

Sampling Distributions of Proportions and Means

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

The scoring guide shows the points for each part. Credit requires named conditions, correct parameters of the sampling distribution, and a probability or conclusion in context.

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

Question 1 Parameter and Statistic (2 points)

(a) The parameter is the mean commute time of all 1,400 students, μ . The statistic is the sample mean, $\bar{x} = 24.5$ minutes. (b) No. Different samples contain different students, so $\bar{x}$ varies from sample to sample (sampling variability).

(a) μ and $\bar{x}$; (b) no, because of sampling variability

Scoring: 1 point each part.

Question 2 Sampling Distribution of $\hat{p}$ (3 points)

(a) $180(0.52) = 93.6$ and $180(0.48) = 86.4$ are at least 10, and 180 is under 10% of all voters. (b) Mean = 0.52, $\sigma = \sqrt{(0.52 \times 0.48/180)} = 0.0372$. (c) $z = (0.47 - 0.52)/0.0372 = -1.34$, probability 0.0897.

(a) conditions met; (b) 0.52 and 0.0372; (c) 0.0897

Scoring: 1 point each part.

Question 3 Sample Size and Spread (2 points)

(a) Size 100: a larger sample makes the statistic vary less. (b) $n = 25$: $\sqrt{(0.5 \times 0.5/25)} = 0.10$; $n = 100$: $\sqrt{(0.5 \times 0.5/100)} = 0.05$.

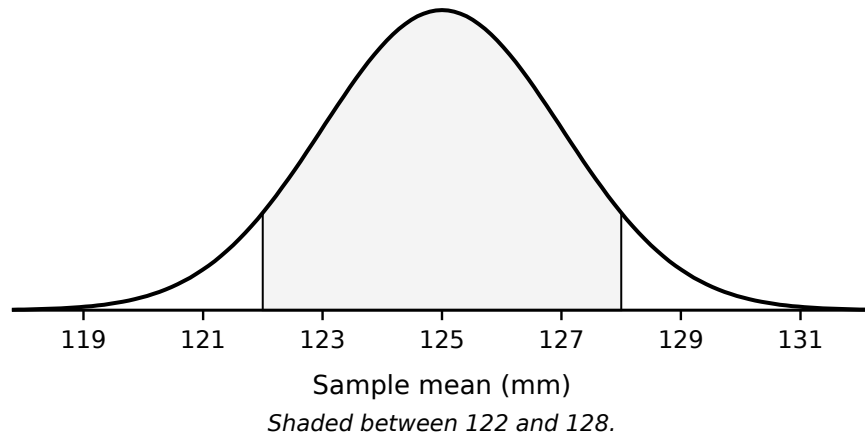
(a) $n = 100$; (b) 0.10 and 0.05

Scoring: 1 point each part.

Question 4 Sample Mean from a Normal Population (3 points)

(a) Mean 125, $\sigma = 6/\sqrt{9} = 2$. (b) The population is normal, so $\bar{x}$ is normal for every sample size.

(c) $z = \pm(3/2) = \pm 1.50$, probability 0.8664.



(a) 125 and 2; (c) 0.8664

Scoring: 1 point each part.

Question 5 Central Limit Theorem Shape (2 points)

(a) With $n = 4$ the sampling distribution is still skewed right, similar to the population, since 4 is too small for the Central Limit Theorem. (b) With $n = 50$, the Central Limit Theorem applies and the distribution is approximately normal.

(a) skewed right; (b) approximately normal

Scoring: 1 point each part with an explanation.

Question 6 Difference of Proportions (3 points)

(a) Mean = 0.10. $\sigma = \sqrt{(0.6 \times 0.4/100 + 0.5 \times 0.5/120)} = \sqrt{(0.0024 + 0.002083)} = 0.0670$. (b) $z = (0 - 0.10)/0.0670 = -1.49$. Probability = 0.0677.

(a) 0.10 and 0.0670; (b) 0.0677

Scoring: 1 point for the mean, 1 point for the standard deviation, 1 point for the probability.

Question 7 Difference of Means (2 points)

Mean = $30 - 27 = 3$. $\sigma = \sqrt{(5^2/25 + 4^2/36)} = \sqrt{(1 + 0.4444)} = 1.2019$.

mean 3, standard deviation ≈ 1.202

Scoring: 1 point each value.

Question 8 Bias and Variability (3 points)

(a) Method A is centered near 0.40 (mean 0.40), so it has little bias, but its estimates range from 0.22 to 0.58: high variability. (b) Method B is centered near 0.48 (mean 0.48), so it is biased high, but its estimates stay between 0.44 and 0.54: low variability. (c) Method A, because its errors average out and larger samples would shrink its spread, while bias cannot be fixed by a larger sample.

A: unbiased but variable; B: biased but consistent; choose A

Scoring: 1 point each part.