LESSON MAKER PRO

Signal or Chance?

Use confidence intervals to judge differences between groups.

HIGH SCHOOL · S.IR.1

S.IR.1 "Interpret and communicate the results of a statistical analysis in context. Recognize when the difference between two sample proportions or two sample means is due to random variation or if the difference is statistically significant..."

NAME _____ DATE _____

CHECK FOR ZERO

Subtract in the stated order to estimate a difference. Then subtract and add the margin of error to find its confidence interval. If an interval for a difference contains 0, the difference is not statistically significant at that confidence level. A 95% confidence level means this method captures the true difference in about 95% of repeated random samples.

WORKED EXAMPLE

In a survey, 73% of one group and 54% of another group chose the same option. The 90% margin of error for the difference, first group minus second group, is 5 percentage points. Find the interval and decide whether the difference is significant at the 10% level.

1. Estimate the difference: 73 - 54 = 19 percentage points.
2. Find the lower end: 19 - 5 = 14.
3. Find the upper end: 19 + 5 = 24.

Answer: The 90% confidence interval is [14, 24] percentage points. It excludes 0, so the difference is significant at the 10% level.

PRACTICE 6 problems

1 Sample A has a rate of 58%, and sample B has a rate of 48%. The 95% margin of error for A minus B is 6 percentage points. Find the confidence interval. Is the difference significant at the 5% level?

ANSWER _____

2 The table shows the share of each group that chose an option. The 95% margin of error for workshop minus no workshop is 7 percentage points. Find the confidence interval. Is the difference significant at the 5% level?

SURVEY RESULTS

Group	Share
Workshop	46%
No workshop	52%

ANSWER _____

3 One sample has a mean of 27 minutes, and another has a mean of 21 minutes. The 95% margin of error for the first mean minus the second is 2 minutes. Find the confidence interval. Is the difference significant at the 5% level?

ANSWER _____

4 The table shows two sample mean scores. The 95% margin of error for A minus B is 10 points. Find the confidence interval. Is the difference significant at the 5% level?

SAMPLE MEAN SCORES

Group	Mean score
A	34
B	40

ANSWER _____

5 An estimated difference is 2 percentage points, with a 95% margin of error of 2 percentage points. Find the confidence interval. Is the difference significant at the 5% level?

ANSWER _____

6 The estimated difference A minus B is -10 percentage points, with a 95% margin of error of 3 percentage points. Find the confidence interval. If the difference is significant at the 5% level, state which group has the higher rate.

ANSWER _____

APPLY IT Show your work

1 In a random sample of students who tried a music app, 63% of premium-plan users and 51% of free-plan users said they would recommend it. The 95% margin of error for premium minus free is 9 percentage points. Find the confidence interval and decide whether the difference is significant at the 5% level. Suggest one follow-up question for a future survey.

WORK SPACE

ANSWER _____

2 A school tests two study spaces. Students in one sample report a mean of 81 minutes of focused study in a quiet room. Students in another sample report a mean of 74 minutes in a shared room. The 95% margin of error for quiet minus shared is 9 minutes. Find the confidence interval and decide whether the school has enough evidence at the 5% level to claim that the quiet room increases mean focus time.

FOCUSED STUDY TIME

Study space	Sample mean
Quiet room	81 minutes
Shared room	74 minutes

ANSWER _____

CHALLENGE One step up

Two randomized trials compare a study playlist with silence. In both trials, the estimated difference in mean focus time, playlist minus silence, is 8 minutes. Trial A has a 95% margin of error of 8 minutes; trial B has a 95% margin of error of 6 minutes. Find both confidence intervals. Which trial supports a claim that the playlist increases mean focus time at the 5% level? Recommend one way to study whether any effect lasts.

WORK SPACE AND ANSWER

Signal or Chance?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Sample A has a rate of 58%, and sample B has a rate of 48%. The 95% margin of error for A minus B is 6 percentage points. Find the confidence interval. Is the difference significant at the 5% level?	**[4, 16] percentage points; yes, it is significant.**
2	The table shows the share of each group that chose an option. The 95% margin of error for workshop minus no workshop is 7 percentage points. Find the confidence interval. Is the difference significant at the 5% level?	**[-13, 1] percentage points; no, it is not significant.**
3	One sample has a mean of 27 minutes, and another has a mean of 21 minutes. The 95% margin of error for the first mean minus the second is 2 minutes. Find the confidence interval. Is the difference significant at the 5% level?	**[4, 8] minutes; yes, it is significant.**
4	The table shows two sample mean scores. The 95% margin of error for A minus B is 10 points. Find the confidence interval. Is the difference significant at the 5% level?	**[-16, 4] points; no, it is not significant.**
5	An estimated difference is 2 percentage points, with a 95% margin of error of 2 percentage points. Find the confidence interval. Is the difference significant at the 5% level?	**[0, 4] percentage points; no, it is not significant because the interval includes 0.**
6	The estimated difference A minus B is -10 percentage points, with a 95% margin of error of 3 percentage points. Find the confidence interval. If the difference is significant at the 5% level, state which group has the higher rate.	**[-13, -7] percentage points; the difference is significant, and B has the higher rate.**

PART 2 · APPLY IT

1. **[3, 21] percentage points; the difference is significant, with a higher recommendation rate among premium-plan users. Possible follow-up question: Why did you choose your current plan?** Subtract 63 - 51 = 12, then calculate 12 ± 9. The interval excludes 0, but this survey does not show that the plan itself caused the difference.
2. **[-2, 16] minutes; no, the interval does not provide enough evidence for the claim at the 5% level.** Subtract 81 - 74 = 7, then calculate 7 ± 9. Because the interval includes 0, the observed difference is not statistically significant at the 5% level.

CHALLENGE

Trial A: [0, 16] minutes, not significant. Trial B: [2, 14] minutes, significant and consistent with an increase. One next step is to run a longer randomized trial and measure focus time each week.

Accept equivalent interval notation and follow-up questions that could help investigate the finding. An interval with 0 as an endpoint includes 0, so it is not significant at the stated level.