Statistical surveys: samples, proportions and claims — Teacher answers

Year 7, lower volume • text pp. 89–94 • textbook lessons 45–47

Use the worked and guided tasks selectively. The eight core paper tasks are prerequisites, independent tasks and exits; further practice and extensions are optional.

Ordinary route: prerequisites 4, short inquiry 5, worked/guided 8, independent 15, correction 5, exit 3 minutes. Advanced route: inquiry 18, organise 4, selected practice 13, exit 5 minutes.

Prerequisites: Read a frequency table and calculate fractions, percentages and a part of 360 degrees.

Ordinary route: use the first fixed case for the five-minute demonstration. Advanced route: complete the full investigation.

Inquiry and discussion: 18 minutes using sampling, explicitly a synthetic population of 200 with 50% choosing A: predict random versus club-only results (3 min). Keep sample size 20 and seed 2026; compare the two selection mechanisms, recording the actual displayed counts rather than assuming them (5 min). Hold mechanism fixed and change seed to 2027, then compare a random sample of 40 with all 40 club members (6 min). Explain sampling fluctuation versus selection bias: surveying the whole biased club does not turn it into the whole school (4 min).

Worked example 1

A school has 400 pupils. To study how they travel to school, randomly select 40 names from the complete pupil list and survey them. Identify the population, individual, sample and sample size.

Reference answer

Population: all 400 pupils’ travel information; individual: one pupil’s travel information; sample: the 40 selected pupils’ travel information; sample size: 40.

1. The target is information about every pupil, not only the 40 selected.
2. The sample contains the selected observations; its size counts observations.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Guided attempt 2

In a survey of 40 pupils, 12 walk, 8 cycle and 20 take a bus. Find the walking sector’s central angle.

1. Walking proportion: $\frac{12}{40} = \frac{3}{\square}$.
2. Central angle: $\frac{12}{40} \times 360^\circ = \square^\circ$.
3. Check: the walking part is less than half the group, so its angle must be less than ____°.

Category	Frequency
Walk	12
Cycle	8
Bus	20

Use the stated conditions and the labelled scales.

Reference answer

108 °.

$$(12/40) \cdot 360$$

1. The given categories account for every observation exactly once.
2. Use $\frac{12}{40}$ of the full 360° circle.
3. The requested result is 108.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Category	Frequency
Walk	12
Cycle	8
Bus	20

Use the stated conditions and the labelled scales.

Prerequisite 3

8 of 40 observations are category A. What percentage is A?

Reference answer

20 %.

$$(8/40)\cdot 100$$

1. The given categories account for every observation exactly once.
2. Use $\frac{8}{40}\times 100\%$ to express a percentage.
3. The requested result is 20.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Prerequisite 4

A frequency table has mutually exclusive counts 12,18,10 and covers everyone once. Find the total.

Reference answer

40.

$$12+18+10$$

1. The given categories account for every observation exactly once.
2. Add the mutually exclusive category counts: $12+18+10$.
3. The requested result is 40.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Independent practice 5

To estimate the whole school’s sports preference, a learner interviews only members of the sports club. Explain a selection problem and propose a better method.

Reference answer

The club may overrepresent sports enthusiasts. Randomly select from the complete school list; a random sample can still fluctuate.

1. Nonmembers have no chance of inclusion in the proposed design.
2. Use a complete frame and equal selection chances instead of voluntary or club-only selection.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Independent practice 6

A survey has counts 15,9,6 for three exclusive categories. Find the first category’s relative frequency.

Reference answer

$\frac{1}{2}$.

$$(15/30)\cdot 1$$

1. The given categories account for every observation exactly once.
2. Use $\frac{15}{30}$ as the relative frequency.
3. The requested result is $\frac{1}{2}$.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Independent practice 7

A random sample of 80 out of 600 pupils contains 24 walkers. Estimate the school’s walker count and label it as an estimate.

