

Probability Rules and Random Variables

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

The scoring guide shows the points for each part. Correct probability notation, a correct setup and an interpretation in context are all required for full credit.

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

Question 1 Two-Way Table (2 points)

(a) $36/180 = 0.20$; $96/180 = 0.533$. (b) $48/80 = 0.60$. Overall $P(\text{hot}) = 84/180 = 0.467$, which is different from 0.60, so the variables are not independent.

(a) 0.20 and 0.533; (b) 0.60, not independent

Scoring: 1 point each part; part (b) requires comparing conditional and marginal probabilities.

Question 2 Venn Diagram Probabilities (2 points)

(a) $0.30 + 0.15 + 0.25 = 0.70$. (b) $P(B) = 0.15 + 0.25 = 0.40$, so $P(A | B) = 0.15/0.40 = 0.375$.

(a) 0.70; (b) 0.375

Scoring: 1 point each part.

Question 3 Independent Events (2 points)

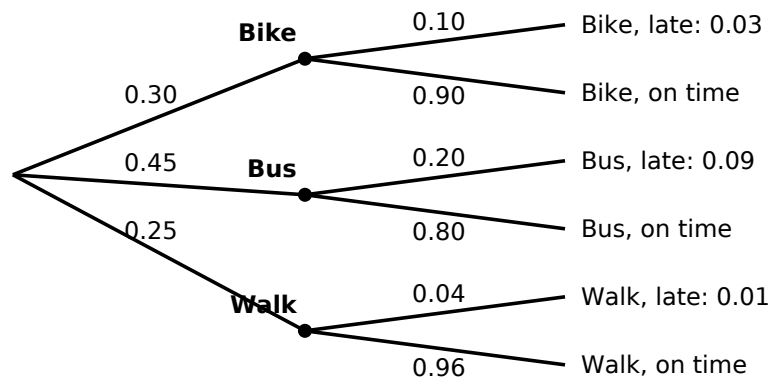
$P(A \text{ and } B) = 0.6 + 0.5 - 0.8 = 0.3$. Also $P(A)P(B) = 0.6 \times 0.5 = 0.3$. The values are equal.

Yes, independent

Scoring: 1 point for finding $P(A \text{ and } B)$, 1 point for the comparison.

Question 4 Tree Diagram (3 points)

(a) $0.30(0.10) + 0.45(0.20) + 0.25(0.04) = 0.03 + 0.09 + 0.01 = 0.13$. (b) $P(\text{bus} | \text{late}) = 0.09/0.13 = 0.692$. (c) $P(\text{late} | \text{bus}) = 0.20$ is not equal to $P(\text{late}) = 0.13$, so they are not independent.



(a) 0.13; (b) 0.692; (c) not independent

Scoring: 1 point each part.

Question 5 Simulation Design (2 points)

Let digits 0 through 5 represent a made shot and 6 through 9 a miss, so $P(\text{make}) = 6/10$. Read 4 digits for one trial and count the made shots. Repeat for many trials (for example 100). The estimate is the number of trials with at least 3 made shots divided by the total number of trials.

Digits 0-5 = make; estimate = (trials with at least 3 makes)/(number of trials)

Scoring: 1 point for correct digit assignment, 1 point for the trial and estimate.

Question 6 Discrete Random Variable (3 points)

(a) $k = 1 - 0.60 = 0.40$. (b) $\mu = 0(0.30) + 1(0.40) + 2(0.20) + 3(0.10) = 1.1$. (c) Variance = $(0 - 1.1)^2(0.30) + (1 - 1.1)^2(0.40) + (2 - 1.1)^2(0.20) + (3 - 1.1)^2(0.10) = 0.89$, so $\sigma \approx 0.943$.

$k = 0.40$; $\mu = 1.1$; $\sigma \approx 0.94$

Scoring: 1 point each part.

Question 7 Expected Value (2 points)

Net gains: 6 gives $6 - 2 = 4$ with probability $1/6$; 4 or 5 gives 0 with probability $1/3$; other rolls give -2 with probability $1/2$. Mean = $4(1/6) + 0(1/3) - 2(1/2) = 2/3 - 1 = -1/3 \approx -0.33$. In the long run, a player loses about 33 cents per play.

Expected net gain $\approx$ $-\$0.33$ per play

Scoring: 1 point for the calculation, 1 point for the interpretation.

Question 8 Without Replacement (2 points)

(a) $(5/12)(4/11) = 20/132 = 0.1515$. (b) $2 \times (5/12)(7/11) = 70/132 = 0.5303$.

(a) 0.152; (b) 0.530

Scoring: 1 point each part.

Question 9 At Least One (2 points)

$P(\text{no green}) = 0.6 \times 0.6 \times 0.6 = 0.216$. $P(\text{at least one green}) = 1 - 0.216 = 0.784$.

0.784

Scoring: 1 point for complement setup, 1 point for the answer.