

Algebra 2 • Unit 8 Worksheet

Statistical Inferences

Name: _____

Date: _____

This unit develops statistical thinking around randomness: study types, sampling, normal distributions, margins of error, and using randomization to decide whether an experimental result is significant.

Part A • Study Types

1. Classify each study as EXPERIMENTAL, OBSERVATIONAL, or SURVEY. Justify briefly.

- a. Researchers randomly assign 100 patients to take Drug A or a placebo and compare blood pressure.

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- b. A teacher records the test scores of students who do or do not eat breakfast.

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- c. A polling firm calls 1000 voters and asks for their preferred candidate.

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- d. Which study type can establish CAUSATION? Why?

Part B • Randomness in Sampling

2. A high school wants to estimate the proportion of students who play a sport. Two sampling methods:

- a. Method A: Ask the first 50 students who walk into the gymnasium.
b. Method B: Use a random number generator to pick 50 student IDs from the school roster.
c. Which is more likely to give a reliable estimate? Why is the OTHER one biased?
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Part C • Normal Distribution

3. Adult human handspan is approximately normally distributed with mean $\mu = 20$ cm and standard deviation $\sigma = 1.5$ cm.

a. About what % of adults have handspan between 18.5 cm and 21.5 cm? _____

b. About what % have handspan between 17 cm and 23 cm? _____

c. What about between 15.5 cm and 24.5 cm? _____

d. State the 68/95/99.7 rule in your own words.

Part D • Margin of Error

4. A poll of 400 voters shows 52% prefer Candidate A. The margin of error is reported as $\pm 5\%$.

a. What is the INTERVAL of plausible support for Candidate A? _____ to _____

b. Can the pollsters confidently claim Candidate A is winning? Why or why not?

c. If the sample size were 4000 instead of 400, would the margin of error grow or shrink? Explain briefly (no calculation needed).

Part E • Variability in Samples

5. A bag has 1000 marbles; 30% are red. You take many random samples of 25 marbles and record the proportion red.

- What proportion would you EXPECT, on average, across samples? _____
- Would every sample have exactly that proportion? Why or why not?

c. If a single sample of 25 has 12 red marbles (proportion 0.48), is that strong evidence that the bag is NOT 30% red? Explain.

Part F • Significance of an Experimental Result

6. An experiment compares a new fertilizer (treatment group) to plain water (control). The treatment group's plants grew 5 cm taller on average. A randomization distribution of 200 trials (assuming no real effect) gave a histogram centered at 0 with standard deviation 2 cm.

- How many standard deviations away from 0 is the observed difference of 5?

b. Is this observed difference UNUSUAL under the assumption of no effect? Use the 95% rule.

c. What can the researcher conclude? Be careful with the language.

Part G • Identifying Bias

7. Identify the source of bias in each scenario, and suggest how to fix it.

- a. A magazine prints a survey about reading habits in their own pages and asks readers to mail back responses.

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- b. Researchers ask volunteers to taste-test a new soda after telling them the brand.

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- c. A poll on a sports website asks visitors which team will win the Super Bowl.

Part H • Error Analysis

8. Mai reads in a news article: 'A study shows that people who eat chocolate weekly are 30% less likely to have heart disease. So eating chocolate prevents heart disease.' Is the conclusion justified?

- ☐ Yes ☐ No — Explain the issue.
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9. Diego claims: 'A 95% confidence interval means there is a 95% probability that the true value is in the interval.' Is this technically right?

Why or why not? (Think carefully about what '95% confidence' means.)

Part I • Designing Your Own Study

10. Suppose you want to know if a certain music app's recommendations are better than a random playlist for listener enjoyment.

a. What TYPE of study would you design? Why?

b. How would you assign participants to groups?

c. What's your response variable (what would you measure)?

d. What could go WRONG with this study? Identify one threat to validity.
