

Probability Rules and Conditional Events

Grade 11 – Algebra 2 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

Every solution names the rule used and shows each fraction before simplifying. If a result differs, check whether the denominator was the total or the given group.

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 · **Level:** Grade 11 Algebra 2

Problem 1 Sample space for two stages

There are $2 \times 6 = 12$ equally likely outcomes. Heads with 2, 4 or 6 gives 3 outcomes. **12 outcomes; $P = 3/12 = 1/4$.**

Problem 2 Complement of an event

$P(\text{not on time}) = 1 - 0.88$. **0.12.**

Problem 3 Events as subsets

$A = \{3, 6, 9, 12\}$ and $B = \{2, 4, 6, 8, 10, 12\}$. $A \cap B = \{6, 12\}$. The union has $4 + 6 - 2 = 8$ outcomes. **$A \cap B = \{6, 12\}$; $P(A \cup B) = 8/12 = 2/3$.**

Problem 4 Addition rule

$0.62 + 0.41 - 0.27 = 0.76$. **0.76.**

Problem 5 Mutually exclusive events

The events cannot overlap, so add: $0.2 + 0.5 = 0.7$. Then $P(\text{neither}) = 1 - 0.7 = 0.3$. **0.7 and 0.3.**

Problem 6 Check independence

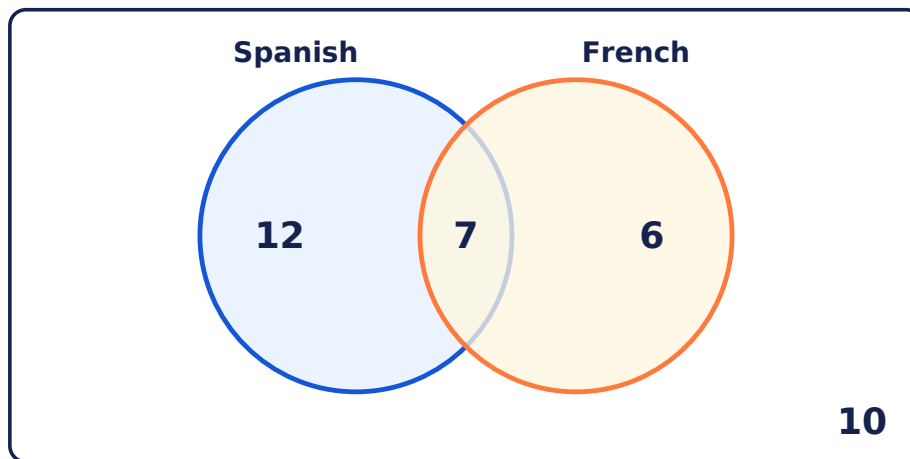
Multiply: $0.35 \times 0.20 = 0.07$, which equals the probability of both. **Yes, they are independent.**

Problem 7 Two free throws

Both: $0.7 \times 0.7 = 0.49$. Exactly one: $0.7 \times 0.3 + 0.3 \times 0.7 = 0.42$. **0.49 and 0.42.**

Problem 8 Venn diagram of language classes

Spanish only = $19 - 7 = 12$ and French only = $13 - 7 = 6$, so 25 students take a language and $35 - 25 = 10$ take neither. $P(\text{French} \mid \text{Spanish}) = 7/19$. **10 neither; 7/19.**



Completed diagram: 10 students take neither.

Problem 9 Two-way table probabilities

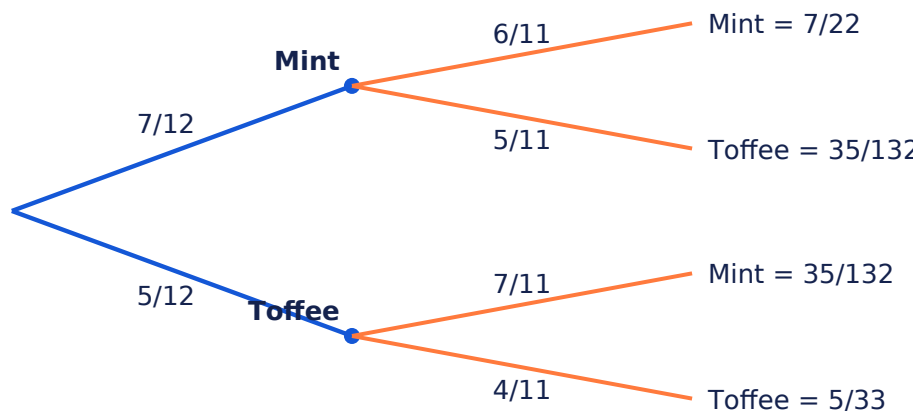
$P(\text{iPhone}) = 64/120 = 8/15$. Among the 64 iPhone users, 26 are juniors, so $26/64 = 13/32$. Among 60 seniors, 38 have an iPhone, so $38/60 = 19/30$. **8/15, 13/32, 19/30.**

Problem 10 Conditional probability formula

$P(\text{helmet} | \text{skateboard}) = 0.14 \div 0.35 = 0.4$. **0.4.**

Problem 11 Draws without replacement

Multiply along the mint-mint path: $7/12 \times 6/11 = 42/132 = 7/22$. **7/22.**



Mint then mint gives $7/12 \times 6/11 = 7/22$.

Problem 12 Test for independence in a table

$P(\text{Android}) = 56/120 \approx 0.467$. $P(\text{Android} | \text{Junior}) = 34/60 \approx 0.567$. The values differ, so **the events are not independent.**

Problem 13 Conditional from percentages

$$P(\text{bicycle} \mid \text{pet}) = 0.25 \div 0.60 = 5/12. \mathbf{5/12 \approx 0.417.}$$

Problem 14 Addition rule with a table

$P(\text{Junior}) = 60/120$, $P(\text{Android}) = 56/120$ and $P(\text{both}) = 34/120$. The sum is $(60 + 56 - 34)/120 = 82/120$. **41/60.**

Problem 15 Union with cards

Face cards: 12. Spades: 13. Face spades: 3. Union: $12 + 13 - 3 = 22$. **22/52 = 11/26.**

Problem 16 Two alarms

The complement is that neither rings: $0.08 \times 0.08 = 0.0064$. So $P(\text{at least one}) = 1 - 0.0064$. **0.9936.**

Problem 17 Defective parts from three factories

$P(\text{defective}) = 0.40(0.01) + 0.35(0.04) + 0.25(0.02) = 0.004 + 0.014 + 0.005 = 0.023$. $P(B \mid \text{defective}) = 0.014/0.023 \approx 0.6087$. **0.023 and ≈ 0.609 .**

Problem 18 Two dice, conditional

Sum 8: (2,6), (3,5), (4,4), (5,3), (6,2), so 5 outcomes. Those with a 6: (2,6) and (6,2). **2/5.**

Problem 19 Allergy screening

$P(\text{allergy and reaction}) = 0.03 \times 0.90 = 0.027$. $P(\text{reaction}) = 0.027 + 0.97 \times 0.05 = 0.027 + 0.0485 = 0.0755$. $P(\text{allergy} \mid \text{reaction}) = 0.027/0.0755 = 0.3576$. $\approx$ **0.36**. Most reactions are false alarms because the allergy is rare.

Problem 20 Independence of a complement

$P(A \cap B') = P(A) - P(A \cap B) = P(A) - P(A)P(B) = P(A)(1 - P(B)) = P(A) \cdot P(B')$. **Therefore A and B' are independent.**