

# AP Statistics · Inference for Proportions · Worksheet Answer Key

Common Core AP Statistics Unit 3 (2026-27) · mathovore.fr

This ap statistics proportions worksheet answer key solves all 24 problems of the inference for proportions worksheet step by step.

Every solution shows the conditions, the formula, the arithmetic and a conclusion in context. Intervals use the table critical values 1.645, 1.960 and 2.576, and P-values come from the standard normal model.

## AP StatisticsCommon Core: AP Statistics Unit 3 (2026-27)

### AP Statistics Proportions Worksheet Answer Key: problems 1-5

#### Problem 1: Large Counts check

Here  $\hat{p} = \frac{9}{45} = 0.20$ . The counts are  $n\hat{p} = 9$  and  $n(1-\hat{p}) = 36$ .

Because  $9 < 10$ , the condition fails. **Large Counts is not met, so a z interval is not appropriate.**

#### Problem 2: Standard error of a proportion

$$\hat{p} = \frac{90}{150} = 0.60.$$

$$SE = \sqrt{\frac{0.60(0.40)}{150}} = \sqrt{0.0016} = \mathbf{0.040}.$$

#### Problem 3: Critical values

For confidence level  $C$ ,  $z^*$  leaves  $\frac{1-C}{2}$  in each tail.

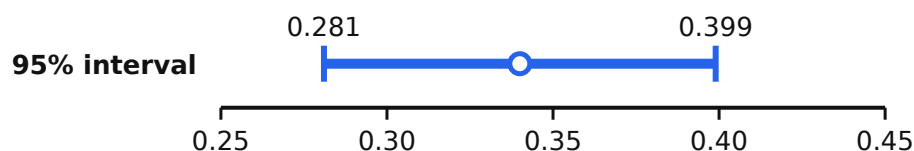
- 90%: area 0.95 to the left gives **1.645**.
- 95%: area 0.975 to the left gives **1.960**.
- 99%: area 0.995 to the left gives **2.576**.

#### Problem 4: One-proportion z interval

**Large Counts.**  $\hat{p} = \frac{85}{250} = 0.340$ ; the counts 85 and 165 are both at least 10.

**Interval.**  $SE = \sqrt{\frac{0.34(0.66)}{250}} = 0.0300$ , so  $ME = 1.960(0.0300) = 0.059$ .

$0.340 - 0.059 = 0.281$  and  $0.340 + 0.059 = 0.399$ . The **95% interval is (0.281, 0.399)**.



The interval 0.281 to 0.399, centered at 0.340.

### Problem 5: Interpreting an interval

**We are 95% confident that the interval from 0.281 to 0.399 captures the true proportion of all players in the league who play a second sport.**

The sentence names the confidence level, the interval, the population, and the parameter.

## AP Statistics Proportions Worksheet Answer Key: problems 6-10

---

### Problem 6: Meaning of the confidence level

The true proportion is a fixed number, not a random quantity, so it is either in the interval or it is not. The 95% describes the **method**.

**If many random samples of the same size were taken and a 95% interval built from each, about 95% of those intervals would capture the true proportion.**

### Problem 7: Sample proportion and margin of error

The sample proportion is the midpoint:  $\hat{p} = \frac{0.412 + 0.508}{2} = \mathbf{0.460}$ .

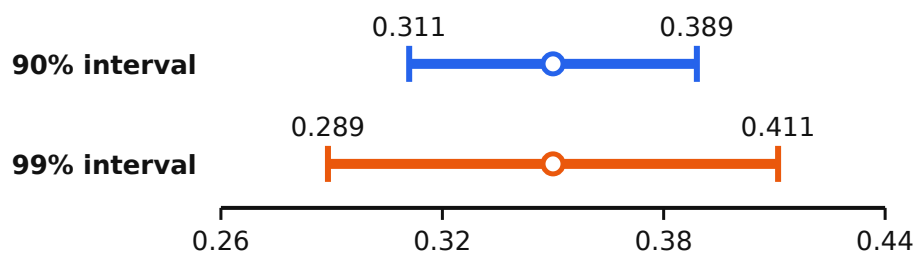
The margin of error is half the width:  $ME = \frac{0.508 - 0.412}{2} = \mathbf{0.048}$ .

