MATHEMATICS · GRADES 10-12

Sampling and bias

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you tell whether a survey about a whole school can be trusted, or whether it only asked the students in one class who already agreed. A poll about school lunch that only asks the students in line at the canteen will miss everyone who brings lunch from home. A company testing a product only on its own employees gets a rosier picture than real customers would give. Knowing sampling and bias tells you when a survey speaks for the whole group and when it only speaks for the people who were easy to ask.



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Rule

Sampling and bias: a sample is biased when it leaves out part of the group it is meant to represent, so its result cannot be trusted for the whole group.

A random sample gives every member the same chance of being picked, so no group is systematically left out. Check who was asked, and who was left out.

Worked examples

EXAMPLE 1

Q **A survey about school lunch asks only students in the cafeteria at lunch. Is it biased?**

SOLUTION

The sample only includes students who already eat in the cafeteria.

Students who bring lunch or skip lunch are left out.

Yes, biased: the sample is not representative.

EXAMPLE 2

Q **Names are drawn from a hat containing every student's name. Is it biased?**

SOLUTION

Every student has the same chance of being picked.

No group is systematically left out.

No, it is a random sample, not biased.

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Practice questions

1 **A survey about a new playground asks only children who use the playground every day. Is it biased?**

- **A** Yes, biased: the sample is not representative
- **B** No, it is a random sample, not biased
- **C** Yes, biased: the sample is too small
- **D** No, children always tell the truth

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2 **A survey asks 10 students from each year group, chosen at random within each group. Is it biased?**

- **A** Yes, biased: only some year groups were asked
- **B** No, it is a random sample, not biased
- **C** Yes, biased: 10 students is too few
- **D** No, it is a systematic sample

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3 **A survey about school lunch asks only students in one class. Who is left out of the sample?**

- **A** Students in the other classes
- **B** Nobody: one class speaks for the whole school

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4 Is surveying only people who reply to an online poll biased?

- **A** No, everyone had the same chance to reply
- **B** No, online polls always reach everyone
- **C** Yes, only people with strong views tend to reply
- **D** Yes, because the poll was online

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5 A survey about homework asks only students in the library after school. What would make the sample fair?

- **A** Ask students from all parts of the school, chosen at random
- **B** Ask more students in the library
- **C** Ask only students who do homework
- **D** Ask the librarian what students think

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6 Every student is given a number, and a computer picks 50 numbers at random. Is it biased?

- **A** Yes, biased: computers cannot choose fairly
- **B** No, it is a random sample
- **C** Yes, biased: only 50 were picked
- **D** No, it is a systematic sample

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A survey picks every 20th student from an alphabetical list. Is it biased?

A. Yes, biased: alphabetical order favours some names

B. No, it is a systematic random sample

C. No, it is a simple random sample

D. Yes, biased: every 20th is too few

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8 **A school has 500 students and wants a systematic sample of 50. How should it pick them?**

- **A** Pick every 10th student from the list
- **B** Pick the first 50 students on the list
- **C** Pick 50 of the principal's friends
- **D** Pick every student whose name starts with A

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9 **A survey asks 5 students, chosen at random. Is the sample biased?**

- **A** No, it is random, though small
- **B** Yes, biased, because only 5 were asked

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What is bias in sampling?

A. A systematic skew that makes the sample unrepresentative

B. A random error that cancels out

C. A sample that is too small

D. A sample chosen by computer

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ANSWER KEY

1. Yes, biased: the sample is not representative

2. No, it is a random sample, not biased

3. Students in the other classes

4. Yes, only people with strong views tend to reply

5. Ask students from all parts of the school, chosen at random

6. No, it is a random sample

7. No, it is a systematic random sample

8. Pick every 10th student from the list

9. No, it is random, though small

10. A systematic skew that makes the sample unrepresentative

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