

Probability Rules, Conditioning and Fair Decisions

Grade 10 – Geometry math · Worksheet · 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

Name: _____ Date: _____ Class: _____

These problems cover sample spaces, unions and complements, independence, conditional probability, counting and fair decisions (S-CP.A.1 to B.9 and S-MD.B.6 and B.7). Early problems use one rule; later ones combine tables, trees and counting. Machines, medical tests and games provide the contexts.

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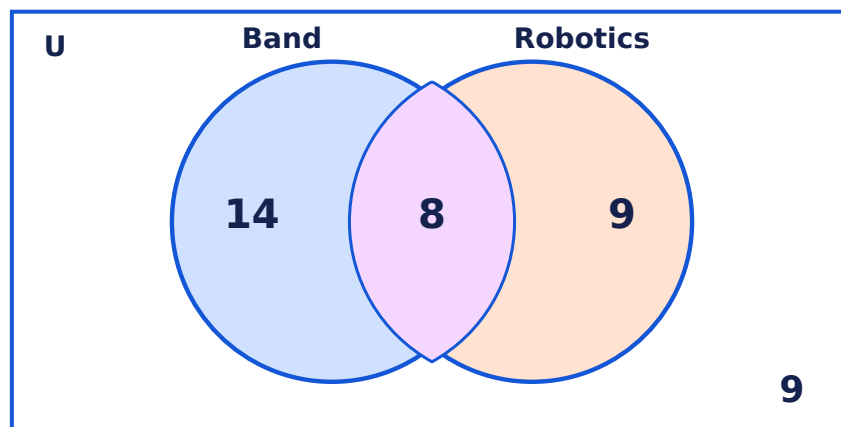
Problem 1 Coin and Die Sample Space (easy)

A coin is flipped and a six-sided die is rolled. (a) List the sample space. (b) Find $P(\text{heads and an even number})$.

Problem 2 Complement of an Event (easy)

The school bus is late on 18% of mornings. Find the probability that it is on time on a randomly chosen morning, and write the complement rule you used.

Problem 3 Union and Intersection from Counts (medium)



40 students; 8 are in both clubs.

Of 40 students, 22 are in band, 17 are in robotics, and 8 are in both. Find $P(\text{band or robotics})$ and $P(\text{neither club})$.

Problem 4 Addition Rule (medium)

For two events, $P(A) = 0.45$, $P(B) = 0.30$ and $P(A \cap B) = 0.12$. Find $P(A \cup B)$.

Problem 5 Test for Independence (medium)

Events A and B have $P(A) = 0.6$, $P(B) = 0.25$ and $P(A \cap B) = 0.15$. Are they independent?

Problem 6 Conditional Probability from a Table (medium)

	Grade 9	Grade 10	Total
Brings lunch	34	41	75
Buys lunch	46	29	75
Total	80	70	150

One student is chosen at random from the table. Find (a) $P(\text{buys lunch})$, (b) $P(\text{buys lunch} \mid \text{Grade 10})$, (c) $P(\text{Grade 10} \mid \text{buys lunch})$. Round to the nearest thousandth where needed.

Problem 7 Conditional Probability Formula (medium)

Given $P(A \cap B) = 0.18$ and $P(B) = 0.45$, find $P(A \mid B)$.

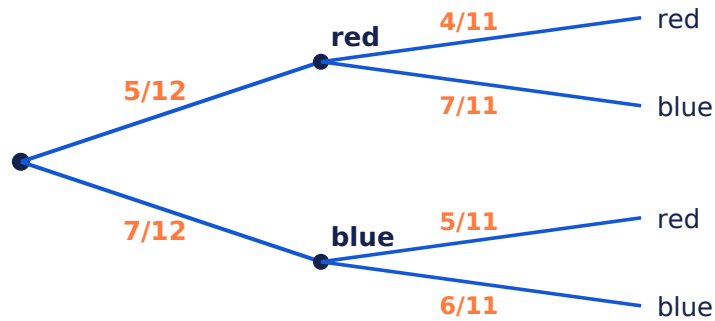
Problem 8 Independence from Counts (hard)

Of 120 students, 48 play an instrument, 75 play a sport, and 30 do both. Are playing an instrument and playing a sport independent? Justify with numbers.

