

# AP Statistics - Sampling Distributions and the Central Limit Theorem - Quiz

Common Core AP STAT 5.1, AP STAT 5.2, AP STAT 5.3, AP STAT 5.4, AP STAT 5.5, AP STAT 5.6, AP STAT 5.7, HSS-IC.A.1, HSS-IC.A.2 · [maths-pdf.fr/en/](https://maths-pdf.fr/en/)

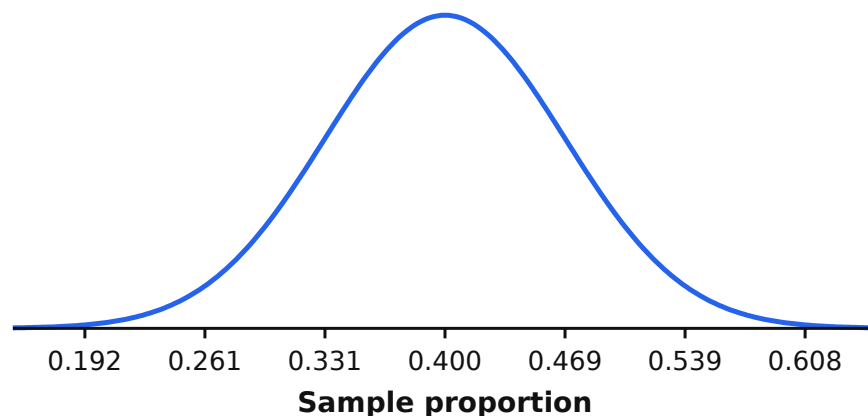
Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Ten multiple-choice questions test the center, spread, and shape of sampling distributions. Read each explanation, since the formulas look similar but the denominators differ.

**AP Statistics** · Common Core State Standards: **AP STAT 5.1, AP STAT 5.2, AP STAT 5.3, AP STAT 5.4, AP STAT 5.5, AP STAT 5.6, AP STAT 5.7, HSS-IC.A.1, HSS-IC.A.2**

## Questions

### Question 1

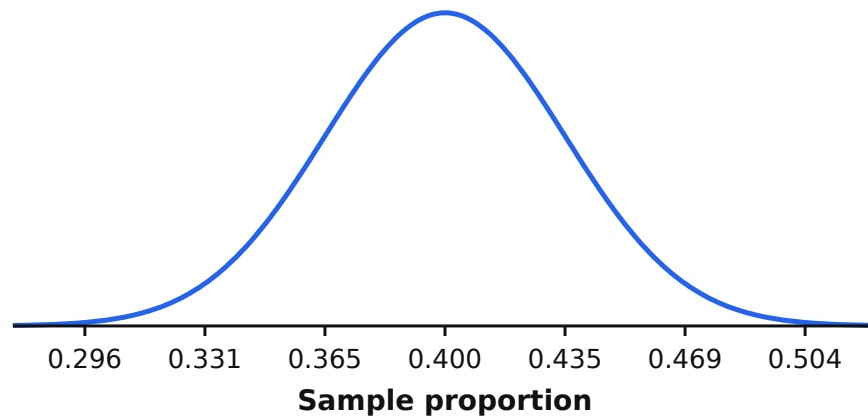


Sampling distribution of  $\hat{p}$  for  $n = 50$ : mean 0.40, standard deviation 0.069.

The mean of this sampling distribution of  $\hat{p}$  is:

