Probability of Simple and Compound Events

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Applications require a sample space and an assumption about equally likely outcomes. Independent spinners multiply probabilities; drawing prizes without replacement changes the second fraction. Predict an expected count using $nP(E)$, but do not promise that exact count. To design a fair game, compare winning probabilities or balance the number of favorable equally likely outcomes, not merely the number of prize labels.

Worked example

Example for form 3: a bag has 5 red and 4 blue counters. Find P(red) on one uniform draw.

1. There are $5 + 4 = 9$ counters in total. The favorable group consists of the 5 red counters, each equally likely to be selected.
2. Divide favorable by total: $P(\text{red}) = 5/9 = \frac{5}{9}$. The remaining counters form the complementary event, blue.
Answer: $P = \frac{5}{9}$

Practice Problems

Show your thinking.

1. A game wins on sectors 1 or 2 of a fair 5-sector spinner. Find its winning chance.

2. A prize requires a head and an even die face using independent fair devices. Find the prize probability.

3. A class draws two names without replacement from 5 girls and 3 boys. Find P(girl then boy).

4. A safety test succeeds with probability 3/4 on each of two independent attempts. Find P(at least one success).

5. A fundraiser sells 200 tickets. Each has a 3/20 chance of a small prize. What is the expected number of small prizes?

6. Design a fair win/lose spinner with 8 equal sectors. How many sectors should win?

7. A quality sample finds 6 defects among 80 items. Estimate the defect probability for similar production.

8. A game draws from 2 gold and 4 silver tokens twice with replacement. Find P(two gold prizes).

9. A game has P(win)=2/5. The organizer wants a 1/2 winning chance using the same 10 equal tickets. How many more winning tickets are needed?

10. A bus is late on 8 of 40 observed school days. Estimate P(not late) from these observations.

Answer Key

1. $P = \frac{2}{5}$
2. $P = \frac{1}{4}$
3. $P = \frac{15}{56}$
4. $P = \frac{15}{16}$
5. 30 prizes (expected).
6. 4 winning sectors.
7. $P = \frac{3}{40}$
8. $P = \frac{1}{9}$
9. 1 additional winning ticket.
10. $P = \frac{4}{5}$

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The five sectors are equally likely and two labels, 1 and 2, win. Thus the favorable count is 2 out of 5.

2. The winning probability is $2/5$. The remaining chance is $1 - 2/5 = 3/5$, so winning and losing are not equally likely.

Problem 2

1. A head has probability $1/2$, and the even die outcomes $2, 4, 6$ have probability $3/6 = 1/2$.

2. Multiply the independent chances: $(1/2)(1/2) = 1/4$. There are 3 prize-winning pairs among $2(6) = 12$ equally likely coin-die pairs.

Problem 3

1. The first draw selects a girl with probability $5/8$. Then all 3 boys remain among 7 students.

2. The requested order has probability $(5/8)(3/7) = 15/56$. Do not also include boy then girl, because this question specifies the order.

Problem 4

1. The failure chance per attempt is $1 - 3/4 = 1/4$. Both attempts fail with probability $(1/4)(1/4) = 1/16$.

2. At least one success is the complement: $1 - 1/16 = 15/16$. This includes success on either attempt or on both.

Problem 5

1. Multiply the number of tickets by the per-ticket chance: $200(3/20) = (200/20)(3) = 10(3)$.

2. The expected count is 30. This is a long-run average under the stated probability, not a promise that exactly thirty of these tickets win.

Problem 6

1. Fair win/lose means $P(\text{win}) = P(\text{lose}) = 1/2$. If w sectors win, require $w/8 = 1/2$.

2. Multiply by 8: $w = 4$. The remaining $8 - 4 = 4$ lose, so both chances are $4/8 = 1/2$.

Problem 7

1. The observed defect fraction is $6/80$. Reduce by dividing numerator and denominator by 2, giving $3/40$.

2. The experimental estimate is $3/40$. Applying it to later items assumes similar production conditions; it does not establish that every group of forty contains exactly three defects.

Problem 8

1. Each draw has gold probability $2/6 = 1/3$. Replacement restores the counts before the second draw, so the draws are independent.

2. The two-gold probability is $(2/6)(2/6) = 4/36 = 1/9$. Without replacement the second fraction would be different.

Problem 9

1. The current winning count is $10(2/5) = 4$. A fair half-winning set of ten tickets needs $10(1/2) = 5$ winners.

2. Convert $5 - 4 = 1$ losing ticket to a winner, keeping ten tickets total. The new winning probability is $5/10 = 1/2$.

Problem 10

1. The count of days not late is $40 - 8 = 32$. Use the full 40 observed days as the denominator.

2. The experimental estimate is $32/40 = 4/5$. This describes the observed sample and can inform planning, but it is not a certainty about the next day.

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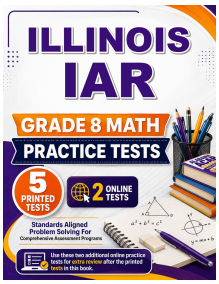

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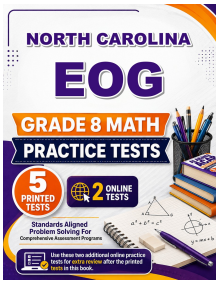

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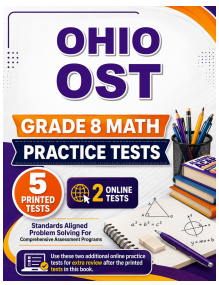

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