Populations and Samples

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

The population is the whole target group; the sample is the group actually studied. Surveying 40 randomly chosen students from 400 samples $40/400 = 1/10$ of the population. Random selection helps avoid bias; a larger convenience sample may still be biased. No sample guarantees exact population results.

Worked example

A town has 900 households; 90 are randomly surveyed. Identify population, sample, and fraction.

1. All 900 households form the target population.
2. The 90 surveyed households form the sample.
3. Sample fraction $= 90/900 = 1/10 = 10\%$.
Answer: Population 900; sample 90; fraction $1/10$.

Practice Problems

Show your thinking.

1. Lunch preferences: A population contains 800 students; 50 are randomly surveyed. Identify population and sample and calculate the sampled fraction.

2. Lunch preferences: A library asks the first 50 cardholders who visit on Saturday to describe all 800 cardholders. Explain who might be missed and suggest a better sampling method.

3. Lunch preferences: Number 800 members. Randomly select 50 distinct numbers. Find the number not selected and explain why every member is eligible.

4. Lunch preferences: A school has two equally large grades totaling 800 students. Randomly sample 25 from each grade. Find total sample and within-grade fraction.

5. Lunch preferences: Compare random samples of 50 and 100 from 800 members. Find fractions and identify which is generally more stable without guaranteeing exactness.

6. Lunch preferences: Only 50 basketball players are surveyed to describe 800 students. Does the sample fraction alone prove representativeness? Explain one concrete source of bias.

7. A neighborhood has 960 households. A survey chooses 96 randomly from the whole list. Identify the population, sample, and fraction not surveyed.

8. Three school groups have $300, 200, 100$ students. A survey takes 10% from each. Find allocations and total sample size.

Answer Key

1. Population 800; sample 50; sampled fraction $\frac{1}{16}$.

2. Population 800; sample 50; sampled fraction $\frac{1}{16}$. Prefer random cardholders; Saturday visitors may have different availability.

3. 750 unselected. Draw 50 distinct numbers from the full list.

4. 25 per grade, 50 total; within-grade fraction $\frac{1}{16}$.

5. Fractions $\frac{1}{16}$ and $\frac{1}{8}$; larger random sample is generally more stable, not guaranteed exact.

6. Population 800; sample 50; sampled fraction $\frac{1}{16}$. No; players or volunteers can have different preferences from nonparticipants.

7. Population 960, sample 96, sampled $1/10$, not contacted 864 $(9/10)$. Use distinct random household numbers, not volunteers.

8. Allocations $30, 20, 10$; total 60. Select randomly within each group.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The target population has 800 members, with $800 - 50 = 750$ outside the intended sample.

2. The sample has 50 distinct members; fraction $50/800 = \frac{1}{16}$.

3. A random sample from the whole list gives all members a selection chance; a convenience group can miss systematically different members.

Problem 2

1. The target population has 800 members, with $800 - 50 = 750$ outside the intended sample.

2. The sample has 50 distinct members; fraction $50/800 = \frac{1}{16}$.

3. A random sample from the whole list gives all members a selection chance; a convenience group can miss systematically different members.

Problem 3

1. Give each of the 800 members one unique number from 1 to 800. The full list is in the draw, so every member is eligible.

2. Draw 50 different numbers without replacement. With replacement, duplicate draws could count the same person twice.

3. Exactly 50 people are contacted, leaving $800 - 50 = 750$ unselected.

Problem 4

1. Add the given groups: $25 + 25 = 50$ surveyed students.

2. Each grade has $800/2 = 400$ students.

3. Within-grade fraction $25/400 = \frac{1}{16}$ is the same in both grades.

Problem 5

1. The target population has 800 members, with $800 - 50 = 750$ outside the intended sample.

2. The sample has 50 distinct members; fraction $50/800 = \frac{1}{16}$.

3. Larger fraction $100/800 = \frac{1}{8}$ reduces typical sampling variation but cannot eliminate it.

Problem 6

1. The target population has 800 members, with $800 - 50 = 750$ outside the intended sample.

2. The sample has 50 distinct members; fraction $50/800 = \frac{1}{16}$.

3. A random sample from the whole list gives all members a selection chance; a convenience group can miss systematically different members.

Problem 7

1. The whole target is all 960 households; sample fraction $96/960 = 1/10$.

2. Not surveyed $960 - 96 = 864$; fraction $864/960 = 9/10$.

3. Number households 1 through 960 and select 96 distinct random numbers; volunteer selection does not give everyone the same chance.

Problem 8

1. The given 10% is $1/10$, so divide each group count by 10.

2. Allocations: $300/10 = 30$, $200/10 = 20$, and $100/10 = 10$.

3. Add to get $30 + 20 + 10 = 60$ surveyed students. The full population is $300 + 200 + 100 = 600$, so $60/600 = 1/10$ checks the rate.

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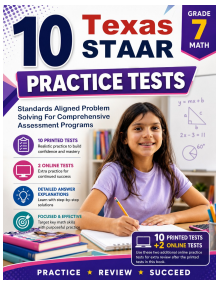

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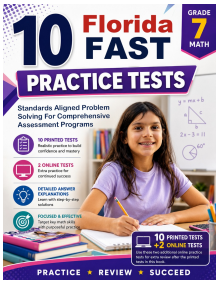

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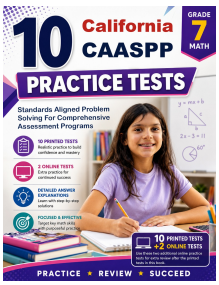

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