- A. 0.0693
- B. 0.40
- C. 0.24
- D. 0.50

### Question 2

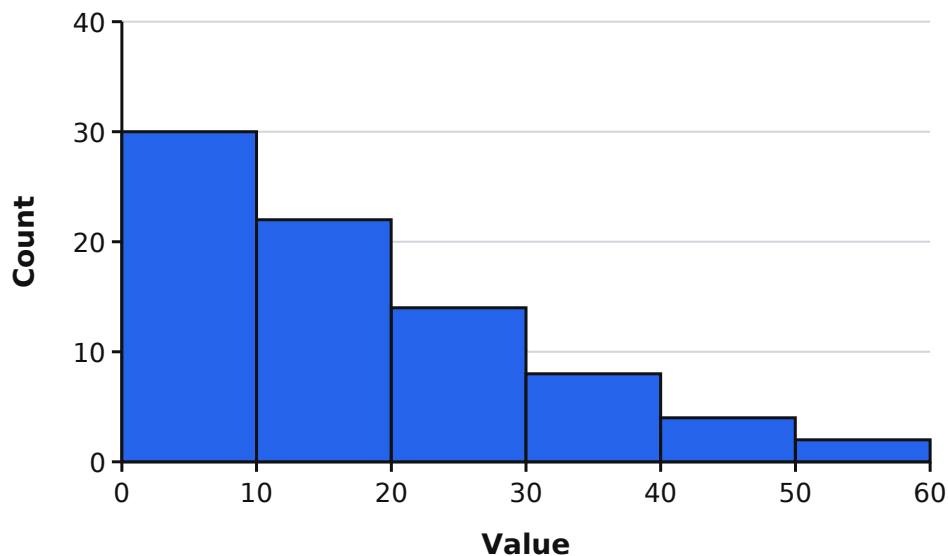


For  $n = 200$  the standard deviation is 0.035: quadrupling  $n$  halves the spread.

Compared with  $n = 50$ , this sampling distribution ( $n = 200$ ) has:

- A. the same center and the same spread
- B. a different center
- C. twice the standard deviation
- D. half the standard deviation

### Question 3



A skewed population.

For samples of size 100 from this population, the distribution of  $\bar{x}$  is:

- A. skewed right like the population
- B. uniform
- C. approximately normal
- D. bimodal

#### Question 4

The standard deviation of  $\bar{x}$  for  $n = 49$  and  $\sigma = 14$  is:

- A. 14
- B. 2
- C. 7
- D. 0.29

#### Question 5

The conditions for a normal model for  $\hat{p}$  include:

- A.  $np \geq 10$  and  $n(1-p) \geq 10$
- B.  $n \geq 30$  only
- C.  $p = 0.5$
- D.  $np \leq 10$

#### Question 6

For independent samples, the standard deviation of  $\hat{p}_1 - \hat{p}_2$  is:

- A. the difference of the two standard deviations
- B.  $\sqrt{p_1(1-p_1)/n_1 + p_2(1-p_2)/n_2}$
- C. the sum of the two standard deviations
- D.  $p_1 - p_2$

#### Question 7

Which statement about bias is true?

- A. A larger sample reduces variability but not bias
- B. A larger sample removes bias
- C. Bias depends on  $n$  only
- D. Unbiased means no variability

#### Question 8

When the population is normal, the sampling distribution of  $\bar{x}$  is normal:

- A. only if  $n \geq 30$
- B. only if  $n = 1$
- C. never
- D. for any sample size

#### Question 9

The mean of the sampling distribution of  $\bar{x}$  is:

- A.  $\mu$
- B.  $\sigma$

- C.  $\mu / \sqrt{n}$
- D.  $n \mu$

### Question 10

To cut the standard deviation of  $\bar{x}$  to one third, the sample size must be:

- A. multiplied by 3
- B. multiplied by 6
- C. multiplied by 9
- D. divided by 3

## Answers

1. **B** - The mean of the sampling distribution of  $\hat{p}$  equals  $p = 0.40$ . The value 0.0693 is its standard deviation.
2. **D** - The center is still  $p$ , and the standard deviation is divided by  $\sqrt{4} = 2$ .
3. **C** - The central limit theorem applies because  $n = 100$  is large.
4. **B** -  $\sigma/\sqrt{n} = 14/7 = 2$ .
5. **A** - These ensure enough successes and failures for the normal shape.
6. **B** - Variances add for sums and differences of independent variables, then take the square root.
7. **A** - Bias comes from the method of selection or estimation, not from sample size.
8. **D** - A mean of normal variables is itself normal.
9. **A** -  $\bar{x}$  is an unbiased estimator of  $\mu$ .
10. **C** -  $\sigma/\sqrt{n}$  falls by a factor of 3 only when  $\sqrt{n}$  rises by 3, so  $n$  rises by 9.

## Remember

- A sampling distribution describes how a statistic varies from sample to sample.
- $\hat{p}$ : mean  $p$ , sd  $\sqrt{p(1-p)/n}$ ; approximately normal if  $np \geq 10$  and  $n(1-p) \geq 10$ .
- $\bar{x}$ : mean  $\mu$ , sd  $\sigma/\sqrt{n}$ ; normal if the population is normal or  $n$  is large (CLT).
- Differences of independent statistics: means subtract, variances add.
- Larger  $n$  reduces variability but never corrects bias; the 10% condition is needed for independence.