

Probability Rules and Random Variables

Grade 12 – AP Statistics math · Worksheet · Standards: AP Statistics Unit 2 (2026-27)

Name: _____ Date: _____ Class: _____

These twenty problems train the probability skills of AP Statistics Unit 2: two-way tables, conditional probability, independence, the addition and multiplication rules, simulation, and the mean and standard deviation of discrete random variables. Contexts range from school surveys to carnival games.

Standards: AP Statistics Unit 2 (2026-27) · **Level:** Grade 12 AP Statistics

Problem 1 Complement Rule (easy)

The probability that a package from a warehouse arrives late is 0.08. (a) Find the probability that a package arrives on time. (b) Two packages are sent independently. Find the probability that at least one is late.

Problem 2 Marginal Relative Frequencies (easy)

A school surveyed 250 students about membership in a sports club.

Club member	Grade 9	Grade 10	Grade 11	Total
Yes	28	35	42	105
No	62	45	38	145
Total	90	80	80	250

Find the marginal relative frequency of (a) club members, (b) 11th graders, (c) 9th graders.

Problem 3 Joint and Conditional Frequencies (medium)

Use the sports club table below.

Club member	Grade 9	Grade 10	Grade 11	Total
Yes	28	35	42	105
No	62	45	38	145
Total	90	80	80	250

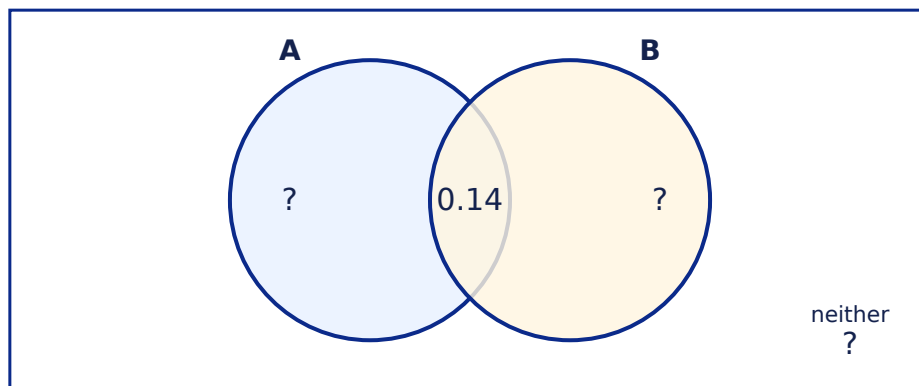
Find (a) $P(\text{club member and Grade 10})$, (b) $P(\text{club member} \mid \text{Grade 11})$, (c) $P(\text{Grade 11} \mid \text{club member})$.

Problem 4 Exclusive Events (easy)

At a lunch counter, 35% of customers order pizza and 25% order a sandwich, and no customer orders both. Find the probability that a customer orders pizza or a sandwich. Are the events independent?

Problem 5 Addition Rule with Overlap (medium)

For events A and B , $P(A) = 0.52$, $P(B) = 0.31$ and $P(A \text{ and } B) = 0.14$.



$$P(A) = 0.52 \text{ and } P(B) = 0.31.$$

Find $P(A \text{ or } B)$ and the probability of neither event.

Problem 6 Conditional Probability from Counts (medium)

Of 300 adults surveyed, 120 own an electric bike, 75 own a regular bike but no electric bike, and the rest own no bike. Among the electric bike owners, 90 also own a car. Find the probability that a randomly chosen electric bike owner owns a car, and the probability that a randomly chosen adult is an electric bike owner who owns a car.

Problem 7 Testing Independence with a Table (medium)

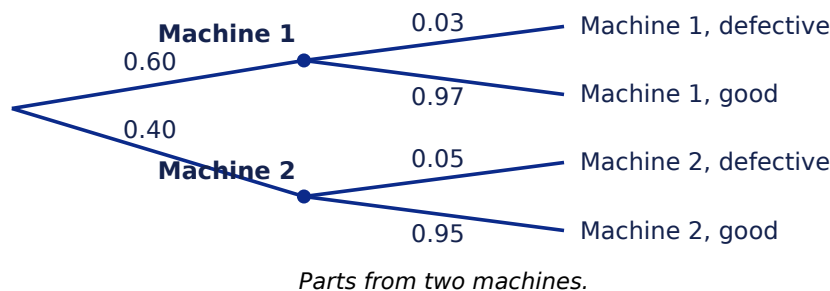
Among 200 students, 40 are left-handed and 160 are right-handed. Of the left-handed students, 12 wear glasses; of the right-handed students, 48 wear glasses. Are wearing glasses and handedness independent? Justify with probabilities.

