

## Guided Notes: Probability of Independent and Dependent Events

**Independent Events:**

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**Dependent Events:**

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Suppose a die is rolled and then a coin is tossed.

- Explain why these events are independent.

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Fill in the table to describe the sample space:

	Roll 1	Roll 2	Roll 3	Roll 4	Roll 5	Roll 6
Head						
Tail						

- How many outcomes are there for rolling the die? \_\_\_\_\_
- How many outcomes are there for tossing the coin? \_\_\_\_\_
- How many outcomes are there in the sample space of rolling the die and tossing the coin? \_\_\_\_\_
- Is there another way to decide how many outcomes are in the sample space?

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Let's see if this works for another situation.

A fast food restaurant offers 5 sandwiches and 3 sides. How many different meals of a sandwich and side can you order?

- If our theory holds true, how could we find the number of outcomes in the sample space?

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- Make a table to see if this is correct.


- Were we correct? \_\_\_\_\_

### Probabilities of Independent Events

The probability of independent events is \_\_\_\_\_,  
denoted by \_\_\_\_\_.

	Roll 1	Roll 2	Roll 3	Roll 4	Roll 5	Roll 6
Head						
Tail						

Fill in the table again and then use the table to find the following probabilities:

1.  $P(\text{rolling a 3}) =$  \_\_\_\_\_
2.  $P(\text{Tails}) =$  \_\_\_\_\_
3.  $P(\text{rolling a 3 AND getting tails}) =$  \_\_\_\_\_
4.  $P(\text{rolling an even}) =$  \_\_\_\_\_
5.  $P(\text{heads}) =$  \_\_\_\_\_
6.  $P(\text{rolling an even AND getting heads}) =$  \_\_\_\_\_

What do you notice about the answers to 3 and 6?

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### Multiplication Rule of Probability

- The probability of two independent events occurring can be found by the following formula:

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**Examples:**

1. At City High School, 30% of students have part-time jobs and 25% of students are on the honor roll. What is the probability that a student chosen at random has a part-time job and is on the honor roll? Write your answer in context.
  
2. The following table represents data collected from a grade 12 class in DEF High School.

Gender	University	Community College	Total
Males	28	56	84
Females	43	37	80
Total	71	93	164

Suppose 1 student was chosen at **random** from the grade 12 class.

- (a) What is the probability that the student is female? \_\_\_\_\_
- (b) What is the probability that the student is going to university? \_\_\_\_\_

Now suppose 2 people both randomly chose 1 student from the grade 12 class. Assume that it's possible for them to choose the same student.

- (c) What is the probability that the first person chooses a student who is female and the second person chooses a student who is going to university? \_\_\_\_\_

3. Suppose a card is chosen at random from a deck of cards, replaced, and then a second card is chosen. Would these events be independent? How do we know?

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What is the probability that both cards are 7s?

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**Probabilities of Depended Events**

Determine whether the events are independent or dependent:

1. Selecting a marble from a container and selecting a jack from a deck of cards. \_\_\_\_\_
2. Rolling a number less than 4 on a die and rolling a number that is even on a second die. \_\_\_\_\_
3. Choosing a jack from a deck of cards and choosing another jack, without replacement. \_\_\_\_\_
4. Winning a hockey game and scoring a goal. \_\_\_\_\_

- We cannot use the multiplication rule for finding probabilities of dependent events because the one event affects the probability of the other event occurring.
- Instead, we need to think about how the occurrence of one event will effect the sample space of the second event to determine the probability of the second event occurring.
- Then we can multiply the new probabilities.

**Examples:**

1. Suppose a card is chosen at random from a deck, the card is NOT replaced, and then a second card is chosen from the same deck. What is the probability that both will be 7s?

- This is similar the earlier example, but these events are dependent? How do we know?

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- How does the first event affect the sample space of the second event?

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Now find the probability that both cards will be 7s.

2. A box contains 5 red marbles and 5 purple marbles. What is the probability of drawing 2 purple marbles and 1 red marble in succession *without replacement*?

3. In Example 2, what is the probability of first drawing all 5 red marbles in succession and then drawing all 5 purple marbles in succession *without replacement*?

**Independent and Dependent Events**

- Determine which of the following are examples of independent or dependent events.
  - Rolling a 5 on one die and rolling a 5 on a second die.
  - Choosing a cookie from the cookie jar and choosing a jack from a deck of cards.
  - Selecting a book from the library and selecting a book that is a mystery novel.
  - Going to the beach and bringing an umbrella.
  - Getting gasoline for your car and getting diesel fuel for your car.
  - Choosing an 8 from a deck of cards, replacing it, and choosing a face card.
  - Choosing a jack from a deck of cards and choosing another jack, without replacement.
  - Being lunchtime and eating a sandwich.
- A coin and a die are tossed. Calculate the probability of getting tails and a 5.
- In Tania's homeroom class, 9% of the students were born in March and 40% of the students have a blood type of O+. What is the probability of a student chosen at random from Tania's homeroom class being born in March and having a blood type of O+?
- If a baseball player gets a hit in 31% of his at-bats, what is the probability that the baseball player will get a hit in 5 at-bats in a row?
- What is the probability of tossing 2 coins one after the other and getting 1 head and 1 tail?
- 2 cards are chosen from a deck of cards. The first card is replaced before choosing the second card. What is the probability that they both will be clubs?
- 2 cards are chosen from a deck of cards. The first card is replaced before choosing the second card. What is the probability that they both will be face cards?
- If the probability of receiving at least 1 piece of mail on any particular day is 22%, what is the probability of *not* receiving any mail for 3 days in a row?
- Johnathan is rolling 2 dice and needs to roll an 11 to win the game he is playing. What is the probability that Johnathan wins the game?
- Thomas bought a bag of jelly beans that contained 10 red jelly beans, 15 blue jelly beans, and 12 green jelly beans. What is the probability of Thomas reaching into the bag and pulling out a blue or green jelly bean and then reaching in again and pulling out a red jelly bean? Assume that the first jelly bean is not replaced.

11. For question 10, what if the order was reversed? In other words, what is the probability of Thomas reaching into the bag and pulling out a red jelly bean and then reaching in again and pulling out a blue or green jelly bean *without replacement*?
12. What is the probability of drawing 2 face cards one after the other from a standard deck of cards *without replacement*?
13. There are 3 quarters, 7 dimes, 13 nickels, and 27 pennies in Jonah's piggy bank. If Jonah chooses 2 of the coins at random one after the other, what is the probability that the first coin chosen is a nickel and the second coin chosen is a quarter? Assume that the first coin is not replaced.
14. For question 13, what is the probability that neither of the 2 coins that Jonah chooses are dimes? Assume that the first coin is not replaced.
15. Jenny bought a half-dozen doughnuts, and she plans to randomly select 1 doughnut each morning and eat it for breakfast until all the doughnuts are gone. If there are 3 glazed, 1 jelly, and 2 plain doughnuts, what is the probability that the last doughnut Jenny eats is a jelly doughnut?
16. Steve will draw 2 cards one after the other from a standard deck of cards *without replacement*. What is the probability that his 2 cards will consist of a heart and a diamond?