 3 Update:** Revised example stem for TM3 to provide clarity.	**Prompt Features:** The student is prompted to identify an explanation for why the predicted relative frequency of an event is not in agreement with the observed frequency. **Stimulus Guidelines:** • Context should be familiar to students 12–14 years old. • Item difficulty can be adjusted via these example methods: o The uniqueness of the distractors. Items with more plausible distractors are more difficult. **TM3** **Stimulus:** The student is presented with predicted and observed relative frequencies of an event that are not in agreement. **Example Stem:** A fair coin is flipped 4 times. It lands facing heads up 3 out of 4 times. The probability of a fair coin landing heads up on one flip is $\frac{1}{2}$. Select the statement that gives the most likely explanation for why the observed frequency is different than the predicted probability. A. The kind of coin used is too heavy. B. The total number of coin flips is small. C. The coin had heads on both sides. D. The probabilities $\frac{3}{4}$ and $\frac{1}{2}$ have different denominators. **Answer Choices:** Distractors will be incorrect explanations based on misconceptions such as the predicted probability being inaccurate, lack of understanding in sufficient sample sizes, or lack of understanding about variance. **Rubric:** (1 point) Student selects correct response (e.g., B). **Response Type:** Multiple Choice, single correct response

Task Model 4 **Response Type: Equation / Numeric** **DOK Level 2** **7.SP.C.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. **Evidence Required:** 4. The student finds probabilities of compound events. **Tools:** Calculator	**Prompt Features:** The student is prompted to determine the probability of a compound event occurring. **Stimulus Guidelines:** • Context should be familiar to students 12–14 years old. • Item difficulty can be adjusted via these example methods: o Compound of two or more events. **TM4** **Stimulus:** The student is presented with a description of a compound event. **Example Stem 1:** A fair coin is flipped 3 times. Enter the probability of the coin landing on its head all 3 times. **Example Stem 2:** Two number cubes, each with faces labeled 1 through 6, are rolled at the same time. Enter the probability that both number cubes land with the number 4 facing up in one roll. **Rubric:** (1 point) Student enters the correct probability (e.g., $\frac{1}{8}$ or 0.125; $\frac{1}{36}$ or 0.027-0.028 or equivalent). **Response Type:** Equation/Numeric