Probability Models

Spot mistakes, reason, and work backward

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

QUICK REVIEW

List every outcome once. Probabilities must be nonnegative and total 1; for instance $0.2 + 0.3 + 0.5 = 1$. Group repeated labels before reporting the model. For trial data, divide each count by the total number of trials.

Worked example

Five equally likely slips are labeled X, X, Y, Z, Z. Build the label model.

1. One slip has probability $1/5$.
2. X and Z each use 2 slips: $P(X) = P(Z) = 2/5$. Y uses one: $P(Y) = 1/5$.
3. Check the total: $2/5 + 1/5 + 2/5 = 1$.
Answer: X: $2/5$, Y: $1/5$, Z: $2/5$.

Practice Problems

Show your thinking.

1. A student says $-0.1, 0.6, 0.5$ are valid probabilities for A, B, C because they total 1. Explain the error. Keep C at 0.5 and make B twice A.

2. One tile is drawn uniformly from 12 tiles. The label probabilities are $P(S) = 1/3$, $P(T) = 1/4$, and $P(U) = 5/12$. A student counts 6 tiles for S and T combined. Recover all three counts and correct the claim.

3. The tally lists outcomes P, Q, R. A report divides each count by 3 because there are three outcomes. Repair the model and identify the most frequent outcome.

Outcome	Count
P	6
Q	12
R	2

4. A, B, C are the only outcomes. If $P(A \text{ or } B) = 3/4$, must A and B each be $3/8$? Give two valid models with different A chances.

5. A student wants exactly $2/3$ orange on a spinner with 10 equal sectors. Can it work? Find the least possible sector total that is a multiple of 10.

6. A raffle ticket is gold, silver, or blank. $P(G) = 1/5$ and $P(S) = 3/10$. A student multiplies to find the chance of gold or silver. Correct it and find the blank chance.

7. A student assigns $0.18, 0.27, 0.65$ to exhaustive outcomes A, B, C. By how much is the total off? Keep A and B and repair C.

8. A uniform spinner is $5/8$ red, $1/4$ blue, and $1/8$ green by area. A student assigns $1/3$ to each color. Correct the model and check the total.

Answer Key

1. Negative probability is invalid. A: $1/6$, B: $1/3$, C: $1/2$.
2. S: 4 tiles, T: 3, U: 5; S and T together use 7.
3. $P(P) = 3/10$, $P(Q) = 3/5$, $P(R) = 1/10$; Q is most frequent.
4. No. (A, B, C) can be $(1/8, 5/8, 1/4)$ or $(1/2, 1/4, 1/4)$.
5. No. Use 30 sectors, with 20 orange.
6. Gold or silver: $1/2$; blank: $1/2$.
7. Total is 0.10 too high; change C to 0.55.
8. Red: $5/8$; blue: $1/4$; green: $1/8$. Total 1.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The total $-0.1 + 0.6 + 0.5 = 1$ is not enough: $-0.1 < 0$.
2. A and B must total $1 - 1/2 = 1/2$. If A is a, then $a + 2a = 1/2$.
3. Divide by 3: $a = 1/6$. B is $2(1/6) = 1/3$.

Problem 2

1. S uses $12(1/3) = 4$ tiles and T uses $12(1/4) = 3$.
2. U uses $12(5/12) = 5$ tiles; $4 + 3 + 5 = 12$.
3. S and T are disjoint, so they use $4 + 3 = 7$ tiles, not 6.

Problem 3

1. Use the number of trials, $6 + 12 + 2 = 20$, not the number of labels.
2. P, Q, and R have rates $6/20 = 3/10$, $12/20 = 3/5$, and $2/20 = 1/10$.
3. Q has the greatest count, 12; the three rates total $20/20 = 1$.

Problem 4

1. Both models need $P(C) = 1 - 3/4 = 1/4$.
2. One split of $3/4$ is $1/8 + 5/8 = 3/4$.
3. Another is $1/2 + 1/4 = 3/4$. Each split with C gives total 1.

Problem 5

1. Ten sectors would require $10(2/3) = 20/3$ orange sectors, not a whole number.
2. The total must be divisible by 3 and by 10; the first such total is 30.
3. Use $30(2/3) = 20$ orange sectors, with $20/30 = 2/3$.

Problem 6

1. A ticket cannot be both gold and silver, so add their 2 chances.
2. $P(G \text{ or } S) = 1/5 + 3/10 = 5/10 = 1/2$.
3. The blank chance is $1 - 1/2 = 1/2$.

Problem 7

1. The stated total is $0.18 + 0.27 + 0.65 = 1.10$.
2. The excess is $1.10 - 1 = 0.10$. Reduce C to $0.65 - 0.10 = 0.55$.
3. Check: $0.18 + 0.27 + 0.55 = 1$.

Problem 8

1. Three labels do not imply equal chances: the red and green shares are $5/8$ and $1/8$.
2. Blue has area share $1/4 = 2/8$, so use that as its probability.
3. The probabilities total $(5 + 2 + 1)/8 = 1$.

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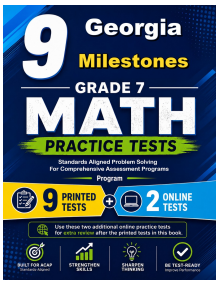

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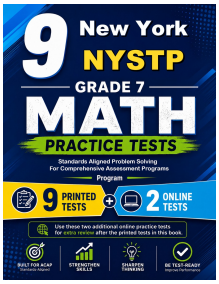

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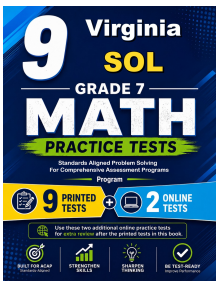

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