Problem 8 Multiplication Rule for Free Throws (medium)

Mia makes 72% of her free throws, and shots are independent. Find the probability that (a) she makes her next three shots, (b) she misses the first and makes the next two.

Problem 9 Tree Diagram for Defects (medium)

Machine 1 makes 60% of a factory's parts, with 3% defective. Machine 2 makes the other 40%, with 5% defective.



Find the probability that a randomly chosen part is defective.

Problem 10 Reverse Conditional Probability (hard)

A part from the factory in the previous problem is found to be defective. What is the probability that it came from Machine 1?

Problem 11 Designing a Simulation (medium)

A quiz has 4 multiple-choice questions, each with 5 options, and a student guesses every answer. Describe how to use random digits to simulate one quiz, then use these 8 simulated quizzes (each group of 4 digits is one quiz) to estimate the probability of getting at least 2 right: 4533 3147 8932 8804 0723 8625 5118 4873.

Problem 12 Using Simulation Results (medium)

A player's set of five free throws was simulated 200 times. The graph shows the number of shots made in each trial.



Results of 200 simulated sets of five free throws.

Estimate the probability that the player makes at least 4 shots, and the probability that the player makes at most 2.

Problem 13 Finding a Missing Probability (easy)

Let X be the number of pets in a household: $P(0) = 0.18$, $P(1) = 0.34$, $P(2) = 0.27$, $P(3) = k$, $P(4) = 0.06$. Find k and $P(X \geq 2)$.

Problem 14 Mean of a Random Variable (medium)

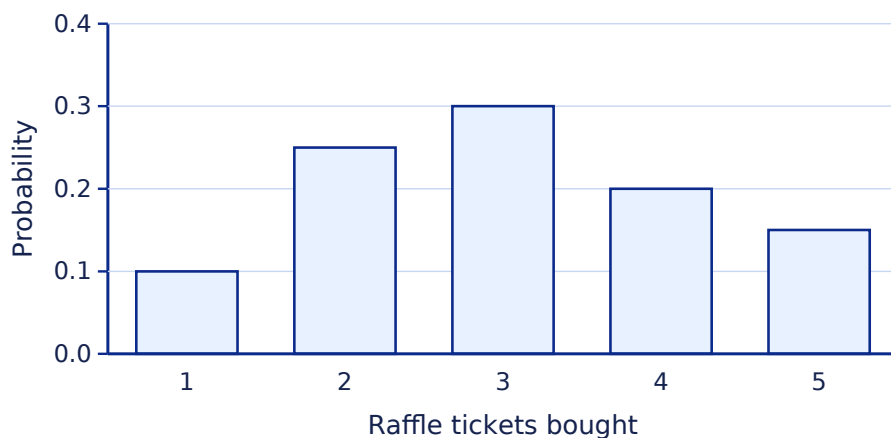
Use the distribution of pets per household from the previous problem. Calculate the mean number of pets and interpret it.

Problem 15 Standard Deviation of a Random Variable (hard)

Calculate the standard deviation of the number of pets per household for the same distribution and interpret it.

Problem 16 Probability Histogram (medium)

The graph shows the probability distribution of the number of raffle tickets bought by a visitor.



Tickets bought by a visitor.

Find $P(X \geq 4)$ and the mean number of tickets.

Problem 17 Expected Value of a Game (hard)

At a ring-toss booth, a player pays \$3 to play. The prize is \$0 with probability 0.7, \$4 with probability 0.2 and \$10 with probability 0.1. Find the expected net gain per play and interpret it.

Problem 18 Sampling without Replacement (hard)

A club has 250 members, 105 of whom are seniors. Two members are chosen at random without replacement for a committee. Find the probability that (a) both are seniors, (b) exactly one is a senior.

Problem 19 At Least One Success (hard)

Each customer entering a shop independently buys something with probability 0.15. Find the probability that among 5 customers (a) at least one buys, (b) the first buyer is the third customer.

Problem 20 Warranty Cost Distribution (hard)

A store sells a \$40 extended warranty on a tablet. The repair cost X is \$0 with probability 0.85, \$120 with probability 0.09, \$300 with probability 0.05 and \$600 with probability 0.01. Find the mean and standard deviation of the repair cost, and the store's expected profit per warranty.