### Problem 8: Effect of confidence level

$$\hat{p} = \frac{140}{400} = 0.350 \text{ and } SE = \sqrt{\frac{0.35(0.65)}{400}} = 0.0238.$$

- 90%:  $ME = 1.645(0.0238) = 0.039$ , interval **(0.311, 0.389)**.
- 99%:  $ME = 2.576(0.0238) = 0.061$ , interval **(0.289, 0.411)**.

A higher confidence level needs a larger  $z^*$ , so the interval is wider.



The 99% interval is wider than the 90% interval.

### Problem 9: Sample size without a prior estimate

Use the conservative value  $\hat{p} = 0.5$ :  $n \geq \left(\frac{1.960}{0.03}\right)^2 (0.5)(0.5) = 4268.4(0.25) = 1067.1$ .

Round up: **n = 1,068**.

### Problem 10: Sample size with a prior estimate

$n \geq \left(\frac{2.576}{0.02}\right)^2 (0.30)(0.70) = 16589.4(0.21) = 3483.8$ .

Round up: **n = 3,484**.

## AP Statistics Proportions Worksheet Answer Key: problems 11-15

---

### Problem 11: Writing hypotheses

Let  $p$  be the true proportion of this company's batteries that are defective.

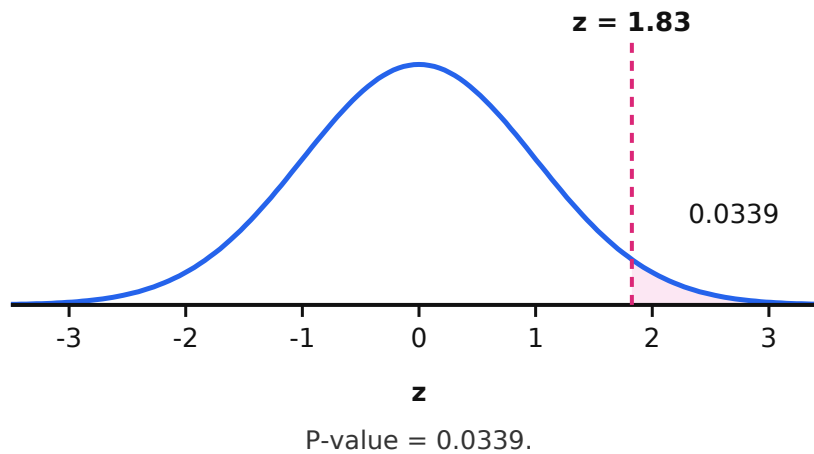
$H_0: p = 0.08$  and  $H_a: p > 0.08$ .

### Problem 12: Right-tailed z test

$H_0: p = 0.10$ ,  $H_a: p > 0.10$ . Large Counts:  $120(0.10) = 12$  and  $120(0.90) = 108$ , both at least 10.

$\hat{p} = \frac{18}{120} = 0.150$ ,  $SE_0 = \sqrt{\frac{0.10(0.90)}{120}} = 0.0274$ .

$z = \frac{0.150 - 0.10}{0.0274} = \mathbf{1.83}$ , and the P-value is  $P(Z > 1.83) = \mathbf{0.034}$ .



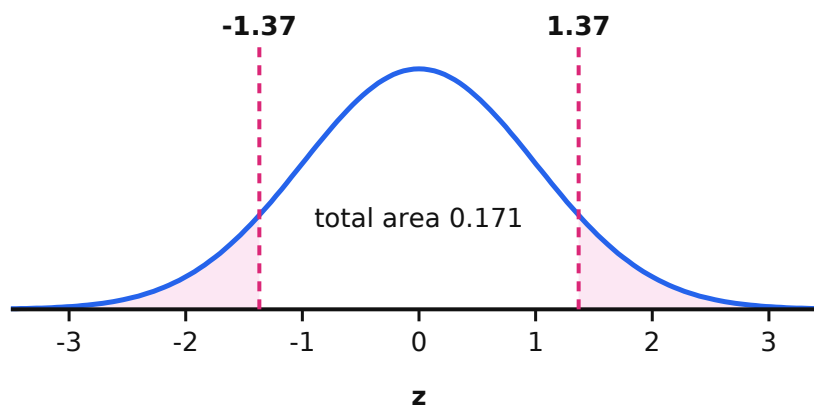
### Problem 13: Two-sided z test

Large Counts:  $180(0.40) = 72$  and  $180(0.60) = 108$ ; both at least 10.

$$\hat{p} = \frac{63}{180} = 0.350, SE_0 = \sqrt{\frac{0.40(0.60)}{180}} = 0.0365.$$

$$z = \frac{0.350 - 0.400}{0.0365} = -1.37.$$

Two-sided P-value =  $2P(Z < -1.37) = \mathbf{0.171}$ .