Reference answer

Estimated 180 pupils.

$$(24/80) \cdot 600$$

1. The given categories account for every observation exactly once.
2. Use $\frac{24}{80}$ of the stated population to obtain an estimate.
3. The requested result is 180; this is an estimate, not a census count.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Independent practice 8

Which chart best shows how the same place’s daily temperature changes over one week?

A. A histogram without dates.

B. A line chart with ordered dates.

C. A sector chart treating temperatures as parts of one total.

Reference answer

A line chart with ordered dates.

1. The question asks for change over ordered time.
2. A line chart connects successive dates; temperatures are not parts of a total.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Exit question 9

To study pupil heights, 100 pupils are sampled from a school of 800. What is one individual in this investigation?

Reference answer

One pupil’s height observation, not the number 100.

1. The variable being investigated is height.
2. 100 is sample size; one individual observation is one pupil’s height.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Exit question 10

A sample suggests 30% prefer A in a school of 1000, giving an estimate of 300. Must the true count equal 300? Explain.

Reference answer

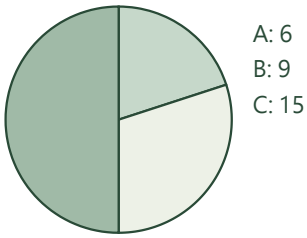
No. A sample estimate can differ from the population count.

1. The estimate uses the sample proportion.
2. A possible true count such as 320 is not ruled out by that estimate alone.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Further practice 11

Counts A=6,B=9,C=15 cover the whole group. Find A’ s central angle.



Use the stated conditions and the labelled scales.

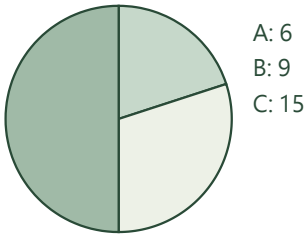
Reference answer

72 °.

$$(6/30) \cdot 360$$

1. The given categories account for every observation exactly once.
2. Use $\frac{6}{30}$ of the full 360° circle.
3. The requested result is 72.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.



Use the stated conditions and the labelled scales.

Further practice 12

A table totals 50 observations; known counts are 12 and 18, with one missing category. Find the missing count.

Reference answer

20.

$$50 - 12 - 18$$

1. Subtract known counts from the total.
2. 50−12−18=20.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Further practice 13

Testing the lifetime of a bulb destroys it. Should a factory test every saleable bulb to estimate lifetime? Give a suitable method.

Reference answer

Use a properly selected sample; a destructive census would leave no tested bulbs saleable.

1. Consider the purpose and cost of a census.
2. Random selection across the production batch is preferable to selecting only one convenient box.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Further practice 14

Two percentages are 40% and 50%. A chart begins its vertical axis at 39%, making visible bar heights 1 and 11. Does this mean the second percentage is eleven times the first?

Reference answer

No. The real ratio is 50/40=5/4, and the truncated baseline exaggerates the visual difference.

1. The visible heights are distances above 39, not the complete percentages.
2. Use the original values when forming a ratio.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Extension 15

Three age groups have population ratio 3:4:3. Choose a sample of 100 proportionally, then randomly within each group. How many from each? Does proportional allocation alone eliminate every possible bias?

Reference answer

30,40,30; no. Selection and nonresponse within each group still matter.

1. The ratio totals 10 parts, so each part is 10 people.
2. Allocate 30,40,30; use a clear random mechanism within each complete group list.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.

Extension 16

A synthetic population has 1000 members, 500 choosing A. Two random samples of 40 contain 19 and 21 A choices. Must one sample have been selected incorrectly? Explain.

Reference answer

No. Both are feasible random outcomes around the population proportion 1/2; variation alone is not proof of biased selection.

1. Each count is possible given 500 A and 500 non-A members.
2. Repeat samples can vary; inspect the selection mechanism separately.

- Use the given conditions and show a justified intermediate step.
- State and check the requested result accurately.