Inspiring Greatness

INDEPENDENCE SCHOOL DISTRICT

## Math Virtual Learning

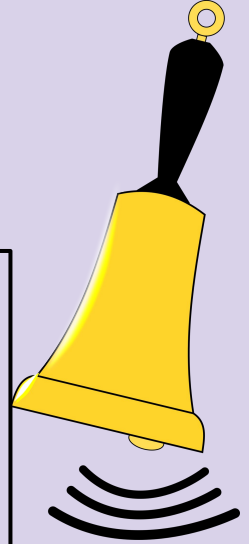
# Probability and Statistics

May 14, 2020

Probability and Statistics
Lesson: May 14, 2020

**Objective/Learning Target:**
Students will be able to calculate the probability of Union and Intersection events

# Let’s Get Started!



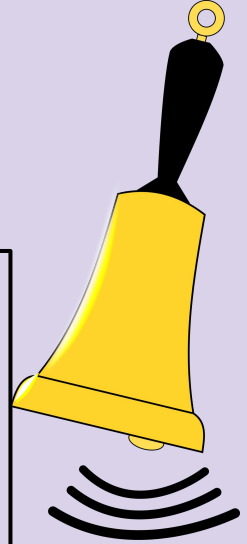
Identify if each situation is INDEPENDENT or DEPENDENT

- Two cards are drawn from a deck of cards without replacement
- A man rolls a die and spins a spinner
- Marla wants to be one of two winners chosen in the raffle

If two card are drawn from a deck of cards without replacement, what is the probability that the first card drawn is a heart?

If the first card drawn is a heart, what is the probability that the second card drawn will also be a heart?

# Let's Get Started! ANSWERS



Identify if each situation is INDEPENDENT or DEPENDENT

- Two cards are drawn from a deck of cards without replacement DEPENDENT - once you remove the first card, the chances in the second draw will be different
- A man rolls a die and spins a spinner INDEPENDENT - These are completely separate items and will have no impact on each other
- Marla wants to be one of two winners chosen in the raffle DEPENDENT - Once the first person is chosen, she has a slightly better chance of being chosen the second time.

If two card are drawn from a deck of cards without replacement, what is the probability that the first card drawn is a heart? 13/52 = 1/4

If the first card drawn is a heart, what is the probability that the second card drawn will also be a heart? 12/51

# Compound Events - Union and Intersection

Today we are going to explore further the idea of Compound Event probability.

The term COMPOUND EVENT means that you are looking at multiple events at once and want to know the likelihood of all events turning out how you want.

The two main Compound Events that we are going to explore are the Union and Intersection of events.

WATCH THIS VIDEO for an explanation about these two types.

# UNION Example #1

A jar contains 5 purple, 6 yellow, 8 green, and 5 orange jelly beans. Your favorite jelly beans are yellow and orange. What is the probability that you will draw (at random) a yellow or orange jelly bean?

# UNION Example #1 ANSWERS

A jar contains 5 purple, 6 yellow, 8 green, and 5 orange jelly beans. Your favorite jelly beans are yellow and orange. What is the probability that you will draw (at random) a yellow or orange jelly bean?

This is a UNION type of question because you are looking for either of two events to occur...not both. This was also asked with the word "or" which is a big hint. Because it is UNION, we will add the individual probabilities

P(Y) = 6/24 P(O) = 5/24 P(Y U O) = 11/24

NOTE: Be sure to check if there is any overlap that you have counted twice. Are there any jelly beans that fit both categories (yellow and orange)?

NO - so there is no need to subtract out any overlap.

# UNION Example #2

The school is hosting a raffle. Below is the breakdown of students who bought tickets.

| Blue Dolphin High School | | |
|---|---|---|
| Grade | Male | Female |
| 9 | 120 | 150 |
| 10 | 100 | 100 |
| 11 | 130 | 110 |
| 12 | 150 | 175 |

What is the probability that the winner drawn at random will be a Junior or a Female?

# UNION Example #2 ANSWERS

| Blue Dolphin High School | | |
|---|---|---|
| Grade | Male | Female |
| 9 | 120 | 150 |
| 10 | 100 | 100 |
| 11 | 130 | 110 |
| 12 | 150 | 175 |

The school is hosting a raffle. Below is the breakdown of students who bought tickets. What is the probability that the winner drawn at random will be a Junior or a Female?

This is a UNION type of question because you are looking for either of two events to occur...not both. This was also asked with the word "or" which is a big hint. Because it is UNION, we will add the individual probabilities

P(J) = 240/1035 P(F) = 535/1035 P(J U F) = 775/1035

NOTE: We need to see if there is anyone that has been counted twice. Are there any students who are both Juniors and Females? Yes - there are 110 of them. Therefore, we have counted them twice and need to subtract out one of the times they were counted.

775 - 110 = 665 Therefore the real P(J U F) = 665/1035

Watch the rest of your video before continuing!

# INTERSECTION Example #1

A jar contains 5 purple, 6 yellow, 8 green, and 5 orange jelly beans. What is the probability that you will randomly draw (in order without replacement) a yellow, orange and then green jelly bean?

# INTERSECTION Example #1 ANSWERS

A jar contains 5 purple, 6 yellow, 8 green, and 5 orange jelly beans. Your favorite jelly beans are yellow and orange. What is the probability that you will randomly draw (in order without replacement) a yellow, orange and then green jelly bean?

This is an INTERSECTION type of question because you are looking for all three events to occur. It also uses the word "and" which is a big hint. Because it is INTERSECTION, we will multiply the individual probabilities.

