

Geometry · Probability: Independence, Conditional Probability and Fair Decisions · Worksheet

Common Core 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 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 24 problems practice the probability standards S-CP.A.1 to S-CP.B.9 and S-MD.B.6 and S-MD.B.7: sample spaces, unions and complements, independence, conditional probability and two-way tables, and the addition and multiplication rules.

The last problems use counting, fair random choices and decisions such as medical tests and game strategy. Show each probability as a fraction or decimal.

GeometryCommon Core: 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

Problem 1: Sample space of a coin and a die

A coin is flipped and a standard die is rolled. (a) How many outcomes are in the sample space? (b) List the outcomes in the event “heads and an even number.” (c) Find the probability of that event.

Problem 2: Complement of an event

A bag holds 6 red, 5 blue and 9 green marbles. Let R be the event that a randomly drawn marble is red. Describe the complement of R in words, then find $P(R)$ and the probability of the complement.

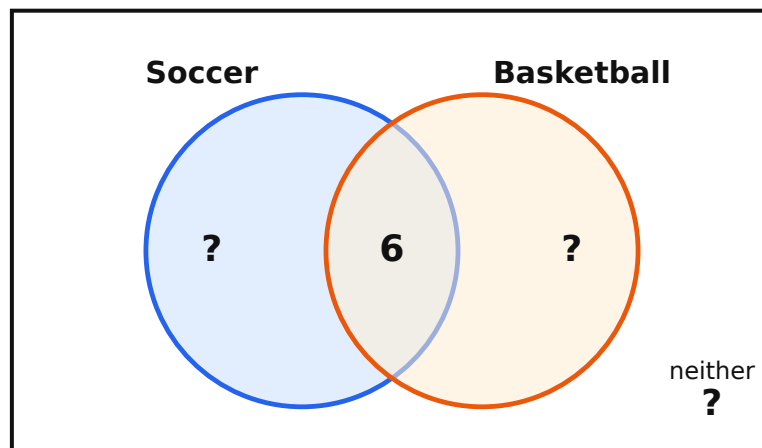
Problem 3: Union and intersection of events

An integer from 1 to 20 is chosen at random. Event A is “a multiple of 3” and event B is “even.” (a) List the outcomes in A and the outcomes in both A and B . (b) How many outcomes are in A or B ? (c) Find $P(A \text{ or } B)$.

Problem 4: Filling in a Venn diagram

Of 40 students, 18 play soccer, 14 play basketball and 6 play both. (a) Find the number of

students in each region of the diagram. (b) Find the probability that a randomly chosen student plays neither sport.



Find the three missing counts.

Problem 5: Addition rule with decimals

Events A and B satisfy $P(A)=0.45$, $P(B)=0.30$ and $P(A \text{ and } B)=0.12$. Find $P(A \text{ or } B)$ and the probability that neither event occurs.

Problem 6: Addition rule with cards

One card is drawn from a standard 52-card deck. Find the probability that it is a heart or a king.

Problem 7: Testing independence with numbers

Decide whether each pair of events is independent. (a)

$P(A)=0.4$, $P(B)=0.5$, $P(A \text{ and } B)=0.2$. (b) $P(C)=0.6$, $P(D)=0.3$, $P(C \text{ and } D)=0.15$.

Problem 8: Independent free throws

Liam makes each free throw with probability 0.7, and the shots are independent. Find the probability that he (a) makes both of two shots, (b) misses both, (c) makes exactly one.

Problem 9: Conditional probability formula

For events A and B, $P(A \text{ and } B)=0.18$ and $P(B)=0.45$. (a) Find $P(A|B)$. (b) If $P(A)=0.4$, are A and B independent? Explain.

Problem 10: Reading a two-way table

A school survey asked 150 students for their favorite lunch. Find (a) $P(\text{girl and pizza})$, (b) $P(\text{pizza given girl})$, (c) $P(\text{girl given pizza})$.

Gender \ Lunch	Pizza	Tacos	Total
Boys	34	26	60
Girls	38	52	90
Total	72	78	150

Favorite lunch by gender.

Problem 11: Independence in a table

A school has 200 upperclassmen. Of 80 seniors, 20 walk and 60 drive; of 120 juniors, 30 walk and 90 drive. Is the way a student gets to school independent of class year? Justify with probabilities.

Problem 12: Comparing conditional probabilities

Use the lunch survey from the reading-a-table exercise. Compare $P(\text{pizza})$, $P(\text{pizza given boy})$ and $P(\text{pizza given girl})$. Are gender and lunch choice independent?

Problem 13: Two aces without replacement

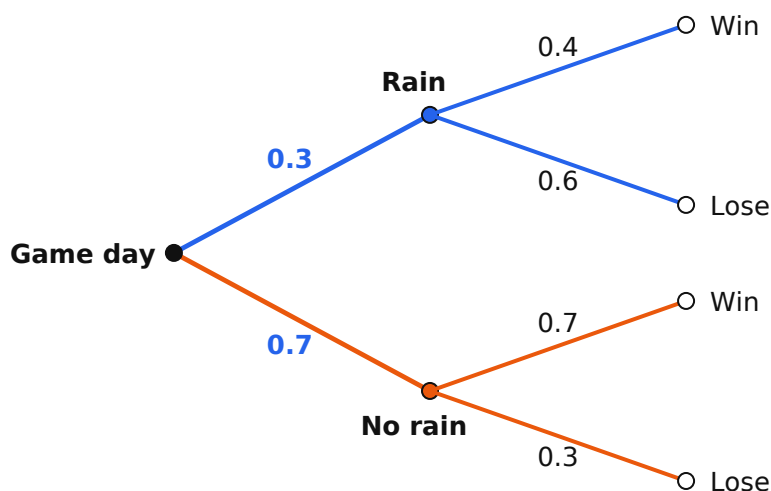
Two cards are dealt from a standard deck without replacement. Find the probability that both are aces.

