Introduction to Probability

Introduction to Probability: Find, Fix, and Work Backward

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QUICK REVIEW

For equally likely outcomes, probability is favorable outcomes divided by all outcomes. A fair six-sided number cube has three even outcomes $(2, 4, 6)$, so $P(\text{even}) = \frac{3}{6} = \frac{1}{2}$. Impossible events have probability 0; certain events have probability 1.

Worked example

A bag holds 3 red, 1 blue, and 4 green counters. Draw one counter uniformly at random. Find the probability of red.

1. All counters are equally likely; total outcomes: $3 + 1 + 4 = 8$.
2. Red outcomes: 3, so $P(\text{red}) = \frac{3}{8} = \frac{3}{8}$.
Answer: $\frac{3}{8}$.

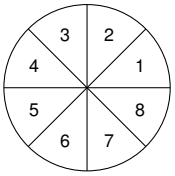
Practice Problems

Show your thinking.

1. A bag has 2 red, 5 blue, and 1 green counter. Draw one counter uniformly at random. A student uses $\frac{2}{6}$ for red. Fix the denominator and probability.

2. One counter is drawn uniformly at random from a bag of 15. The probability of red is $\frac{2}{5}$. Recover the red and non-red counts.

3. A child says one spin of the fair spinner has probability $\frac{1}{8}$ of even because even names one event. Correct it.



4. Roll a fair 1-through-6 number cube once. Find a whole number t so that the probability of a result less than t is exactly $\frac{1}{2}$.

5. A bag holds 3 red, 2 blue, and 5 green counters. Draw one counter uniformly at random. Lee says not red means only blue. Correct the event and its probability.

6. A bag has 2 red, 3 blue, and 7 green counters. Method A chooses one counter uniformly from the bag. B chooses a color with equal chance for each color, then one counter uniformly from that color. Compare the red chances.

Answer Key

1. Use 8 as the denominator; probability $\frac{1}{4}$.
2. 6 red and 9 non-red counters.
3. $\frac{1}{2}$.
4. $t = 4$.
5. Blue or green; probability $\frac{7}{10}$.
6. A: $\frac{1}{6}$. B: $\frac{1}{3}$, the greater chance.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The denominator counts all counters, not just the $5 + 1 = 6$ non-red ones.
2. Use $2 + 5 + 1 = 8$ counters: $\frac{2}{8} = \frac{1}{4}$.

Problem 2

1. One fifth of the counters is $15 \div 5 = 3$. Two fifths give $2 \times 3 = 6$ red counters.
2. The others number $15 - 6 = 9$. Check $\frac{6}{15} = \frac{2}{5}$.

Problem 3

1. Even sectors are $2, 4, 6, 8$, giving 4 favorable outcomes.
2. There are 8 equally likely outcomes, so $P = \frac{4}{8} = \frac{1}{2}$.

Problem 4

1. Half of the 6 outcomes is 3 outcomes.
2. The first three faces are $1, 2, 3$, all less than 4. Thus $P = \frac{3}{6} = \frac{1}{2}$.

Problem 5

1. Not red includes 2 blue and 5 green counters, so $2 + 5 = 7$ qualify.
2. All counters total $3 + 2 + 5 = 10$, giving $\frac{7}{10}$.

Problem 6

1. A counts all $2 + 3 + 7 = 12$ counters. Red chance is $\frac{2}{12} = \frac{1}{6}$.
2. B gives one of 3 equal chances to each color. Picking red forces a red counter, so its chance is $\frac{1}{3}$.

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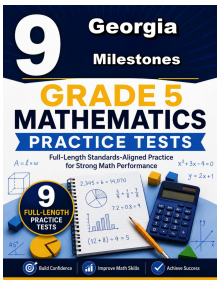

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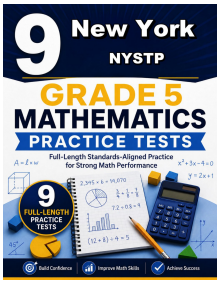

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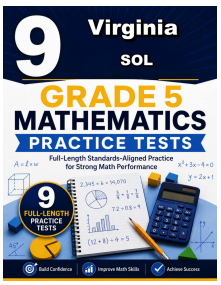

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