

Chance by Counting

Use arrangements and groups to find probability.

HIGH SCHOOL • HSS-CP.B.9

CCSS.Math.Content.HSS-CP.B.9 "(+) Use permutations and combinations to compute probabilities of compound events and solve problems."

NAME _____

DATE _____

COUNT, THEN COMPARE

When order matters, count outcomes with permutations, nPr . When order does not matter, count outcomes with combinations, nCr , then divide the number of favorable outcomes by the total number of outcomes.

WORKED EXAMPLE

Seventeen finalists are randomly assigned four distinct award places. What is the probability that Imani and Noor receive the top two places, in either order?

1. Total ordered assignments: $17P4$.
2. Favorable assignments: $2 \times 15P2$.
3. Probability = $(2 \times 15P2)/(17P4) = 1/136$.

Answer: 1/136

PRACTICE 6 problems

- 1** A debate club has 9 members. A 5-member team is chosen at random. What is the probability that both Kai and Rowan are on the team?

ANSWER _____

- 2** Eight posters will be displayed in a random order. What is the probability that three specific posters appear consecutively?

ANSWER _____

- 3** A box contains 11 cards, 5 red and 6 blue. Five cards are selected at random. What is the probability that exactly 2 selected cards are red?

ANSWER _____

- 4** Seven applicants are equally likely to be chosen for a 3-person panel. What is the probability that a particular pair of applicants is selected?

ANSWER _____

- 5** Six runners line up randomly for a photo. What is the probability that Jordan and Sam are in the first two positions, in either order?

ANSWER _____

- 6** A cafe offers 10 toppings, 7 fruit toppings and 3 other toppings. A customer chooses 3 distinct toppings at random. What is the probability that all 3 are fruit toppings?

ANSWER _____

APPLY IT Show your work

- 1** A music festival is choosing a 5-person media crew from 12 applicants. Seven applicants have video-editing experience, and the other 5 have graphic-design experience. Each applicant has exactly one of these listed skills. What is the probability that the crew has exactly 3 video editors?

WORK SPACE

ANSWER _____

- 2** A student radio show has 8 possible songs, 5 indie songs and 3 hip-hop songs. The host randomly chooses and orders 3 songs. What is the probability that the first song is hip-hop and the next 2 songs are indie?

WORK SPACE

ANSWER _____

CHALLENGE One step up

At a hackathon, 15 finalists are split into two groups. Seven have coding experience. The remaining 8 do not have coding experience and have design experience. A 5-person team is selected at random. What is the probability that the team has exactly 3 coding-experienced finalists and 2 design-experienced finalists? Explain why combinations, rather than permutations, are appropriate.

WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A debate club has 9 members. A 5-member team is chosen at random. What is the probability that both Kai and Rowan are on the team?	5/18
2	Eight posters will be displayed in a random order. What is the probability that three specific posters appear consecutively?	3/28
3	A box contains 11 cards, 5 red and 6 blue. Five cards are selected at random. What is the probability that exactly 2 selected cards are red?	100/231
4	Seven applicants are equally likely to be chosen for a 3-person panel. What is the probability that a particular pair of applicants is selected?	1/7
5	Six runners line up randomly for a photo. What is the probability that Jordan and Sam are in the first two positions, in either order?	1/15
6	A cafe offers 10 toppings, 7 fruit toppings and 3 other toppings. A customer chooses 3 distinct toppings at random. What is the probability that all 3 are fruit toppings?	7/24

PART 2 • APPLY IT

1. **175/396** Count favorable crews with $C(7,3) \times C(5,2)$, then divide by all possible crews, $C(12,5)$. This gives $350/792$, which simplifies to $175/396$.
2. **5/28** There are $8P3$ possible ordered playlists. Favorable playlists number $3 \times 5P2$, so the probability is $60/336 = 5/28$.

CHALLENGE

140/429. The favorable teams are $C(7,3) \times C(8,2)$, and all possible teams are $C(15,5)$. Because the team has no positions or ranks, changing the order of the same people does not create a new outcome.

Accept equivalent fractions and correctly formed unsimplified counting expressions that equal the listed results. For ordered outcomes, accept permutation-based reasoning; for groups, students should not count different orders as different selections.