The Response Bias Project

The poster will be due Monday Nov 19th

Exit Tickets

Go into the LCQ category and count half a normal LCQ's (which get scaled to 10 pts each).

Exit tickets get scaled to 5 points.

Put a tally mark in <u>one</u> of the four cells.

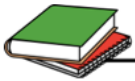|	Prefer English	Prefer Math	total
female			
male			
total			

5.3 day 1

CALCULATE and INTERPRET conditional probabilities.

DETERMINE if two events are independent.

USE the general multiplication rule to CALCULATE probabilities.

Lesson 5.3: Day 1: Do you prefer English or Math?
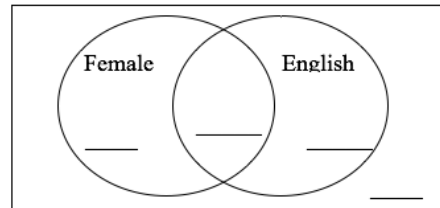
English   VS   MATH

Definition: Two events are **independent** if knowing whether or not one event has occurred does not change the probability that the other event will occur.

Are the events "Female" and "prefers English" independent?

1. Collect class data to fill in the following two-way table and Venn Diagram.

	English	Math	Total
Female			
Male			
Total			

Female   English
___   ___   ___

2. Suppose that we randomly choose a student from class. Find the following probabilities.

P(Female) =   P(English) =
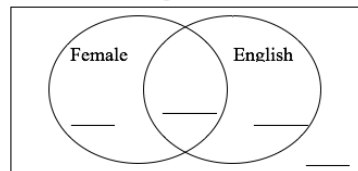
P(not Female) =   P(not English) =

P(Female AND English) =   P(English AND not Female) =

P(Female AND not English) =   P(not Female AND not English) =

	English	Math	Total
Female			
Male			
Total			

Venn diagram: two overlapping circles labeled "Female" and "English" within a box.

3. Find P(Female OR English).

4. What is the probability that a student prefers English, given that they are a female? Write as a percent.

5. What is the probability that a student prefers English, given that they are a male? Write as a percent.

6. Are the events "Female" and "prefers English" independent? Explain.

NOW DISTRIBUTION
OF ALL SENIORS

To get a deeper look at independence, consider the following distribution of all seniors at EKHS.

	English	Math	Total
Female	180	140	320
Male	150	130	280
Total	330	270	600

7. Find each of the following using the data in the table:

   a. P(English)   b. P(English | Female)   c. P(English | not Female)

To get a deeper look at independence, consider the following distribution of all seniors at EKHS.

	English	Math	Total
Female	180	140	320
Male	150	130	280
Total	330	270	600

7. Find each of the following using the data in the table:

   a. P(English)

   $$\frac{330}{600} = .55$$

   b. P(English | Female)

   $$\frac{180}{320} = .5625$$

   c. P(English | not Female)

   $$\frac{150}{280} = .536$$

8. Fill in the table as if the events WERE **independent**.

	A English	A' Math	Total
B Female			320
B' Male			280
Total	330	270	600

9. Find each of the following using the **INDEPENDENT** table:

   a. P(English)

   b. P(English | Female)

   c. P(English | Not Female)

8. Fill in the table as if the events WERE **independent**.

A

		English	Math	Total
B	Female	176	144	320
	Male	154	126	280
	Total	330	270	600

9. Find each of the following using the **INDEPENDENT** table:

   P(A)

   a. P(English)   b. P(English | Female)   c. P(English | Not Female)

   $\frac{330}{600} = .55$ $\frac{176}{320} = .55$ $\frac{154}{280} = .55$

---

10. What do you notice about your answers in #7 and #9?

11. Generalize: Complete the following statement:

    If events A and B are independent then…

10. What do you notice about your answers in #7 and #9?

When they are not independent (#7), the probabilities were different. when they are independent (#9), the probabilities we equal.

11. Generalize: Complete the following statement:

If events A and B are independent then…

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

If these two probabilities are equal, then knowing whether or not the person is female does not change the probability that the person prefers English.
   The two events are independent!
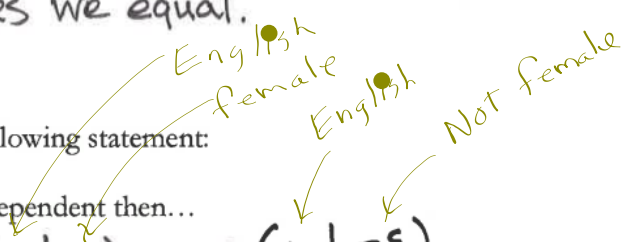
English
female

English   Not female

Conditional Probability and Independence

Big Ideas:

Conditional Probability and Independence

Big Ideas:

CONDITIONAL PROBABILITY

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

INDEPENDENCE:

when knowing that an event has or has not occurred does **not** affect the probability of the second event.

