

Inference for Proportions: Intervals and Tests

Grade 12 – AP Statistics math · Worksheet · Standards: AP Statistics Unit 3 (2026-27)

Name: _____ Date: _____ Class: _____

These twenty problems train the inference skills of AP Statistics Unit 3 for proportions: conditions, confidence intervals, sample size, hypotheses, z tests, p-values, Type I and Type II errors and power, for one proportion and for a difference of two proportions.

Standards: AP Statistics Unit 3 (2026-27) · **Level:** Grade 12 AP Statistics

Problem 1 Conditions for an Interval (easy)

A principal randomly selects 180 of the 4,200 students at her school and finds that 54 favor a later start time. State and check the conditions for constructing a confidence interval for the proportion of all students who favor a later start.

Problem 2 A 90% Confidence Interval (medium)

Among 300 randomly chosen visitors to a science museum, 134 say they prefer the planetarium show. Find a 90% interval estimate of the proportion of all visitors who prefer it.

Problem 3 Interpreting an Interval (medium)

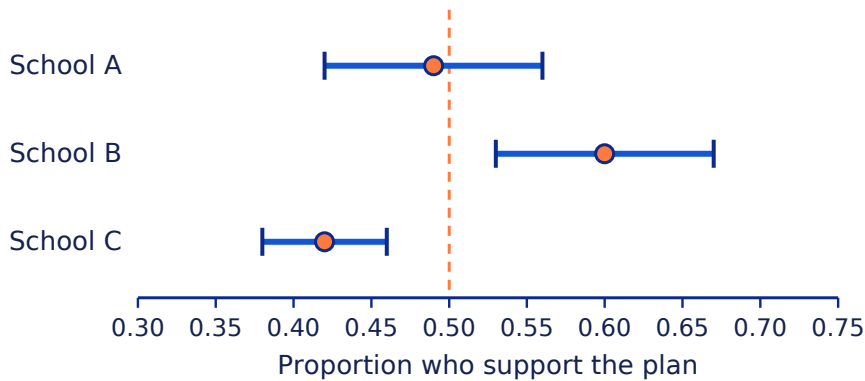
For the museum survey (134 of 300 visitors prefer the planetarium), a 95% confidence interval is (0.390, 0.503). Explain what the interval and the confidence level tell us.

Problem 4 Margin of Error (easy)

Among 500 randomly chosen commuters, 310 take public transit ($\hat{p} = 0.62$). Find the margin of error for a 99% confidence interval.

Problem 5 Using Intervals to Justify a Claim (medium)

Three schools each took a random sample and built a 95% confidence interval for the proportion of students who support a new lunch plan.



95% intervals for the proportion supporting a plan; the dashed line marks 0.50.

For each school, state whether the interval provides convincing evidence that a majority (more than 50%) of students support the plan.

Problem 6 Sample Size for a Margin of Error (medium)

A pollster needs a 95% interval for a proportion whose margin of error is no larger than 0.03. (a) Find the necessary sample size with no prior estimate. (b) Find it if an earlier study suggests the proportion is about 0.30.

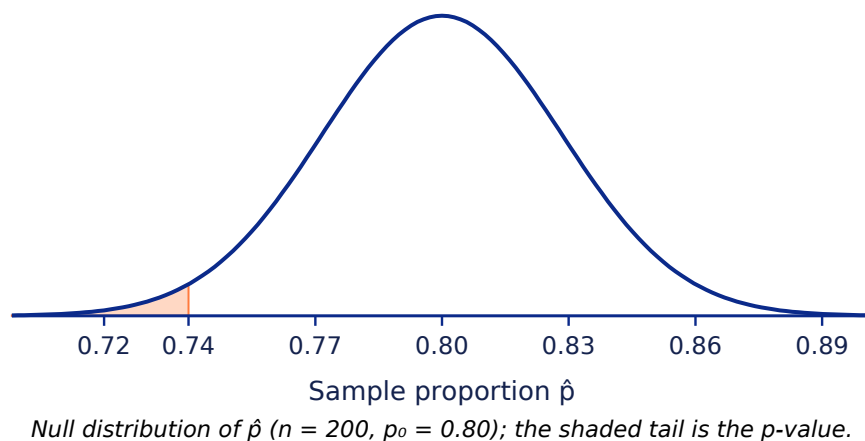
Problem 7 Writing Hypotheses (easy)

Write the null and alternative hypotheses for each claim.

- A shipping company says 80% of its packages arrive on time, and a customer group suspects it is less.
- A teacher believes that more than 25% of her students walk to school.
- A coin-flipping app claims to be fair, and a tester suspects it is not.