Problem 9 Free Throws in a Row (medium)

A basketball player makes 72% of her free throws, and each shot is independent. What is the probability that she makes three in a row, to the nearest thousandth?

Problem 10 Two Draws Without Replacement (hard)



Probabilities change after the first draw.

A bag holds 5 red marbles and 7 blue marbles. Two marbles are drawn without replacement. Find the probability that both are red.

Problem 11 Medals for Eight Runners (medium)

Eight runners reach a final. In how many ways can gold, silver and bronze be given out?

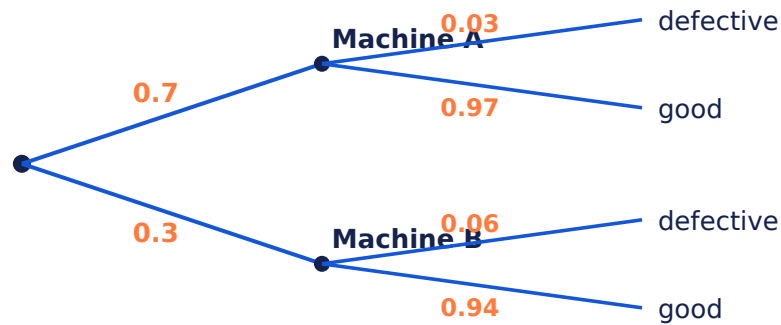
Problem 12 Choosing a Committee (medium)

A club with 11 members elects a committee of 4. How many different committees are possible?

Problem 13 All-Girl Officers (hard)

Three officers are chosen at random from a group of 6 girls and 4 boys. Find the probability that all three are girls.

Problem 14 Defective Parts (hard)



A factory with two machines.

Machine A makes 70% of a factory's parts and 3% of them are defective. Machine B makes 30% and 6% are defective. (a) Find $P(\text{a random part is defective})$. (b) Given a defective part, find the probability that it came from machine B.

Problem 15 Medical Test Result (hard)

A disease affects 2% of a population. A screening test is positive for 95% of people who have the disease and for 8% of people who do not. A person tests positive. Find the probability that the person actually has the disease, to the nearest tenth of a percent.

Problem 16 Drawing Lots for a Trip (medium)

Fourteen volunteers want to attend a robotics event and 3 may go. Names are drawn at random. (a) What is the probability that a particular volunteer is chosen? (b) How many different groups of 3 are possible? (c) Explain why drawing names is a fair method.

Problem 17 Is the Dice Game Fair? (hard)

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

Sums of 7 or 11 are highlighted.

Two players roll two dice. Player A scores when the sum is 7 or 11. Player B scores on any other sum. Is the game fair? If not, find the probability that A scores.

Problem 18 Three Doors Strategy (hard)

A prize is hidden behind one of three doors. A contestant picks door 1. The host, who knows where the prize is, opens another door that has no prize and offers a switch. Find the probability of winning (a) by staying and (b) by switching.

Problem 19 Raffle Tickets (hard)

A raffle has 120 tickets and 3 different prizes are drawn without replacement. Marcus holds 5 tickets. Find the probability that he wins at least one prize, to the nearest thousandth.

Problem 20 Coffee and Pastry Orders (hard)

At a cafe, 45% of customers buy coffee and 30% buy a pastry. Of the coffee buyers, 40% also buy a pastry. Find (a) $P(\text{coffee and pastry})$, (b) $P(\text{coffee or pastry})$, (c) $P(\text{coffee} \mid \text{pastry})$, and (d) decide whether the two purchases are independent.