Name: Key

CC ALGEBRA 2

Date: 5/14/18

TROICI

LESSON #2: EVALUATING ~~INDEPENDT~~ INDEPENDENT EVENTS

Do Now: One rainy Saturday morning, Adam woke up to hear his mom complaining about the house being dirty. "Mom is always grouchy when it rains," Adam's brother said to him.

So, Adam decided to figure out if this statement was actually true. For the next year, Adam charted every time it rained and every time his mom was grouchy.

Is his brother's statement true? Justify your answer.

	Raining	Not Raining	Total
Grouchy	7	66	73
Not Grouchy	28	264	292
Total	35	330	365

1. P(Grouchy) = $\frac{73}{365} = .2$	2. P(Grouchy and Raining) = $\frac{7}{365} = .0191$
3. P(Raining) = $\frac{35}{365} = .0958$	4. P(Grouchy, given that it is raining) = $\frac{7}{35} = .2$

5. What do you notice? Do you agree with Adam's brother?

P(Grouchy) = P(Grouchy | Raining) so, the rain does not effect mom's grouchiness.

VOCABULARY/NOTATION

WORD	DEFINITION	NOTATION
Joint Probability	The prob. of two events happening @ the same time. Compared to TOTAL.	$P(A \cap B)$ ↓ And!
Conditional Probability	The prob. of an event occuring given that another event has already occured.	$P(A \mid B)$ ↓ given!
Dependent Events	The prob. of one event depends on the prob. of another event happening	$P(A) \neq P(A \mid B)$
Independent Events	The prob. of one event does not depend on the prob. of another event	$P(A) = P(A \mid B)$ in other words - the prob. will not change based on a condition

There are two ways to evaluate if events are independent:

OPTION #1	OPTION #2
$P(A) = P(A \text{ given } B)$	$P(A) \bullet P(B) = P(A \cap B)$

EXAMPLES:

1. Sean's team has a baseball game tomorrow. He pitches 50% of the games. There is a 40% chance of rain during the game tomorrow. If the probability that it rains given that Sean pitches is 40%, it can be concluded that these two events are:
   a. Independent
   b. Dependent
   c. Mutually exclusive
   d. Complements

$P(\text{Rain}) = .4$

$P(\text{Rain} \mid \text{Pitches}) = .4$

$P(A) = P(A \mid B)$

2. The results of a poll of 200 students are shown in the table below. For this group of students, does this data suggest that gender and preferred music styles are independent of each other? Justify your answer.

Try techno & female:

$P(\text{Techno}) = \frac{90}{200} = .45$

$P(\text{Female}) = \frac{106}{200} = .53$

$P(T \cap F) = \frac{54}{200} = .27$ not equal

$P(T) \cdot P(F) = .45 \cdot .53 = .2385$

	Preferred Music Style			
	Techno	Rap	Country	
Female	54	25	27	106
Male	36	40	18	94
	90	65	45	200

∴ Gender and music st[yles] are dependent events.

3. A survey of 57 sixth graders was done to determine which subject was their favorite. The results are shown in the table below sorted by gender.

Try female:

$P(F) = \frac{30}{57} = .5263$

$P(SS) = \frac{19}{57} = .\overline{3}$

$P(F \cap SS) = \frac{10}{57} = .1754$

	Math	English	Social Studies	Science	Total
Female	8	6	10	6	30
Male	10	4	9	4	27
Total	18	10	19	9	57

Does it appear, based on the data in this table, that the preference for social studies as a favorite subject has dependence on a student's gender? Show the analysis and explain your findings.

$P(F) \cdot P(SS) = .5263 \times .\overline{3} = .1754$

∴ A students gender does not influence a preference for SS. (independent)

OR:

$P(F) = \frac{30}{57} = .5263$

$P(F \mid SS) = \frac{10}{19} = .526$

independent!

4. An airport colloects data on 180 random flights that arrive at an airport.The data is shown in the following 2-way table. Is a late arrival independent of the flight being an international flight? Justify your answer.

$P(L) = \frac{18}{180}$

$P(I) = \frac{60}{180}$

$P(L \cap I) = \frac{6}{180} = \frac{1}{30}$

$P(L) \cdot P(I) = \frac{1}{30}$ yes, A late arrival is independent of an international flight

	Late Arrival	On Time	Total
Domestic Flight	12	108	120
International Flight	6	54	60
Total	18	162	180

OR $P(L) = 18/180 = .1$

$P(L|I) = 6/60 = .1$

$\therefore$ independent

5. A farmer wants to know if an insecticide is effective in preventing small insects called aphids from living in tomato plants. The farmer checks 80 plants. The data is shown in the following two-way table. Is having aphids independent of being sprayed with insecticide? Justify your answer.

$P(A) = \frac{26}{80}$

$P(S) = \frac{52}{80}$

$P(A \cap S) = \frac{12}{80} = .15$

$P(A) \cdot P(S) = .21125$

No! They are dependent of eachother.

	Has Aphids	No Aphids	Total
Was sprayed with insecticide	12	40	52
Was not sprayed with insecticide	14	14	28
Total	26	54	80

OR:

$P(A) = 26/80 = .325$

$P(A|S) = 12/52 = .2307$

dependent

6. If $P(A) = 0.4$, $P(B) = 0.6$, and $P(A \, and \, B) = 0.24$, what conclusion can you make about A and B?

$P(A) \cdot P(B) = .24$

(1) $P(A|B) = 0.6$

(2) A and B are independent events

(3) A and B are not independent events

(4) No conclusion is possible

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LESSON #2: EXIT TICKET

1. The table below shows the results of a survey in which young adults ages 18-26 were asked if they ever used social media. Use the table to answer the question below.

	Female	Male
Used Social Media	153	126
Never Used Social Media	39	32

$\boxed{71}$

What is the conditional probability that the randomly selected person is a female given they never used social media?

1) $\frac{39}{350}$ 2) $\frac{39}{71}$ 3) $\frac{192}{350}$ 4) $\frac{153}{279}$

2. If A and B are independent, then which of the following is true?

a. $P(A \cap B) = P(A) \bullet P(B)$

b. $P(B) = \frac{1}{P(A)}$

c. $P(B) = 1 - P(A)$

d. $P(A \mid B) = P(B)$

3. If $P(A) = 0.7$, $P(B) = 0.6$, and $P(A \cap B) = .4$, what conclusion can you make about *A* and *B*?

a. $P(A \mid B) = 0.6$

b. *A* and *B* are independent events

c. *A* and *B* are not independent events

d. No conclusion is possible

$P(A) \cdot P(B) = .42$

not equal!

4. A total of 500 people were asked to pick one of two candidates running for an office in a future election. The table below lists whether they chose candidate A of candidate B by gender.

	candidate A	**candidate B**	**Total**
Male	125	155	280
Female	100	120	220
Total	225	275	500

Is being a male and choosing candidate B independent of each other? Show and label work to justify your answer.

$P(m) = \frac{280}{500}$

$P(B) = \frac{275}{500}$

$P(m \cap B) = \frac{155}{500} = \frac{31}{100}$

$P(m) \cdot P(B) = \frac{77}{250}$

NO! Dependent

$P(m) = \frac{280}{500} = .56$

$P(m \mid B) = \frac{155}{275} = .5636$

NO!