



- 1 There are 800 students at a school.

Mia asks a sample of 40 students how they travel to school. 12 of the students in the sample walk to school.

Work out an estimate for the number of students at the school who walk to school.

(2 marks)

$$\text{Fraction of the sample who walk} = \frac{12}{40}$$

$$\text{Estimate} = 800 \times \frac{12}{40} = 800 \times 0.3 = 240$$

This assumes the sample's proportion is representative of the whole school. It is an estimate, so the actual number may differ

240

- 2 1200 people visited a supermarket one Saturday.

A manager took a sample of 50 of these people. 18 of the people in the sample used a discount voucher.

- Work out an estimate for the total number of people who used a discount voucher that Saturday.
- Write down one assumption you made in working out your estimate.

(3 marks)

$$\text{Fraction of the sample using a voucher} = \frac{18}{50}$$

$$\text{Estimate} = 1200 \times \frac{18}{50} = 1200 \times 0.36 = 432$$

This assumes the sample is representative of all the Saturday shoppers

- 3 Mo wants to find out which sport the students in his school like best. There are 600 students. He asks 5 of his friends in the school football team.

Give two reasons why this is not a good way to choose a sample.

(2 marks)

reason 1

only 5 out of 600 - the sample is too small

reason 2

all in the football team - likely to prefer football

too small and biased

4

A town has 5600 residents.

A council officer asks a sample of 80 residents whether they support a new cycle lane. 28 of the residents in the sample support the cycle lane.

- Work out an estimate for the number of residents of the town who support the cycle lane.
- State one assumption you made. Explain how your estimate would be affected if the assumption is not true.

(3 marks)

$$\text{Fraction of the sample in support} = \frac{28}{80}$$

$$\text{Estimate} = 5600 \times \frac{28}{80} = 5600 \times 0.35 = 1960$$

This assumes the 80 residents are representative of all 5600; if the sample is biased, the estimate could be too high or too low

5

A farm packs apples in batches of 1500.

A quality checker takes a sample of apples from a batch. She finds that 3 out of every 20 apples in the sample are bruised.

- Work out an estimate for the number of bruised apples in the batch.
- Give one reason why the estimate might not be reliable.

(3 marks)

$$\text{Fraction of bruised apples in the sample} = \frac{3}{20}$$

$$\text{Estimate} = 1500 \times \frac{3}{20} = 225$$

If the sample was small or all taken from one part of the batch, it may not represent the whole batch

6

A sports club has 480 members: 192 juniors and 288 seniors.

Grace takes a stratified sample of 50 members, by junior or senior.

Work out how many juniors and how many seniors should be in the sample.

(3 marks)

$$\begin{aligned} \text{juniors} &= \frac{192}{480} \times 50 \\ &= 20 \end{aligned}$$

$$\begin{aligned} \text{seniors} &= \frac{288}{480} \times 50 \\ &= 30 \end{aligned}$$

$$\text{check: } 20 + 30 = 50 \checkmark$$

20 juniors, 30 seniors

7

A television show asks viewers to vote by phone on whether the town should build a new swimming pool. 3000 people phone in and 2400 of them vote yes. The presenter says, "80% of people in the town want a new pool."

Give two reasons why the presenter's statement may not be correct.

(3 marks)

reason 1

only viewers who choose to phone take part - not random

reason 2

people with strong views phone more - biased

the sample is not representative

8

Ben wants to find out how many of the 3400 adults in a village travel to work by car.

a. Ben plans to survey adults standing on the platform at the village railway station at 8 am. Explain why this sample is likely to be biased.

b. Instead, Ben surveys a fair sample of 120 adults from the village. 42 of them travel to work by car.

Work out an estimate for the number of adults in the village who travel to work by car.

(3 marks)

People at the station at 8 am are mostly travelling by train, so the sample would not represent all adults in the village

Fraction of the fair sample using a car = $\frac{42}{120}$

Estimate = $3400 \times \frac{42}{120} = 3400 \times 0.35 = 1190$

9

A leisure centre has 2400 members.

The manager takes a random sample of 60 members.

24 of the members in the sample are female.

15 of the members in the sample are female members who attend a fitness class each week.

a. Work out an estimate for the number of female members of the leisure centre.

b. Work out an estimate for the number of members who are female and attend a fitness class each week.

(3 marks)

Estimate of female members = $2400 \times \frac{24}{60} = 960$

Estimate of female members attending a class = $2400 \times \frac{15}{60} =$

600

10

There are 450 students in Year 9: 240 boys and 210 girls.

Priya wants a stratified sample of 60 students, by gender.

- Work out how many boys and how many girls should be in the sample.
- Priya asks the 32 boys and 28 girls in her sample whether they would join a coding club. 15 of the boys and 14 of the girls say yes. Work out an estimate for the number of Year 9 students who would join the club. Give your answer to the nearest whole number.

(3 marks)

a)

$$\text{boys} = \frac{240}{450} \times 60 = 32$$

$$\text{girls} = \frac{210}{450} \times 60 = 28$$

b)

$$\text{boys: } \frac{15}{32} \times 240 = 112.5$$

$$\text{girls: } \frac{14}{28} \times 210 = 105$$

$$\begin{aligned} \text{total} &= 112.5 + 105 \\ &= 217.5 \end{aligned}$$

a) 32 boys, 28 girls b) about 218

11

A school has 900 students. The head teacher wants a random sample of 30 students.

The names of all the students are on an alphabetical list.

Describe a method she could use to select a random sample of 30 students.

(3 marks)

- number the students 1 to 900
- random number generator: whole numbers 1 to 900
- ignore repeats, until 30 different numbers
- the students with those numbers are the sample

every student has an equal chance

12

A factory fills 5000 jars of jam each day.

One day, a supervisor checks a sample of 150 jars. 6 of the jars in the sample are underfilled.

- Work out an estimate for the number of underfilled jars filled that day.
- The sample of 150 jars was taken during the first hour of production only. Explain why this could make the estimate unreliable.

(3 marks)

$$\text{Fraction underfilled in the sample} = \frac{6}{150}$$

$$\text{Estimate} = 5000 \times \frac{6}{150} = 200$$

Machines can drift or behave differently through the day, so jars filled later may have a different underfill rate to the first hour

13

Jo wants to estimate how many of the 1800 students at her school would buy food from a new salad bar.

She asks a sample of 90 students. 54 of them say they would buy food from the salad bar.

- Work out an estimate for the number of students at the school who would buy food from the salad bar.
- Jo only asked students in Year 7. Explain how this could affect your estimate.
- Describe one way Jo could improve her sample.

(4 marks)

$$\text{Fraction of the sample saying yes} = \frac{54}{90}$$

$$\text{Estimate} = 1800 \times \frac{54}{90} = 1800 \times 0.6 = 1080$$

A sample of only Year 7 students is biased because their preferences may differ from older students

Select students randomly from a list covering all year groups. This reduces the Year 7 selection bias and makes a representative sample more likely, though no random sample is guaranteed to match the population exactly