LESSON MAKER PRO

Count the Chances

Use counting to find probabilities of compound events.

HIGH SCHOOL · S.P.1

S.P.1 "Connect basic probability concepts to statistical analysis. Describe events as subsets of a sample space. Describe the relationship between theoretical and empirical probabilities using the Law of Large Numbers..."

NAME _____ DATE _____

COUNT FAVORABLE OUTCOMES

When outcomes are equally likely, probability is the number of favorable outcomes divided by the total number of outcomes. Use C(n, k) to count ways to choose k items from n when order does not matter. For a draw without replacement, count the groups that fit the event, then divide by the number of possible groups.

WORKED EXAMPLE

A bag has 9 green tokens and 5 yellow tokens. You draw 4 tokens without replacement. What is the probability of drawing exactly 3 green tokens?

1. Choose the green tokens: C(9, 3) = 84.
2. Choose the yellow token: C(5, 1) = 5, so there are 84 × 5 = 420 favorable groups.
3. Count all groups: C(14, 4) = 1001.
4. Divide: 420/1001 = 60/143.

Answer: 60/143

PRACTICE 6 problems

1 A bag has 6 blue tokens and 2 orange tokens. You draw 2 without replacement. What is the probability that both are blue?

ANSWER _____

2 A playlist has 8 songs, including 3 favorites. If 2 songs are chosen at random, what is the probability that both are favorites?

ANSWER _____

3 A club has 10 members. How many different groups of 2 members can it choose?

ANSWER _____

4 Six runners compete in a race. How many different ways can they finish in first, second, and third place?

ANSWER _____

5 A bag has 6 black tokens and 4 white tokens. You draw 2 without replacement. What is the probability of drawing exactly 1 white token?

ANSWER _____

6 You flip a fair coin twice. List the outcomes in the event 'exactly one head,' then find its probability. Record heads as H and tails as T.

ANSWER _____

APPLY IT Show your work

1 A music app has 8 new tracks, 4 pop and 4 rock. It randomly picks 3 different tracks for a preview playlist. What is the probability that exactly 2 are pop?

WORK SPACE

ANSWER _____

2 In a game app, each play has 10 equally likely prize outcomes: 3 rare and 7 regular. A student plays 40 times and gets a rare prize 15 times. Find the theoretical and empirical probabilities of a rare prize. What does the Law of Large Numbers predict if the student plays many more times?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A bag has 6 red tokens and 4 blue tokens. You draw 3 without replacement. What is the probability of drawing at least 2 red tokens?

WORK SPACE AND ANSWER

ANSWER KEY

Count the Chances

HIGH SCHOOL · S.P.1

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A bag has 6 blue tokens and 2 orange tokens. You draw 2 without replacement. What is the probability that both are blue?	**15/28**
2	A playlist has 8 songs, including 3 favorites. If 2 songs are chosen at random, what is the probability that both are favorites?	**3/28**
3	A club has 10 members. How many different groups of 2 members can it choose?	**45**
4	Six runners compete in a race. How many different ways can they finish in first, second, and third place?	**120**
5	A bag has 6 black tokens and 4 white tokens. You draw 2 without replacement. What is the probability of drawing exactly 1 white token?	**8/15**
6	You flip a fair coin twice. List the outcomes in the event 'exactly one head,' then find its probability. Record heads as H and tails as T.	**{HT, TH}; 1/2**

PART 2 · APPLY IT

1. **3/7** There are C(4, 2) × C(4, 1) = 24 favorable playlists out of C(8, 3) = 56 possible groups. The probability is 24/56 = 3/7.
2. **Theoretical: 3/10. Empirical: 15/40 = 3/8. Over many plays, the empirical probability tends to get closer to 3/10.** Use 3 rare outcomes out of 10 for the theoretical probability and 15 rare prizes out of 40 plays for the empirical probability. The Law of Large Numbers predicts a long-run relative frequency near 3/10, but it does not guarantee that every additional set of plays will bring the frequency closer.

CHALLENGE

2/3

Accept equivalent fractions and correct counting expressions. For the challenge, the favorable groups are C(6, 2) × C(4, 1) + C(6, 3) = 80 out of C(10, 3) = 120.