What Are My Chances?

A lesson plan designed to teach students about **conditional** and **independent** probability

It can be really confusing learning how to apply conditional and independent probability to real-life situations. This lesson focuses on several examples and practice problems to help you learn how to find conditional probability. In this lesson, we will discuss the differences in the two kinds of probability.

COMMON CORE STANDARDS

CCSS.MATH.CONTENT.HSS.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.

CCSS.MATH.CONTENT.HSS.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.

CONDITIONAL VS INDEPENDENT PROBABILITY

Independent Probability is when events A and B, do not effect each other. For example, attempting to pull an ace of spades out of a deck is an independent probability. There is no effect on the event.

Conditional Probability is the probability that an event “A” will occur, given that another event “B” has already occurred. For example, suppose you are attempting to pull the Ace of Spades out of a deck of cards. Your first pull fails; and you DO NOT PUT THE CARD BACK. Your odds of pulling the Ace of Spades are now 1/51. Event A affected the odds of Event B.

Exercise: With a partner, brainstorm 3 examples of independent and conditional probability. Make sure to include the probability of each event occurring.

Should students want to watch an introduction of the lesson, please enter the following link: https://www.youtube.com/watch?v=AQ66NSVZKXk

PROBABILITY OF TWO EVENTS HAPPENING

Suppose we want to find the probability of pulling a pair of aces from our deck of cards. We can use the following formula to determine the probability of A (pulling an ace) and B (then pulling a second ace):

P(A and B) = P(A) x P(B)

The probability that both A and B will occur = (The probability that event A will occur) x (The probability that event B will occur, given that event A has already occurred)

The probability that event A will occur (pulling an ace from the deck)= 4 / 52

The probability event B will occur = 3/51.

So the probability that both events occur =

P(A and B)= (4 / 52) x (3 / 51)
P(A and B)= 12 / 2652, which we reduce to 1 / 221

EXERCISE

Work with a partner to brainstorm 3 scenarios in which you might need to find the probability that two dependent events will occur. Write and solve the equations for each of your scenarios. Students are encouraged to use cards, dice, coins, and other materials to create problems.

Gambling Probability

What is Probability?

Gambling is the act of taking a risk in the hopes of gaining an advantage. Gamblers are willing to risk something of value because they believe in the chance or likelihood of a favorable outcome. These hopes are linked to the mathematical concept of probability.

Probability is a concept more commonly referred to as "odds." Stop and think about the many ways people calculate odds. Medical researchers do clinical trials of new medicines to determine the odds that they will be able to help sick people. Auto insurance rates are determined by the odds that a driver will have an accident. People decide when to invest in the stock market based on the likelihood that the market will increase in value.

In your own words, describe what you think probability means. ____________

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Probability (P) is defined mathematically by the following equation:

$$P = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}}$$

Use this equation to figure out the probability of flipping a coin and having it land "heads" side up.

$$P = \frac{1}{2} \quad \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}} = \frac{\text{heads (1)}}{\text{heads or tails (2)}} = .5 \text{ or } 50\%$$

In other words, each time you flip a coin, the probability or chance of it landing on "heads" is 50 percent. The chance of it landing on "tails" is also 50 percent.

Now, use the above equation to determine the probability of rolling a die and getting a 3.

P= ____

The Odds Are Against You

The concept of probability will help you better understand the odds involved in various gambling activities. Mathematically speaking, the odds never favor the gambler. You can use the probability equation from page one to evaluate the chances a person who buys a $1 lottery ticket has of winning the Florida Lotto. After picking six numbers between 1-53…

If a Person Matches	Average Payout Is:	Approximate Odds Are:
3 of 6 numbers	$5	1:71 (In this case, 1 is the favorable outcome; 71 is the total possible number of outcomes)
4 of 6 numbers	$70	1:1,416
5 of 6 numbers	$5,000	1:81,410
6 of 6 numbers	jackpot (approximately $6 million)	1:22,957,480

Use the probability equation (and a calculator, if it will help) to figure out the chance a person has of winning, depending on numbers correctly matched.

3 of 6 numbers $P = \_\_\_\_\_ \left(\frac{\text{\# of favorable outcomes}}{\text{total \# of outcomes}} \right) = \_\_\_\_\_\_\%$

6 of 6 numbers $P = \_\_\_\_\_ \left(\frac{\text{\# of favorable outcomes}}{\text{total \# of outcomes}} \right) = \_\_\_\_\_\_\%$

The probability of a single player forming a bingo within 25 calls is about 6.4%. How does this probability of winning compare to the chance of matching 4 of 6 numbers in the Florida Lotto? ______________________________

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Does gambling seem like a good way to win large amounts of money?