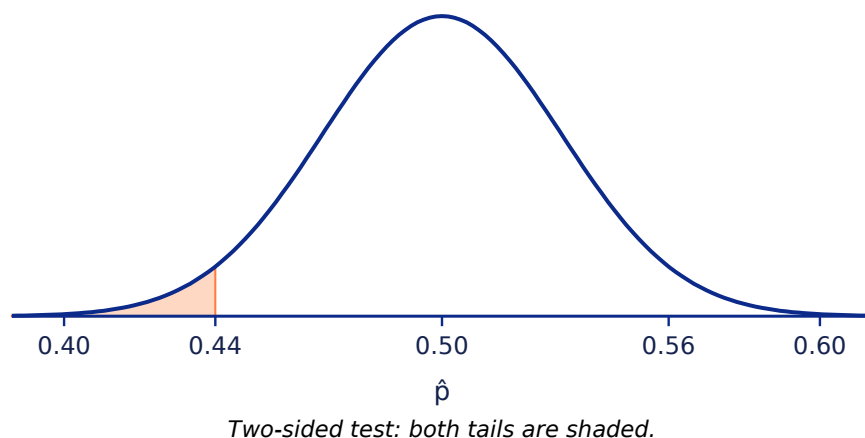
Problem 8 One-Sided z Test (medium)

A company claims 80% of flights are on time. Among 200 randomly chosen flights, 148 were on time. Test $H_a: p < 0.80$ and find the test statistic and p-value.



Problem 9 Two-Sided z Test (medium)

A manufacturer says that exactly half of its customers prefer the new design. In a random sample of 250 customers, 140 prefer it. Test $H_0: p = 0.50$ against $H_a: p \neq 0.50$ at $\alpha = 0.05$. The curve shows the null distribution; shading marks one tail.



Problem 10 Interpreting a p-Value (medium)

In the previous problem the p -value was 0.058. Explain what this p -value says about the situation.

Problem 11 Large Counts for a Test (easy)

A tester wants to test $H_0: p = 0.90$ using a random sample of 60 items from a very large lot. Check the large counts condition.

Problem 12 Decisions and Significance Levels (easy)

Three tests gave p -values 0.032, 0.067 and 0.0004. For each, state the decision at $\alpha = 0.05$ and

at $\alpha = 0.01$.

Problem 13 Type I and Type II Errors (medium)

A hospital tests H_0 : the proportion of patients who develop an infection after surgery is 0.04, against H_a : the proportion is greater than 0.04. Explain, in the words of the hospital setting, what a Type I error and a Type II error would be, and give a consequence of each.

Problem 14 Factors That Affect Power (medium)

A test has power 0.62. State whether each change would increase, decrease or leave the power unchanged (all else equal): (a) a larger sample size, (b) a smaller significance level α , (c) a true proportion farther from p_0 .

Problem 15 A Complete One-Proportion Test (hard)

A city says 33% of its residents recycle. A random sample of 350 residents of the city (a very large population) shows 133 who recycle. Is there convincing evidence that more than 33% recycle? Use $\alpha = 0.05$ and complete all four steps.

Problem 16 Interval for a Difference (hard)

A school gave a new reading program to a random sample of 150 students, and 96 passed the end-of-year test. A random sample of 160 students who did not use the program had 78 passing. Check conditions, then find a 95% interval estimate of the difference in pass rates (program minus no program).

Problem 17 Using the Interval to Decide (medium)

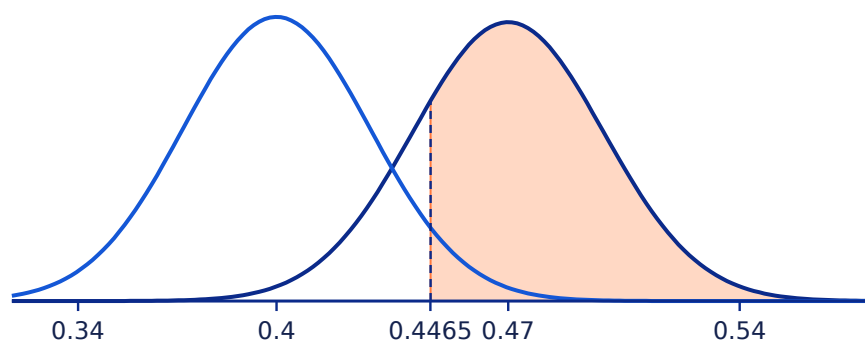
The 95% confidence interval for the difference in pass rates in the previous problem is (0.043, 0.262). Does it provide convincing evidence that the program increases the pass rate? Explain the interval in context.

Problem 18 Two-Proportion z Test (hard)

A random sample of 120 teens from city A includes 45 who volunteer regularly; a random sample of 110 teens from city B includes 30. Test whether the volunteering proportions differ, using $\alpha = 0.05$.

Problem 19 Computing Power (hard)

A test of $H_0: p = 0.40$ against $H_a: p > 0.40$ uses $n = 300$ and $\alpha = 0.05$. Find the power when the true proportion is 0.47.



Power is the shaded area right of the critical value.

Problem 20 Poll Planning and Claim (hard)

A random poll of 900 voters finds that 486 (54%) support a ballot measure. (a) Find a 95% interval estimate. (b) Does it show convincing evidence that a majority support the measure? (c) By what factor must the sample size increase to cut the margin of error in half?