Two-sided P-value =  $2(0.0854) = 0.171$ .

### Problem 14: Interpreting a P-value

**If the true proportion of underweight muffins were 0.10, there would be about a 3.4% chance of getting a sample proportion of 0.150 or greater just by random sampling variability.**

It is not the probability that  $H_0$  is true.

### Problem 15: Drawing a conclusion

Since  $0.034 < 0.05$ , reject  $H_0$ . **There is convincing evidence that more than 10% of the**

**bakery's muffins are underweight.**

At  $\alpha = 0.01$ ,  $0.034 > 0.01$ , so we fail to reject  $H_0$ : **the conclusion changes**, and the data would not be convincing.

## AP Statistics Proportions Worksheet Answer Key: problems 16-20

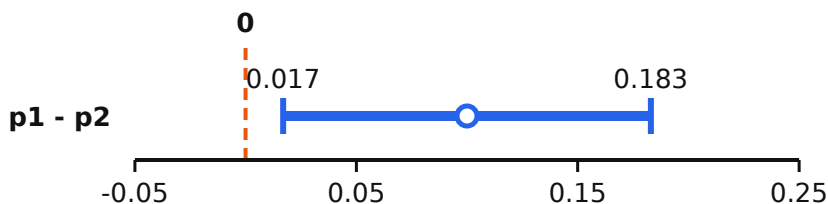
---

### Problem 16: Interval for a difference

$\hat{p}_A = 0.520$ ,  $\hat{p}_B = 0.420$ , difference 0.100.

$$SE = \sqrt{\frac{0.52(0.48)}{300} + \frac{0.42(0.58)}{250}} = \sqrt{0.000832 + 0.000974} = 0.0425.$$

$ME = 1.960(0.0425) = 0.083$ . The interval is  $0.100 \pm 0.083$ : **(0.017, 0.183)**.



The interval lies to the right of 0.

### Problem 17: Justifying a claim with an interval

**No.** The interval contains 0, so 0 is a plausible value for the difference. Negative values are also plausible, so the data do not give convincing evidence that group 1 has the higher proportion.

### Problem 18: Two-proportion z test

$H_0: p_A = p_B$ ,  $H_a: p_A > p_B$ .  $\hat{p}_A = 0.650$ ,  $\hat{p}_B = 0.560$ .

Pooled:  $\hat{p}_c = \frac{130+112}{400} = 0.605$ .

$$SE = \sqrt{0.605(0.395)\left(\frac{1}{200} + \frac{1}{200}\right)} = 0.0489, \text{ so } z = \frac{0.650 - 0.560}{0.0489} = \mathbf{1.84}.$$

P-value =  $P(Z > 1.84) = \mathbf{0.033}$ . Since  $0.033 < 0.05$ , there is convincing evidence that App A has the higher completion rate.

### Problem 19: Describing a Type I error

A Type I error rejects a true  $H_0$ . **The inspector concludes that more than 8% of the batteries are defective when the true proportion is actually 8%.** The company might

stop production unnecessarily.

The probability of a Type I error equals the significance level: **0.05**.

### Problem 20: Describing a Type II error

A Type II error fails to reject a false  $H_0$ . **The inspector does not find convincing evidence that more than 8% of the batteries are defective, even though the true proportion is greater than 8%.**

Consequence: defective batteries keep being shipped to customers.