$P(Y) = 6/24$ $P(O) = 5/23$ $P(G) = 8/22$ $P(Y \cap O \cap G) = 240/12144 = 5/253$

NOTE: The events were dependent events because you don't replace the jelly bean. Therefore, on the second draw there are only 23 jelly beans remaining in the jar and on the third draw there are only 22 jelly beans remaining in the jar.

# INTERSECTION Example #2

The school is hosting a raffle with two winners. Below is the breakdown of students who bought tickets.

| Blue Dolphin High School | | |
|---|---|---|
| Grade | Male | Female |
| 9 | 120 | 150 |
| 10 | 100 | 100 |
| 11 | 130 | 110 |
| 12 | 150 | 175 |

What is the probability that both winners will be Freshmen?

# INTERSECTION Example #2 ANSWERS

| Blue Dolphin High School | | |
|---|---|---|
| Grade | Male | Female |
| 9 | 120 | 150 |
| 10 | 100 | 100 |
| 11 | 130 | 110 |
| 12 | 150 | 175 |

The school is hosting a raffle with two winners. Below is the breakdown of students who bought tickets. What is the probability that both winners will be Freshmen?

This is an INTERSECTION type of question because you are looking for BOTH of two events to occur. Because it is INTERSECTION, we will multiply the individual probabilities

P(F) = 120/1035 P(F) = 119/1034 P(F ∩ F) = 14280/1070190 = 1% chance

NOTE: After the first freshman is drawn, they are no longer in the running for the second drawing. Therefore there are only 119 Freshmen left in the drawing and only 1034 students left.

# INTERSECTION Example #3

During spirit day, Bob's school is selecting 2 random students from each grade level to come up and represent their class in a game. They would like one male and one female. Bob's grade has 105 males and 95 females. What is the probability that Bob (a male) will be drawn second?

# INTERSECTION Example #3 ANSWERS

During spirit day, Bob's school is selecting 2 random students from each grade level to come up and represent their class in a game. They would like one male and one female. Bob's grade has 105 males and 95 females. What is the probability that Bob (a male) will be drawn second?

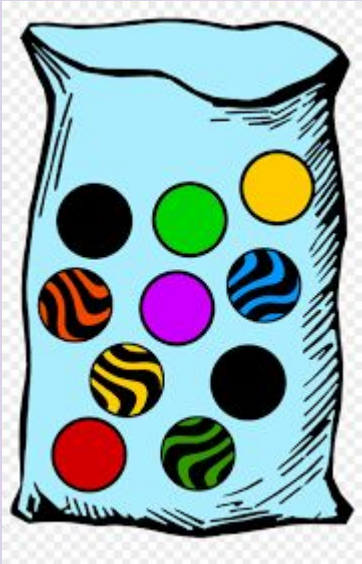
This is a little trickier to identify. This is INTERSECTION because in order for Bob to be chosen second, a female would have to be chosen first. Therefore the picks would have to be female first and then male. So we are going to multiply the probability.

$P(F) = 95/200$ $P(M) = 1/105$ $P(F \cap M) = 95/21000 = 0.4\%$ chance

NOTE: Once a female was chosen first, all females are now out of the pool of possibilities for the second choice. That is why the second probability is 1/105.

# YOUR TURN Practice #1

A bag of marbles is shown to the right. If a person was blindfolded and drew a marble at random, what are the chances that the marble they drew would have stripes on it or have green on it?



- Would this be an INTERSECTION or UNION probability?
- Would you add or multiply the probabilities?
- Find the probability of the event

# YOUR TURN Practice #1 ANSWERS

A bag of marbles is shown to the right. If a person was blindfolded and drew a marble at random, what are the chances that the marble they drew would have stripes on it or have green on it?

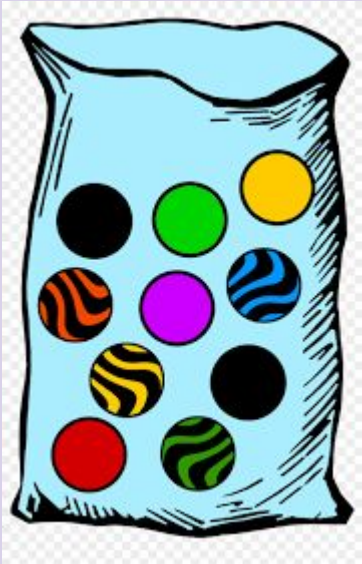
- Would this be an INTERSECTION or UNION probability?
  UNION - You need either stripes or green, not both.
- Would you add or multiply the probabilities? ADD
- Find the probability of the event?

P(S) = 4/10  P(G) = 2/10  P(S U G) = 6/10

BUT - one marble is striped and green so I need to subtract that one overlap P(S U G) = 5/10 = 1/2

# YOUR TURN Practice #2

A bag of marbles is shown to the right. If a person was blindfolded and drew two marbles at random, what are the chances that the marble they drew would be a striped marble and then a green marble?



- Would this be an INTERSECTION or UNION probability?
- Would you add or multiply the probabilities?
- Find the probability of the event

# YOUR TURN Practice #2 ANSWERS

A bag of marbles is shown to the right. If a person was blindfolded and drew two marbles at random, what are the chances that the marble they drew would be a striped marble and then a green marble?

- Would this be an INTERSECTION or UNION probability?
  INTERSECTION- You need BOTH stripes and green
- Would you add or multiply the probabilities? MULTIPLY
- Find the probability of the event?

P(S) = 4/10  P(G) = 2/10  P(S ∩ G) = 8/100 = 2/25