

Random Samples and Population Inferences

Grade 7 math · Lesson · Standards: 7.SP.A.1, 7.SP.A.2

Quick answer: A population is the whole group being studied, and a sample is a smaller part of it. A random sample gives every member an equal chance of being chosen, so it represents the population. To estimate, find the proportion in the sample and multiply it by the population size. Different random samples vary a little.

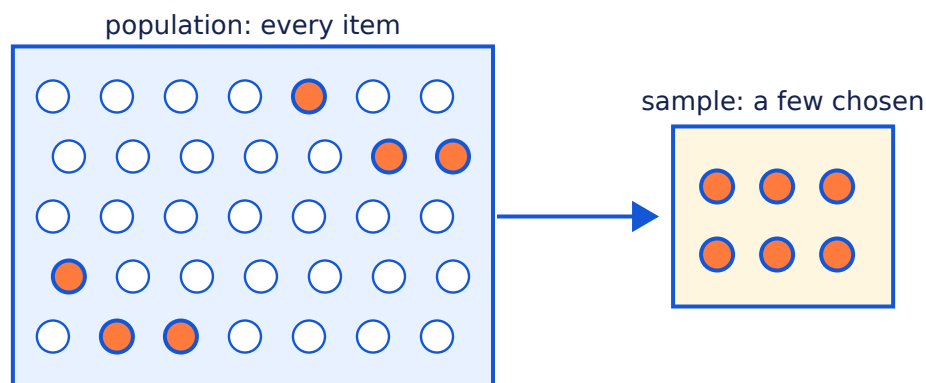
Standards: 7.SP.A.1, 7.SP.A.2 · **Level:** Grade 7

What are a population and a sample?

Counting every member of a large group is often too slow or too costly. Statisticians study a smaller piece instead.

Key terms

- **Population:** the entire group being studied, such as all 840 students at a school.
- **Sample:** a part of the population that is actually measured or surveyed.
- **Random sample:** a sample in which every member has an equal chance of being chosen.
- **Biased sample:** a sample that favors some members, so it does not represent the population.



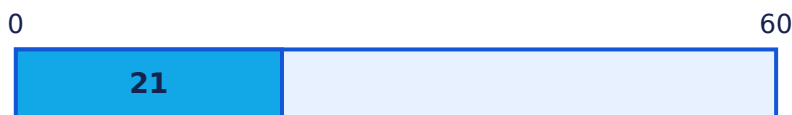
A sample is a small part of the population, chosen to represent it.

What makes a sample trustworthy?

A sample is representative only when it is chosen without favoring anyone. Drawing names from a bowl or using a random number generator on a full list gives each member the same chance. Asking only volunteers, friends, or people at one location usually leaves out parts of the population. A larger random sample also tends to give a more dependable estimate than a tiny one.

How do you use a sample to estimate the population?

Treat the sample as a small copy of the population: the same fraction of the population should have the trait. Write the result as a proportion, then scale it up.



21 of 60 students: $21 \div 60 = 0.35 = 35\%$

A sample result written as a part out of a total.

Method for an estimate

1. Write the sample result as a fraction or percent.
2. Check that the sample was random and large enough to trust.
3. Multiply the proportion by the size of the population.
4. State the answer as an estimate, using words such as about.

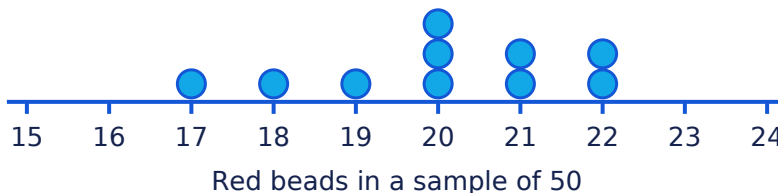
Worked example

A random sample of 60 students at a school with 840 students was asked about a new lunch menu. In the sample, 21 students prefer it.

Proportion: $21 \div 60 = 0.35$. Estimate for the school: $0.35 \times 840 = 294$ students.

Why do different samples give different results?

Even random samples of the same size are not identical. Each one catches a slightly different mix of members, which is called sampling variation. To see it, take many samples and plot the results. The dots cluster around the true value, and the spread shows how far one sample can miss.



Ten random samples of 50 beads: the counts vary, but cluster near 20.

In the dot plot, the typical count is 20 red beads out of 50, so about 40% of the beads are red. The counts range from 17 to 22, which means estimates from single samples can range from 34% to

44%.

Common mistake

Treating a sample result as exact. A sample gives an estimate, and another random sample will usually give a slightly different number.

Mathbot's tip

Before computing anything, ask who was left out. If a group could not have been picked, the sample is biased and the numbers cannot be trusted.

Key points to remember

- Population: the whole group; sample: the part actually measured.
- Random samples are fair; biased samples favor some members.
- Estimate = sample proportion $\times$ population size.
- Larger random samples tend to vary less.
- Repeated samples of the same size give different results.

Random Samples and Population Inferences: frequently asked questions

What is the difference between a population and a sample?

The population is every member of the group you want to learn about. The sample is the smaller set you actually survey or measure. Conclusions from the sample are used to estimate facts about the population.

How can you tell if a sample is biased?

Ask whether some members of the population had little or no chance of being picked. Surveying only volunteers, only one location, or only friends usually creates bias.

Why does a larger sample help?

A larger random sample covers more of the population, so single unusual members affect the result less. Estimates from large samples tend to be closer together and closer to the truth.

Why are two random samples different?

Each random sample includes a different mix of members, so the results change slightly from sample to sample. This natural difference is called sampling variation, and it does not mean a sample was done wrong.

How do I turn a sample percent into a population estimate?

Change the sample result into a proportion and multiply by the population size. If 35% of a random sample prefers an option and the population has 840 members, the estimate is $0.35 \times 840 = 294$.