## AP Statistics Proportions Worksheet Answer Key: problems 21-24

---

### Problem 21: Power and Type II error

$$\beta = 1 - \text{power} = 1 - 0.72 = \mathbf{0.28}.$$

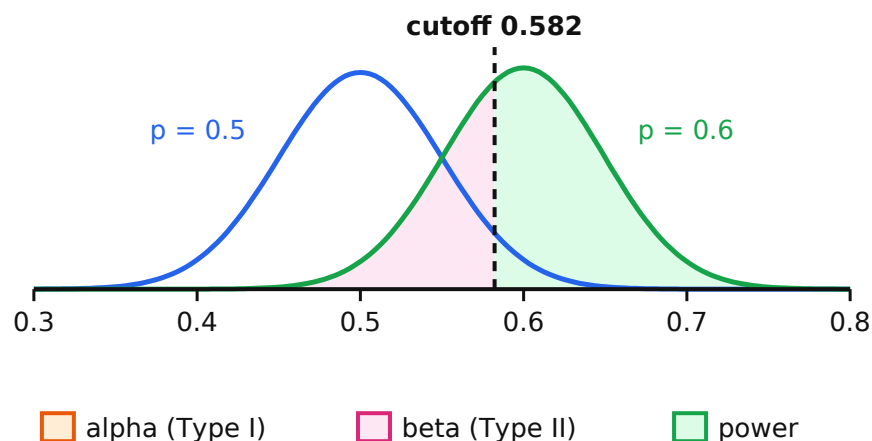
Power increases if the **sample size is increased** or if the **significance level  $\alpha$  is increased** (accepting a higher chance of a Type I error).

### Problem 22: Computing power

**Step 1: rejection cutoff.** Under  $H_0$ ,  $SD = \sqrt{\frac{0.5(0.5)}{100}} = 0.05$ . Reject when  $\hat{p} > 0.5 + 1.645(0.05) = 0.5822$ .

**Step 2: power.** If  $p = 0.60$ ,  $SD = \sqrt{\frac{0.6(0.4)}{100}} = 0.0490$ , so  $P(\hat{p} > 0.5822) = P\left(Z > \frac{0.5822 - 0.6}{0.0490}\right) = P(Z > -0.36) = \mathbf{0.641}$ .

About a 64% chance of detecting the change, so  $\beta$  is about 0.36.



Blue: sampling distribution if  $p = 0.5$ . Green: if  $p = 0.6$ . Power is the green area, about 0.64.

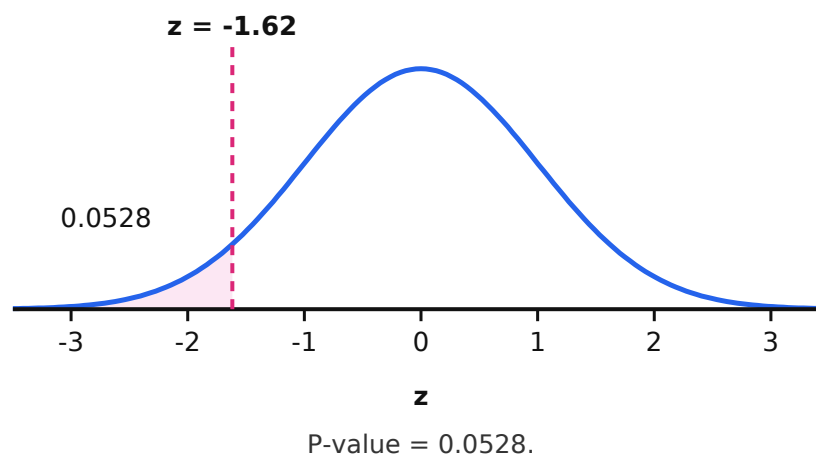
### Problem 23: Four-step significance test

**State.**  $H_0: p = 0.70$ ,  $H_a: p < 0.70$ , where  $p$  is the proportion of all seniors in the state who plan to attend college;  $\alpha = 0.05$ .

**Plan.** One-proportion z test. Conditions: random sample; the population is more than 10 times the sample;  $220(0.70) = 154$  and  $220(0.30) = 66$  are both at least 10.

**Do.**  $\hat{p} = \frac{143}{220} = 0.650$ ,  $SE_0 = \sqrt{\frac{0.70(0.30)}{220}} = 0.0309$ ,  $z = \frac{0.650 - 0.700}{0.0309} = -1.62$ , P-value  $= P(Z < -1.62) = 0.053$ .

**Conclude.** Since  $0.053 > 0.05$ , fail to reject  $H_0$ . **There is not convincing evidence that fewer than 70% of the state's seniors plan to attend college.**



### Problem 24: Interval and test agree

A two-sided test at  $\alpha = 0.05$  rejects  $H_0$  exactly when the null value lies outside the 95% interval.

- 0.60 is outside (0.43, 0.57): **reject**  $H_0$ . There is convincing evidence that  $p \neq 0.60$ .
- 0.50 is inside the interval: **fail to reject**  $H_0$ . There is not convincing evidence that  $p \neq 0.50$ .

### How to use this ap statistics proportions worksheet answer key

Read this ap statistics proportions worksheet answer key after trying each problem yourself, and redo any problem you missed.

