Vertical Progression:

6th Grade	**ELG 6.1 Understand ratio concepts and use ratio reasoning to solve problems.** o **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. o **6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. o **6.RP.A.3.a** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. o **6.RP.A.3.c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
7th Grade	**ELG 7.9 Investigate chance processes and develop, use, and evaluate probability models.** o **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 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. o **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.* o **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. o **7.SP.C.7.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.* o **7.SP.C.7.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?* o **7.SP.C.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. o **7.SP.C.8.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. o **7.SP.C.8.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. o **7.SP.C.8.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?*
	ELG.MA.HS.S.6 Understand independence and conditional probability and use them to interpret data o **S-CP.A.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

	o **S-CP.A.2** Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. o **S-CP.A.3** Understand the conditional probability of *A* given *B* as *P(A* and *B)/P(B),* and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. o **S-CP.A.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Students will demonstrate command of the ELG by:

- Understanding how the probability of an event can be expressed as a number greater than or equal to zero and less than or equal to one.
- Collecting data and using the data to approximate probabilities.
- Using modules to determine theoretical probabilities.
- Explaining the difference in a theoretical and experimental probability for the same event.
- Understanding the difference between compound and simple probability and calculation compound and simple probability.
- Representing sample spaces for multiple events with tree diagrams, organized lists, and tables.
- Designing and using a simulation to generate frequencies for compound events.

Vocabulary:

- compound event
- experimental probability
- event
- likelihood
- long run
- outcome
- probability
- sample space
- simulation
- theoretical probability
- tree diagram

Sample Instructional/Assessment Tasks:

1) **Standard(s): 7.SP.C.8**

Source: https://www.illustrativemathematics.org/content-standards/7/SP/C/8/tasks/890

Item Prompt:
A fair six-sided die is rolled twice. What is the theoretical probability that the first number that comes up is greater than or equal to the second number?

Correct Answer(s):

We can record the different possible outcomes as the six sided die is rolled. One way of doing this is with a table as shown below.

1,1*	1,2	1,3	1,4	1,5	1,6
2,1*	2,2*	2,3	2,4	2,5	2,6
3,1*	3,2*	3,3*	3,4	3,5	3,6
4,1*	4,2*	4,3*	4,4*	4,5	4,6
5,1*	5,2*	5,3*	5,4*	5,5*	5,6
6,1*	6,2*	6,3*	6,4*	6,5*	6,6*

In the table the entry marked 1,3 means that the first throw was a 1 and the second throw a 3. An asterisk next to the entry means that the first number that came up is greater than or equal to the second number. There are 36 possibilities listed in the table, each equally likely. For the 21 starred cases, the first number was greater than or equal to the second number. So the probability that the first number is greater than or equal to the second number is $\frac{21}{36} = \frac{7}{12}$.

Note: Additional solution methods can be found via the link.

2) **Standard(s): 7.SP.C.6**

Source: https://www.illustrativemathematics.org/content-standards/7/SP/C/6/tasks/1521

Item Prompt:
Each of the 20 students in Mr. Anderson's class flipped a coin ten times and recorded how many times it came out heads.

1. How many heads do you think you will see out of ten tosses?
2. Would it surprise you to see 4 heads out of ten tosses? Explain why or why not.
3. Here are the results for the twenty students in Mr. Anderson's class. Use this data to estimate the probability of observing 4, 5 or 6 heads in ten tosses of the coin. (It might help to organize the data in a table or in a dot plot first.)

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of heads	3	5	4	6	4	8	5	4	9	5	3	4	7	5	8	6	3	6	5	7

Correct Answers:

1. Most students will reply that they expect to see 5 heads, but encourage answers like "around 5 heads".
2. It would not be surprising to see only 4 heads in ten tosses. Although this outcome might occur less often than getting 5 heads, students should understand that there will be variability in the outcomes when a coin is tossed ten times, and that you don't always get 5 heads.
3. It helps to organize the data before estimating the requested probability. A dot plot of the data is shown below. Because 12 of the observed outcomes were 4, 5 or 6, the estimated probability is 12/20 = 0.60.