Problem 14: Marbles without replacement

A bag has 5 red and 3 blue marbles. Two are drawn without replacement. Find the probability of (a) red then blue, (b) one marble of each color in either order.

Problem 15: Tree diagram for a game

The chance of rain on game day is 0.3. Ethan's team wins with probability 0.4 in the rain and 0.7 in dry weather. (a) Find $P(\text{win})$. (b) If the team won, find the probability that it rained.



Probability tree for weather and result.

Problem 16: Awarding medals (permutations)

Eight runners finish a race with no ties. (a) In how many ways can gold, silver and bronze medals be awarded? (b) If all orders are equally likely, find the probability that Priya, Diego and Aisha win gold, silver and bronze in that order.

Problem 17: Choosing a committee (combinations)

A committee of 3 is chosen at random from 10 students. (a) How many different committees are possible? (b) Find the probability that Maya and Jamal are both on it.

Problem 18: Probability with combinations

A club has 7 girls and 5 boys. Four members are chosen at random for a team. Find the probability that (a) all four are girls, (b) exactly two are girls.

Problem 19: Lottery odds

A school raffle asks each player to pick 5 different numbers from 1 to 30; order does not matter. How many different tickets are possible, and what is the probability that one ticket wins the grand prize?

Problem 20: Is the die rule fair?

Maya, Jamal and Sofia use a die to choose who sets up chairs. Rule X gives Maya 1 and 2, Jamal 3 and 4, Sofia 5 and 6. Rule Y, shown below, gives Maya 1, Jamal 2 and 3, Sofia 4, 5 and 6. Which rule is fair? Support the answer with probabilities.

1	2	3	4	5	6
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Maya Jamal Jamal Sofia Sofia Sofia

Die result (top) and who is chosen (bottom)

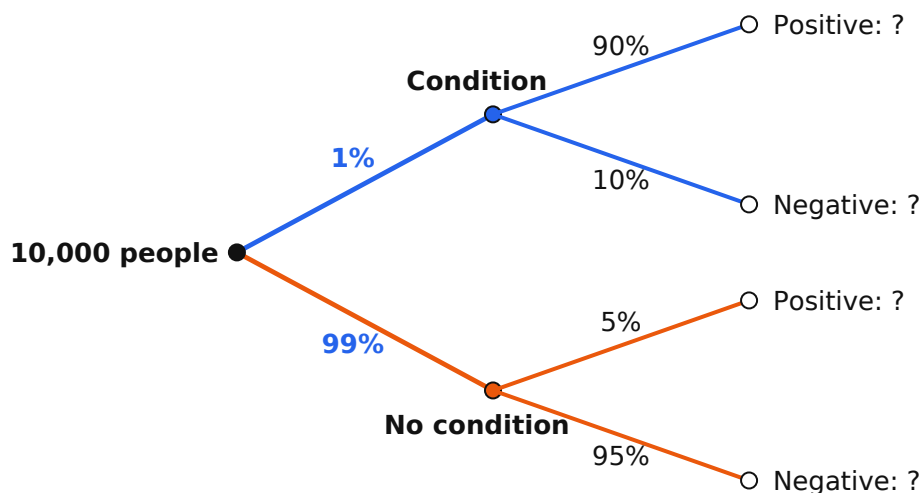
Rule Y.

Problem 21: A fair dice game

Diego and Aisha roll two dice. Diego wins if the sum is 8 or more, Aisha wins if the sum is 6 or less, and they roll again if the sum is 7. Is the game fair?

Problem 22: Analyzing a medical test

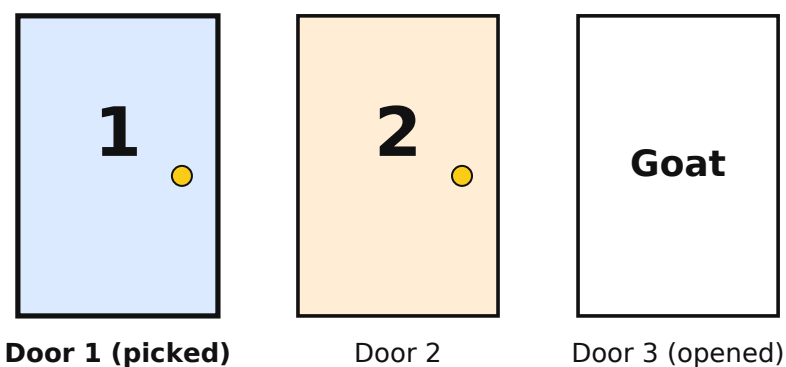
A condition affects 1% of a population. A test detects it in 90% of people who have it, and gives a false positive for 5% of people who do not. For 10,000 people, find the number of true positives and false positives, then the probability that a person with a positive test has the condition.



Fill in the four counts.

Problem 23: Game strategy: stay or switch

A game show hides a car behind one of three doors and goats behind the other two, placed at random. A contestant picks Door 1. The host, who knows where the car is, opens Door 3 to reveal a goat and offers a chance to switch to Door 2. Find the probability of winning by staying and by switching.



The contestant picked Door 1; Door 3 is open.

Problem 24: Language electives

Of 240 juniors, 150 take Spanish, 90 take French and 40 take both. Find (a) the probability that a junior takes neither language, (b) $P(\text{French given Spanish})$, (c) whether taking French is independent of taking Spanish.