

Probability Focus

Use conditions to narrow the sample space.

HIGH SCHOOL • HSS-CP.A.3

CCSS.Math.Content.HSS-CP.A.3 "Understand the conditional probability of A given B as $P(A \text{ and } B) / P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A..."

NAME _____

DATE _____

CONDITIONAL PROBABILITY

When you find $P(A \text{ given } B)$, look only at outcomes in B. Use $P(A \text{ given } B) = P(A \text{ and } B) / P(B)$, as long as $P(B)$ is not zero. Events are independent when knowing one event happened does not change the probability of the other event.

WORKED EXAMPLE

In a student club with 77 members, 49 members take photos for the club website. Of those members, 28 also write articles. Find $P(\text{writes articles given takes photos})$.

1. Let A = writes articles and P = takes photos.
2. $P(A \text{ given } P) = P(A \text{ and } P) / P(P) = (28/77) / (49/77)$.
3. $(28/77) / (49/77) = 28/49$.
4. $28/49 = 4/7$.

Answer: 4/7

PRACTICE 6 problems

- 1** Eighteen students take art. Six of those students also take coding. Find $P(\text{coding given art})$.

ANSWER _____

- 2** $P(A \text{ and } B) = 5/18$ and $P(B) = 5/6$. Find $P(A \text{ given } B)$.

ANSWER _____

- 3** $P(M) = 2/9$ and $P(M \text{ given } N) = 2/9$. Are M and N independent?

ANSWER _____

- 4** $P(A) = 5/12$ and $P(A \text{ given } B) = 1/3$. Are A and B independent?

ANSWER _____

- 5** $P(G) = 3/5$, $P(H) = 1/2$, and $P(G \text{ and } H) = 3/10$. Are G and H independent? Show a conditional probability comparison.

ANSWER _____

- 6** Events J and K are independent. If $P(K) = 3/8$, find $P(K \text{ given } J)$.

ANSWER _____

APPLY IT Show your work

- 1** At a school esports event, 30 students compete in a tournament. Six of the competitors also host part of the livestream. If one competitor is chosen at random, find $P(\text{hosts the livestream given competes})$.

WORK SPACE

ANSWER _____

- 2** A survey of 48 students shows that 16 use a study playlist while doing homework. Of the 24 students who play a sport after school, 8 use a study playlist while doing homework. Are using a study playlist and playing a sport after school independent?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A survey of 90 students found that 30 ride public transit to school and 27 listen to podcasts on the way to school. Let x be the number who do both. If the two events are independent, find x . Then calculate $P(\text{podcasts given transit})$ and $P(\text{transit given podcasts})$ to verify independence.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Eighteen students take art. Six of those students also take coding. Find $P(\text{coding given art})$.	1/3
2	$P(A \text{ and } B) = 5/18$ and $P(B) = 5/6$. Find $P(A \text{ given } B)$.	1/3
3	$P(M) = 2/9$ and $P(M \text{ given } N) = 2/9$. Are M and N independent?	Yes, M and N are independent.
4	$P(A) = 5/12$ and $P(A \text{ given } B) = 1/3$. Are A and B independent?	No, A and B are not independent.
5	$P(G) = 3/5$, $P(H) = 1/2$, and $P(G \text{ and } H) = 3/10$. Are G and H independent? Show a conditional probability comparison.	Yes. $P(G \text{ given } H) = (3/10) / (1/2) = 3/5$, which equals $P(G)$.
6	Events J and K are independent. If $P(K) = 3/8$, find $P(K \text{ given } J)$.	3/8

PART 2 • APPLY IT

- 1/5** Use the competitors as the conditional group. $P(\text{hosts given competes}) = 6/30 = 1/5$.
- Yes, the events are independent.** $P(\text{playlist}) = 16/48 = 1/3$, and $P(\text{playlist given sport}) = 8/24 = 1/3$. Since these probabilities match, the events are independent.

CHALLENGE

$x = 9$. $P(\text{podcasts given transit}) = 9/30 = 3/10$, which equals $P(\text{podcasts}) = 27/90$. $P(\text{transit given podcasts}) = 9/27 = 1/3$, which equals $P(\text{transit}) = 30/90$.

Accept equivalent fractions. For an independence conclusion, accept a correct comparison of a conditional probability with its matching overall probability; the challenge should include both requested conditional comparisons.