Finding Probabilities of Compound Events

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

Multiply independent stage chances for an AND event: $(1/4)(1/5) = 1/20$. Add disjoint winning paths, or subtract the losing chance from 1. Without replacement, update the remaining counts.

Worked example

Flip a fair coin and independently spin five equal sectors A, B, C, D, E. Find the chance of tails and either A or E.

1. Tails has chance $1/2$.
2. A or E takes 2 of 5 sectors, so its chance is $2/5$.
3. Both are needed and the stages are independent: $(1/2)(2/5) = 1/5$.
Answer: $1/5$.

Practice Problems

Show your thinking.

1. Flip two independent fair coins. List the four ordered outcomes and find the probability of two heads.

2. Flip three independent fair coins. Find the probability of at least one head using the losing event.

3. Roll two distinguishable fair six-sided dice independently. List the ordered pairs that sum to 7 and find their probability.

4. Roll a fair six-sided die and independently flip a fair coin. Find the probability of a die result at most 4 and heads.

5. Draw twice without replacement from 3 red and 2 blue counters, uniformly each time. Find the exact chance of two red counters.

6. Independent spinners have equal sectors $1, 2, 3$ and $1, 2, 3, 4$. What is the chance their product is a multiple of 3?

7. A bag has 2 red and 3 blue counters. Draw twice at random with replacement. Find the chance of one red and one blue in either order.

8. Roll a fair six-sided die and independently spin four equal sectors H, H, H, T. Find the chance of an odd roll or T, including both.

Answer Key

1. HH, HT, TH, TT; two heads: $1/4$.
2. $7/8$.
3. $(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)$; $1/6$.
4. $1/3$.
5. $3/10$.
6. $1/2$.
7. $12/25$.
8. $5/8$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The $2(2) = 4$ equally likely outcomes are HH, HT, TH, and TT.
2. Only HH is favorable, so the probability is $1/4$.
3. Check by independence: $(1/2)(1/2) = 1/4$.

Problem 2

1. The only losing outcome is TTT: all 3 flips are tails.
2. $P(\text{TTT}) = (1/2)(1/2)(1/2) = 1/8$.
3. Subtract from 1: $P(\text{at least one head}) = 1 - 1/8 = 7/8$.

Problem 3

1. Each first roll has 6 possible second rolls: $6(6) = 36$ outcomes.
2. To sum to 7, pair each first result a with $7 - a$. This gives 6 ordered pairs: $(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)$.
3. The probability is $6/36 = 1/6$.

Problem 4

1. Numbers $1, 2, 3, 4$ qualify, so the die chance is $4/6$.
2. Heads has chance $1/2$. Both stages must succeed.
3. By independence, $(4/6)(1/2) = 1/3$.

Problem 5

1. The first red chance is $3/5$.
2. If the first is red, 2 red remain among 4 counters, so the second chance is $2/4$.
3. Along the red-then-red path, $(3/5)(2/4) = 3/10$.

Problem 6

1. A multiple of 3 needs a 3 on at least one of these spinners.
2. Neither lands on 3 with chance $(2/3)(3/4) = 1/2$.
3. The complement gives $1 - 1/2 = 1/2$.

Problem 7

1. Red then blue: $(2/5)(3/5) = 6/25$.
2. Blue then red: $(3/5)(2/5) = 6/25$. Replacement keeps the probabilities unchanged.
3. The orders are disjoint, so add: $6/25 + 6/25 = 12/25$.

Problem 8

1. Odd has chance $3/6 = 1/2$; T has chance $1/4$.
2. Both occur with chance $(1/2)(1/4) = 1/8$.
3. Add and subtract that overlap once: $1/2 + 1/4 - 1/8 = 5/8$.

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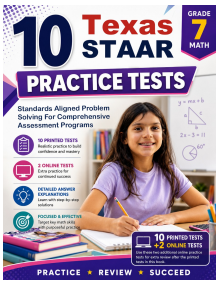

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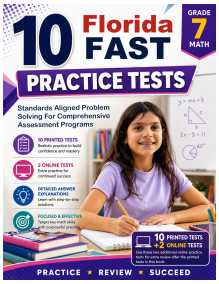

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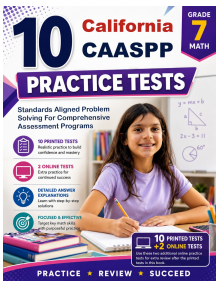

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