TEACHER'S GUIDE

MATH SERIES 2

PROBABILITY, Part 2:
Probability Complement & Tree Diagram

15 Minutes

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FOR USE IN: Mathematics

LEVEL: Grades 7-9

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EDUCATIONAL OBJECTIVES:

To help the students understand:

- **calculating the complement of an event, which is the probability of that event not happening**
- **the changing probabilities of each of three events occurring in a small number trial without replacement**
- **representing all possible outcomes from multiple events with a tree diagram**

BACKGROUND INFORMATION:

Probability is a key concept in modern mathematics and in the modern world. Estimating the probability of various events can be of vital importance for the solution of technical, economic, social-political, and other problems. It is fair to say that a recognition of the probabilistic nature of most observed events is one of the foundations of modern culture. The mathematical theory of probability was created relatively recently. Its rudiments first appeared in the 16th-17th centuries, while a strict axiomatic theory was constructed in the 20th century. While the concept of "probability" is familiar to students from their early childhood, formulating a strict definition of it remains rather difficult.

BEFORE SHOWING THE VIDEO:

Review the concepts presented in Probability, Part 1:

- *the concepts of certain and impossible events, and the probability of an event happening which is neither certain nor impossible*
- *small and large number experimental trials with replacement to approximate probability*
- *defining and calculating theoretical probability*
- *expressing probability as odds*

It may be useful to present applications of the above concepts in the following problems:

1. There are 14 books on a shelf. 8 of them are textbooks; the rest are novels. One book is taken as random. What is the probability that it will be a novel? A textbook? What are the odds that it will be a novel? A textbook?
2. What is the probability that a randomly chosen letter from the word MATHEMATICS will be an M?
3. It is known that there are 18 pencils in a drawer, and that the probability of randomly pulling out a red one is equal to $\frac{1}{3}$. How many red pencils are in the drawer?

In the course of the discussion, the teacher can tell the students that the totality of all possible outcomes is sometimes referred to in mathematics as a "sample space." The teacher should also point out that calculations done in the video will generally be indicated as being rounded off to two digits after the decimal point. For instance, $\frac{5}{12}$ will be said to be equal to 0.42, rounded off to two decimal places. .

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CONTENT OF THE VIDEO:

The complement probability, that is the probability of the event not happening, is first illustrated with the probability of the event happenng, the probability of selecting a sandwich with chili when 2 of the eight sandwiches have chili That probabillty is 2 ÷ 8, or 1 ÷ 4. Eating a chili sandwich was a mistake – too hot – so what is the probability of choosing a sandwich without chili. The complement probability, that is the probability of the event not happening - of not selecting a sandwich with chili, is equal to 1 minus the probability of the event happening, which gives a result of 6 ÷ 8 or 3 ÷ 4.

Given a bag with candies in three assorted flavors and in different amounts, what is the probability of blindly choosing any one flavor? The changing probabilities of selecting either a strawberry (10 of them), orange (8 of them), or apricot (6 of them) candy at random from a bag without replacement, is amusingly and vividly illustrated after each candy is

withdrawn from the sample space (24 candies in all). Without replacement, the probability of selecting any one of the three flavors changes after the withdrawal of any one particular flavor, because the sample space becomes smaller by one after each withdrawal.
How does one calculate the probability of having 3 children, two boys and one girl, in any order? A tree diagram is used to show all possible outcomes. The first birth has 2 (branches) possible outcomes, the second has four (branches), and the third has eight (branches) possible outcomes. Of the eight possible outcomes (branches), three have 2 boys and 1 girl, .in one order or another. So the probability of having 2 boys and 1 girl in any order, before having any, is 3 ÷ 8. A tree diagram will also show all the other possible outcomes of boy – girl combinations in a 3 child family.

AFTER SHOWING THE VIDEO:
The students can be given the following problems:

1. It is known that the probability of a lottery ticket winning the jackpot in a certain lottery is equal to 0.00001%. What is the complement probability – the probability that it will not win the jackpot?

2. The weather forecast states that tomorrow there is a 68% chance of rain and a 44% chance of no rain. Is there a mistake here?

3. John and Jim are competing in a race. The commentator says: the probability that John will win is 90%, and the probability that Jim will win is 70%. Do you think that the commentator is mistaken?

4. A wallet has 5 dimes, 7 quarters, and 3 nickels in it. The first coin touched at random is pulled out. Determine the probability that this coin (a) will be a dime, (b) will not be a nickel or a quarter, (c) will not be a quarter, (d) will not be a dime or a nickel. Suppose that first coin was pulled out a dime, and put back. Answer the same questions as before for a second coin that is pulled out at random. Suppose that the first coin pulled out was a dime and not put back. Now answer the same questions as before for a second coin that is pulled out at random.

5. A coin will be tossed by a student four times. Make a tree diagram of all possible outcomes before any tosses are made (16 branches). What is the probability of tails

coming up twice? Three times? Four times? Now toss the coin in a 4 trials experiment and record the results. Note which one of the branches your total result is identical with.

(a) What was the probability of the recorded trial experiment result happening?
(b) What was the probability that the coin will land heads half the time, and tails half the time after 4 tosses?
(c) What was the probability complement that it would not land tails and heads an equal number of times?

Math Series 1, consists of 10 videos:

ALGEBRA: A Piece of Cake Part 1
ALGEBRA: A Piece of Cake Part 2
SLOPES: That's a Bit Steep!
PERCENTAGES: That Make Sense
LINEAR EQUATIONS and Their Graphs: Let's Get It Straight Part 1
LINEAR EQUATIONS and Their Graphs: Let's Get It Straight Part 2
INTEGER OPERATIONS: Into the Negative Zone Part 1 Adding and Subtracting
INTEGER OPERATIONS: Into the Negative Zone Part 2 Multiplying and Dividing
FACTORING IS FANTASTIC Part 1: Common Factors
FACTORING IS FANTASTIC Part 2: Quadratic Trinomials

Math Series 2, consists of 12 videos:

PROBABILITY, Parts 1 & 2
RATIOS
TRIGONOMETRY, Parts 1 & 2
STATISTICS Parts 1 & 2
PROBLEM SOLVING Parts 1 & 2
GEOMETRIC SOLIDS Parts 1, 2, &3