

Probability Connections

Use conditional probability and independence to analyze events.

HIGH SCHOOL • HSS-CP.A

CCSS.Math.Content.HSS-CP.A "Understand independence and conditional probability and use them to interpret data"

NAME _____

DATE _____

THE BIG IDEA

Conditional probability changes the total to match the event after the word "given." Use $P(A | B) = P(A \text{ and } B) / P(B)$. Events A and B are independent when $P(A \text{ and } B) = P(A) \times P(B)$, so knowing one event happened does not change the probability of the other.

WORKED EXAMPLE

In a survey, 26 students are in the photography club, and 11 of them also write for the school paper. Find $P(\text{write for paper} | \text{photography club})$.

1. The given event is being in photography club, so the total is 26.
2. There are 11 students who write for the paper and are in photography club.
3. $P(\text{write for paper} | \text{photography club}) = 11/26$.

Answer: 11/26

PRACTICE 6 problems

- 1** Events A and B are independent. If $P(A) = 4/9$ and $P(B) = 5/8$, find $P(A \text{ and } B)$.

ANSWER _____

- 2** In a group of 36 students, 9 wear glasses. Of the students who wear glasses, 6 play soccer. Find $P(\text{play soccer} | \text{wear glasses})$.

ANSWER _____

- 3** Events U and V have $P(U) = 2/3$, $P(V) = 3/10$, and $P(U \text{ and } V) = 1/5$. Are U and V independent?

ANSWER _____

- 4** In a group of 25 students, 10 take art. Of those students, 4 also take drama. Find $P(\text{drama} | \text{art})$.

ANSWER _____

- 5** Events M and N have $P(M) = 1/2$, $P(N) = 2/7$, and $P(M \text{ and } N) = 1/8$. Are M and N independent?

ANSWER _____

- 6** If $P(A \text{ and } B) = 7/18$ and $P(B) = 7/9$, find $P(A | B)$.

ANSWER _____

APPLY IT Show your work

- 1** A gaming club has 45 members. Twenty members play strategy games, 15 members stream games, and 8 members do both. If a randomly selected member is known to stream games, what is the probability that the member plays strategy games?

WORK SPACE

ANSWER _____

- 2** At a school basketball game, 50 student fans are surveyed. Thirty are in the spirit club, 20 bought a snack, and 12 are in the spirit club and bought a snack. Are being in the spirit club and buying a snack independent? Explain using probabilities.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

At a school, 60 students are surveyed. Twenty-four students are in film club, and 15 students have part-time jobs. Let x be the number of students who are in film club and have part-time jobs. What value of x would make these events independent? Explain your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Events A and B are independent. If $P(A) = 4/9$ and $P(B) = 5/8$, find $P(A \text{ and } B)$.	5/18
2	In a group of 36 students, 9 wear glasses. Of the students who wear glasses, 6 play soccer. Find $P(\text{play soccer} \mid \text{wear glasses})$.	2/3
3	Events U and V have $P(U) = 2/3$, $P(V) = 3/10$, and $P(U \text{ and } V) = 1/5$. Are U and V independent?	Yes, because $(2/3) \times (3/10) = 1/5 = P(U \text{ and } V)$.
4	In a group of 25 students, 10 take art. Of those students, 4 also take drama. Find $P(\text{drama} \mid \text{art})$.	2/5
5	Events M and N have $P(M) = 1/2$, $P(N) = 2/7$, and $P(M \text{ and } N) = 1/8$. Are M and N independent?	No, because $(1/2) \times (2/7) = 1/7$, which is not $1/8$.
6	If $P(A \text{ and } B) = 7/18$ and $P(B) = 7/9$, find $P(A \mid B)$.	1/2

PART 2 • APPLY IT

- 8/15** Use the 15 members who stream games as the conditional total. Of those members, 8 also play strategy games, so $P(\text{strategy} \mid \text{stream}) = 8/15$.
- Yes. $P(\text{spirit club}) \times P(\text{snack}) = (30/50) \times (20/50) = 6/25$, and $P(\text{spirit club and snack}) = 12/50 = 6/25$.** Compare the product of the individual probabilities with the intersection probability. Since both equal $6/25$, the events are independent.

CHALLENGE

$x = 6$, because $P(\text{film club}) \times P(\text{part-time job}) = (24/60) \times (15/60) = 1/10$. Therefore $P(\text{film club and part-time job})$ must be $1/10$, so $x/60 = 1/10$ and $x = 6$.

Accept equivalent fractions in simplified or unsimplified form. For independence questions, accept any correct comparison showing that $P(A \text{ and } B)$ does or does not equal $P(A) \times P(B)$.