

Probability Rules and Random Variables

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

Name: _____ Date: _____ Class: _____

This 45-minute test has nine AP-style questions worth 20 points. Show all probability statements and calculations, define events before using them, and interpret results in context.

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

Time: 45 minutes · 9 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Two-Way Table (2 points)

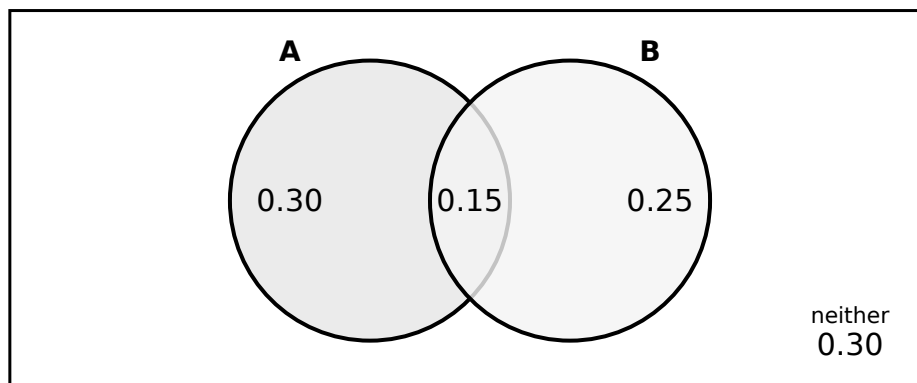
A district surveyed 180 students about lunch.

	Hot lunch	Cold lunch	Total
Middle school	48	32	80
High school	36	64	100
Total	84	96	180

- Find $P(\text{high school and hot lunch})$ and $P(\text{cold lunch})$. (1 point)
- Find $P(\text{hot lunch} \mid \text{middle school})$. Are lunch choice and school level independent? Justify. (1 point)

Question 2 Venn Diagram Probabilities (2 points)

The Venn diagram shows probabilities for events A and B .



Probabilities for events A and B .

- Find $P(A \text{ or } B)$. (1 point)

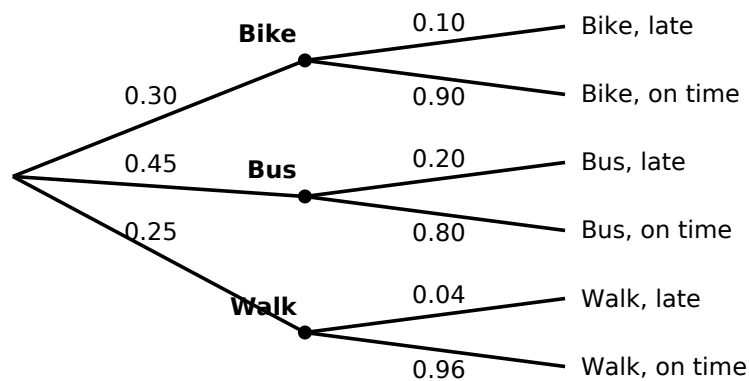
b. Find $P(A | B)$. (1 point)

Question 3 Independent Events (2 points)

For events A and B , $P(A) = 0.6$, $P(B) = 0.5$ and $P(A \text{ or } B) = 0.8$. Are A and B independent? Justify.

Question 4 Tree Diagram (3 points)

A student commutes by bike, bus or on foot with the probabilities shown.



Commute method and lateness.

- Find the probability that the student is late. (1 point)
- Given that the student is late, find the probability that the student took the bus. (1 point)
- Are lateness and commute method independent? Explain. (1 point)

Question 5 Simulation Design (2 points)

A basketball player makes 60% of her free throws. Describe a simulation using random digits to estimate the probability that she makes at least 3 of her next 4 shots, and state how the estimate is computed.

Question 6 Discrete Random Variable (3 points)

Let X be the number of siblings of a randomly chosen student: $P(0) = 0.30$, $P(1) = k$, $P(2) = 0.20$, $P(3) = 0.10$.

- Find k . (1 point)
- Find the mean of X . (1 point)
- Find the standard deviation of X . (1 point)

Question 7 Expected Value (2 points)

A game costs \$2 to play. A fair die is rolled: a 6 wins \$6, a 4 or 5 wins \$2, and any other roll wins nothing. Find the expected net gain and interpret it.

Question 8 Without Replacement (2 points)

A bag holds 5 red chips and 7 blue chips. Two chips are drawn at random without replacement. Find the probability that (a) both are red, (b) the two chips have different colors.

Question 9 At Least One (2 points)

Three traffic lights on a route operate independently, and each is green when a driver arrives with probability 0.4. Find the probability that the driver meets at least one green light.