❑ yes ❑ no Explain your answer. ______________________________

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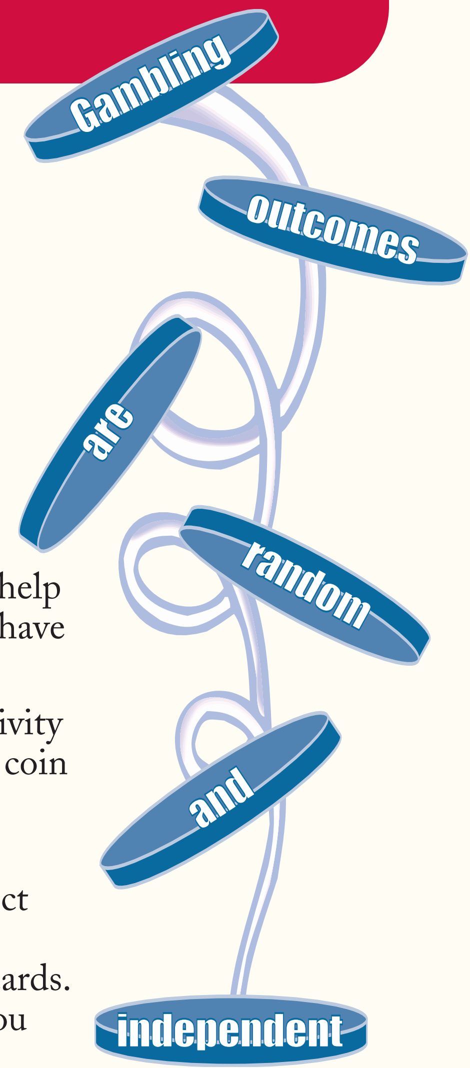
Why Risk It?



Now that you understand the concept of probability, why do you think gamblers risk money or other items of value even though their odds of winning are so low?____________________

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Two additional concepts, randomness and independence, can help you discover certain mistaken beliefs some problem gamblers have that can eventually lead to addictive behavior.

Randomness means each possible outcome of a gambling activity has the same probability or chance of occurring. Every time a coin is tossed, dice are rolled or a slot machine lever is pulled, each outcome has the same likelihood of occurring.

Independence means the outcome of one event does not affect the outcome of a later event. Independence does not apply to certain gambling activities, such as those involving a deck of cards. Drawing a card from a deck is a dependent activity because you will no longer be able to draw that exact card from the deck.

Gamblers make two mistakes in their thinking:

1. **They do not believe that the outcomes of gambling activities are random. They think a certain outcome of gambling is more likely to occur than another. They might believe in luck or be superstitious that certain numbers are more likely to be picked than others.**

2. **They mistake independent events for dependent events. For example, they think flipping a coin nine times in a row and having it land on heads every time increases the chances of it landing on tails on the tenth flip.**

What is the probability of it landing on tails on the tenth flip? _______ **%**

Coins don't "remember" what happened on past flips in order to "decide" what they should do next.

Another Look at the Odds

The probability of losing is far greater for gamblers than the probability of winning. In most gambling activities, the amount a gambler hopes to win is less than the odds the gambler faces.

Consider the following two situations. For each, use the concepts of probability, randomness and independence to describe the person's chances of winning.

Did you know?
If you choose to gamble, odds are you won't win.

1. **Your mom wants to help fund your class trip this year by purchasing school raffle tickets. You explain that tickets are $5 each and that your class' goal is to sell 1,000 tickets. Prizes vary in value from $1 to $15. There are 3 - $15 prizes, 5 - $10 prizes, 10 - $5 prizes and 20- $1 prizes.**
   If your mom purchases 10 tickets, what is the probability that she will win any prize? State your answer as a percentage.

   $$P = \_\_\_\_\_ \left(\frac{\text{\# of favorable outcomes}}{\text{total \# of outcomes}} \right) = \_\_\_\_\_\_\% $$

   What is the minimum number of times your mom would need to win in order to have her initial investment returned to her? __________
   Explain your answer. ____________________________________

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2. **Your uncle tells you he's entering an office pool for this year's Super Bowl game. He guarantees that the team he's putting his money on is going to win this year because they haven't won in years and "their time is coming." Explain why your uncle isn't guaranteed to win. ________________________**

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Gamblers are lured to risk their money by the chance, however small, of winning something. Gambling can become a problem when people lose sight of the odds against them, focusing on the distant prospect of a giant win.

There is help

If you or someone you know has a gambling problem, don't try to handle it alone. Reach out and call the Florida Council on Compulsive Gambling's 24-hour toll-free confidential HelpLine: 888-ADMIT-IT.