If $P(A) = P(A \mid B) = P(A \mid B^c)$

THEN A and B are independent.

AP Exam Tip

↳ Formula
    Sheet $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$

but try to use
context as much
as possible.

$P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$ ← Probability of both

← Prob. of the "Given"

(reduced Sample Space

Conditional Probability and Independence

Big Ideas:

CONDITIONAL PROBABILITY

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

INDEPENDENCE:

when knowing that an event has or has not occurred does <u>not</u> affect the probability of the second event.

If $P(A) = P(A \mid B) = P(A \mid B^c)$

THEN A and B are independent.

$$P\left(\begin{array}{c} \text{smells} \\ \text{Parkinson} \\ \text{11 times} \\ \text{out of 12} \end{array} \middle| \begin{array}{c} \text{Null Hypothesis is} \\ \text{true} \end{array} \right) =$$

Check Your Understanding:

Yellowstone National Park surveyed a random sample of 1526 winter visitors to the park. They asked each person whether he or she owned, rented, or had never used a snowmobile. Respondents were also asked whether they belonged to an environmental organization (like the Sierra Club). The <u>two way</u> table summarizes the survey responses.

		Environmental club		
		No	Yes	Total
Snowmobile experience	Never used	445	212	657
	Renter	497	77	574
	Owner	279	16	295
	Total	1221	305	1526

Suppose we randomly select one of the survey respondents. Define events E: environmental club member, S: snowmobile owner, and N: never used.

1. Find <u>P</u>(N | E). Interpret this value in context.

Check Your Understanding:

Yellowstone National Park surveyed a random sample of 1526 winter visitors to the park. They asked each person whether he or she owned, rented, or had never used a snowmobile. Respondents were also asked whether they belonged to an environmental organization (like the Sierra Club). The two way table summarizes the survey responses.

		Environmental club		
		No	Yes	Total
Snowmobile experience	Never used	445	212	657
	Renter	497	77	574
	Owner	279	16	295
	Total	1221	305	1526

Suppose we randomly select one of the survey respondents. Define events E: environmental club member, S: snowmobile owner, and N: never used.

1. Find P(N | E). Interpret this value in context.

The probability that someone has never used a snowmobile given they are in the environmental club.

= 212/305

		Environmental club		
		No	Yes	Total
Snowmobile experience	Never used	445	212	657
	Renter	497	77	574
	Owner	279	16	295
	Total	1221	305	1526

2. Given that the chosen person is not a snowmobile owner, what's the probability that she or he is an environmental club member? Write your answer as a probability statement using correct symbols for the events.

3. Are the events "Snowmobile owner" and "Environmental club member" independent? Explain.

Snowmobile experience	Environmental club		
	No	Yes	Total
Never used	445	212	657
Renter	497	77	574
Owner	279	16	295
Total	1221	305	1526

2. Given that the chosen person is not a snowmobile owner, what's the probability that she or he is an environmental club member? Write your answer as a probability statement using correct symbols for the events.

$$P(E \mid S^c) = \frac{212+77}{657+574} = \frac{289}{1231} = .23$$

$P(\text{environ} \mid \text{not a snowmobile}) =$

3. Are the events "Snowmobile owner" and "Environmental club member" independent? Explain.

$P(\text{Snowmobile}) = \frac{295}{1926} = .19$

$P(\text{Snowmobile} \mid \text{Environ}) = \frac{16}{305} = .05$

$P(\text{Snowmobile} \mid \text{Enviro}^c) = \frac{279}{1221} = .23$

No.

$P(S) \neq P(S \mid E) \neq P(S \mid E^c)$

If you are in the environmental club you are less likely to be a snowmobile owner.

Tip

Many students lose credit on AP exams for not showing enough work (detail) on probability questions.

Brain
Break

and then●●●..●●●●

Extra Extra Practice

≋ this material can potentially more difficult

5.3 ..... 61-71 (odds), 77, 79

study pp. 330-338