

Probability Rules, Conditioning and Fair Decisions

Grade 10 – Geometry math · Worksheet Answer Key · Standards: S-CP.A.1, S-CP.A.2, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7, S-CP.B.8, S-CP.B.9, S-MD.B.6, S-MD.B.7

Each solution names the rule, shows the substitution and states the result as a fraction or decimal. When a result differs, check whether you divided by the correct total, especially in conditional probability.

Standards: S-CP.A.1, S-CP.A.2, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7, S-CP.B.8, S-CP.B.9, S-MD.B.6, S-MD.B.7 · **Level:** Grade 10 Geometry

Problem 1 Coin and Die Sample Space

(a) H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6 (12 outcomes).

(b) Heads with 2, 4 or 6 gives 3 outcomes: $\frac{3}{12} = \frac{1}{4}$.

(b) 1/4

Problem 2 Complement of an Event

$P(\text{on time}) = 1 - P(\text{late}) = 1 - 0.18 = 0.82$.

0.82 (82%)

Problem 3 Union and Intersection from Counts

Band only = $22 - 8 = 14$. Robotics only = $17 - 8 = 9$. Union = $14 + 8 + 9 = 31$. Neither = $40 - 31 = 9$.

$P(\text{band or robotics}) = \frac{31}{40}$ and $P(\text{neither}) = \frac{9}{40}$.

31/40 and 9/40

Problem 4 Addition Rule

$P(A \cup B) = 0.45 + 0.30 - 0.12 = 0.63$.

0.63

Problem 5 Test for Independence

$$P(A) \cdot P(B) = 0.6 \cdot 0.25 = 0.15, \text{ which equals } P(A \cap B).$$

Yes, independent

Problem 6 Conditional Probability from a Table

(a) $75 \div 150 = 0.5$.

(b) Among 70 Grade 10 students, 29 buy lunch: $\frac{29}{70} \approx 0.414$.

(c) Among 75 who buy lunch, 29 are in Grade 10: $\frac{29}{75} \approx 0.387$.

(a) 0.5 (b) ≈ 0.414 (c) ≈ 0.387

Problem 7 Conditional Probability Formula

$$P(A | B) = \frac{0.18}{0.45} = 0.4.$$

0.4

Problem 8 Independence from Counts

$$P(\text{instrument}) = \frac{48}{120} = 0.4. \quad P(\text{sport}) = \frac{75}{120} = 0.625. \quad \text{Product} = 0.25.$$

$$P(\text{both}) = \frac{30}{120} = 0.25, \text{ equal to the product.}$$

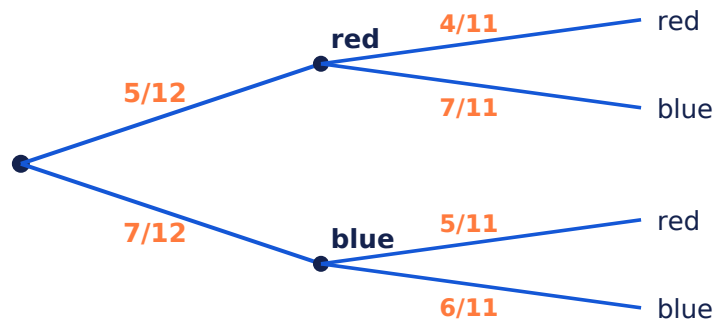
Yes, independent

Problem 9 Free Throws in a Row

$$0.72 \cdot 0.72 \cdot 0.72 = 0.72^3 = 0.373248.$$

≈ 0.373

Problem 10 Two Draws Without Replacement



Red-red path: $5/12 \cdot 4/11 = 5/33$.

$P(\text{red first}) = \frac{5}{12}$. Given a red first, $P(\text{red second}) = \frac{4}{11}$.

Product = $\frac{20}{132} = \frac{5}{33} \approx 0.152$.

$5/33 \approx 0.152$

Problem 11 Medals for Eight Runners

Order matters: $8 \cdot 7 \cdot 6 = 336$.

336 ways

Problem 12 Choosing a Committee

Order does not matter: ${}_{11}C_4 = \frac{(11 \cdot 10 \cdot 9 \cdot 8)}{(4 \cdot 3 \cdot 2 \cdot 1)} = 330$.

330 committees

Problem 13 All-Girl Officers

Favorable: ${}_6C_3 = 20$. Total: ${}_{10}C_3 = 120$.

Probability = $\frac{20}{120} = \frac{1}{6}$.

$1/6$

Problem 14 Defective Parts

(a) $0.7(0.03) + 0.3(0.06) = 0.021 + 0.018 = 0.039$.

(b) $P(B \mid \text{defective}) = \frac{0.018}{0.039} = \frac{6}{13} \approx 0.462$.

(a) 0.039 (b) $\frac{6}{13} \approx 0.462$

Problem 15 Medical Test Result

Positive and sick: $0.02 \cdot 0.95 = 0.019$. Positive and healthy: $0.98 \cdot 0.08 = 0.0784$.

$P(\text{positive}) = 0.0974$. $P(\text{sick} \mid \text{positive}) = \frac{0.019}{0.0974} \approx 0.1951$.

$\approx 19.5\%$ (most positives are false alarms because the disease is rare).

Problem 16 Drawing Lots for a Trip

(a) Each volunteer has the same chance: $\frac{3}{14} \approx 0.214$.

(b) ${}_{14}C_3 = \frac{(14 \cdot 13 \cdot 12)}{6} = 364$.

(c) Every group of 3 is equally likely, so every volunteer has the same chance.

(a) $\frac{3}{14}$ (b) 364 (c) equal chances for all

Problem 17 Is the Dice Game Fair?

Die 1	Die 2					
	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

8 of 36 cells.

Sum 7 has 6 outcomes and sum 11 has 2 outcomes out of 36: $P(A) = \frac{8}{36} = \frac{2}{9} \approx 0.222$.

Then $P(B) = \frac{7}{9}$. The chances are not equal.

Not fair; A scores with probability $\frac{2}{9}$

Problem 18 Three Doors Strategy

- (a) The first pick wins with probability $\frac{1}{3}$ and stays the same.
- (b) If the first pick was wrong (probability $\frac{2}{3}$), the host reveals the other empty door and the remaining door must hold the prize. Switching wins with probability $\frac{2}{3}$.

(a) 1/3 (b) 2/3, so switching is the better strategy

Problem 19 Raffle Tickets

Use the complement. $P(\text{none of his tickets win}) = \frac{{}^{115} \cdot {}^{114} \cdot {}^{113}}{(120 \cdot 119 \cdot 118)} \approx 0.8792$.

Alternatively, ${}_{115}C_3 \div {}_{120}C_3$. So $P(\text{at least one}) = 1 - 0.8792 \approx 0.121$.

≈ 0.121

Problem 20 Coffee and Pastry Orders

(a) $0.45 \cdot 0.40 = 0.18$.

(b) $0.45 + 0.30 - 0.18 = 0.57$.

(c) $\frac{0.18}{0.30} = 0.6$.

(d) $P(\text{coffee}) \cdot P(\text{pastry}) = 0.45 \cdot 0.30 = 0.135$, which is not 0.18. Not independent.

(a) 0.18 (b) 0.57 (c) 0.6 (d) not independent