nexamind EDUCATION

Name _____ Date _____

6.2 Taking a sample — worked answers

Choose a sampling method, understand how sample size affects how much you can trust a result, and recognise bias. · 75 questions

A · Fluency — Sampling fractions, percentages and estimates.

1 A sample of 10 is taken from a school of 500 learners. What percentage of the population is sampled?

Answer: 2

10 ÷ 500 = 0.02, which is 2%.

2 A sample of 25 is taken from a town survey of 1000 households. What percentage of the population is sampled?

Answer: 2.5

25 ÷ 1000 = 0.025, which is 2.5%.

3 A sample of 50 is taken from a club with 200 members. What percentage of the population is sampled?

Answer: 25

50 ÷ 200 = 0.25, which is 25%.

4 A sample of 30 is taken from a year group of 600. What percentage of the population is sampled?

Answer: 5

30 ÷ 600 = 0.05, which is 5%.

5 A sample of 40 is taken from a company with 800 staff. What percentage of the population is sampled?

Answer: 5

40 ÷ 800 = 0.05, which is 5%.

6 A sample of 20 people is chosen from 200. One person in how many is chosen?

Answer: 10

200 ÷ 20 = 10, so one person in every 10.

7 A sample of 15 people is chosen from 300. One person in how many is chosen?

Answer: 20

300 ÷ 15 = 20, so one person in every 20.

8 A sample of 45 people is chosen from 900. One person in how many is chosen?

Answer: 20

900 ÷ 45 = 20, so one person in every 20.

9 A sample of 32 people is chosen from 160. One person in how many is chosen?

Answer: 5
160 ÷ 32 = 5, so one person in every 5.

10 A sample of 18 people is chosen from 360. One person in how many is chosen?

Answer: 20
360 ÷ 18 = 20, so one person in every 20.

11 What kind of sampling is **asking every tenth person on a list**?

☐ random
☐ systematic
☐ convenience

Answer: systematic
It is **systematic** sampling: a fixed rule chooses the members: every 10th one.

12 What kind of sampling is **drawing names out of a hat**?

☐ random
☐ systematic
☐ convenience

Answer: random
It is **random** sampling: every member has the same chance of being chosen.

13 What kind of sampling is **asking your own friends**?

☐ random
☐ systematic
☐ convenience

Answer: convenience
It is **convenience** sampling: you asked whoever was easiest to reach, which is why it is biased.

14 What kind of sampling is **giving every learner a number and using a random number generator**?

☐ random
☐ systematic
☐ convenience

Answer: random
It is **random** sampling: every number is equally likely.

15 What kind of sampling is **asking the first 20 people who walk past the school gate**?

☐ random
☐ systematic
☐ convenience

Answer: convenience
It is **convenience** sampling: it samples only the people who happened to be there.

16 What kind of sampling is **choosing every 5th name on the register**?

☐ random
☐ systematic
☐ convenience

Answer: systematic
It is **systematic** sampling: the rule is fixed and mechanical.

17 A fair dice is rolled 60 times. If each number is equally likely, about how many 1s would you expect?

Answer: 10
Each of the 6 numbers is equally likely, so about 60 ÷ 6 = 10.

18 In a sample of 120, 30 people said yes. What percentage said yes?

Answer: 25
30 ÷ 120 = 0.25 = 25%.

19 In a sample of 200, 50 people said yes. What percentage said yes?

Answer: 25
50 ÷ 200 = 0.25 = 25%.

20 In a sample of 80, 20 people said yes. What percentage said yes?

Answer: 25
20 ÷ 80 = 0.25 = 25%.

21 In a sample of 150, 60 people said yes. What percentage said yes?

Answer: 40
60 ÷ 150 = 0.4 = 40%.

22 In a sample of 250, 100 people said yes. What percentage said yes?

Answer: 40
100 ÷ 250 = 0.4 = 40%.

23 In a sample of 60, 15 people said yes. What percentage said yes?

Answer: 25
15 ÷ 60 = 0.25 = 25%.

24 In a sample of 90, 45 people said yes. What percentage said yes?

Answer: 50
45 ÷ 90 = 0.5 = 50%.

25 In a sample of 400, 100 people said yes. What percentage said yes?

Answer: 25
100 ÷ 400 = 0.25 = 25%.

26 In a sample of 50 people, 20 said yes. Estimate how many of the whole population of 500 would say yes.

Answer: 200
The sample proportion is 20 ÷ 50 = 0.4. Applying it to 500: 0.4 × 500 = 200.

27 In a sample of 40 people, 10 said yes. Estimate how many of the whole population of 400 would say yes.

Answer: 100
The sample proportion is 10 ÷ 40 = 0.25. Applying it to 400: 0.25 × 400 = 100.

28 In a sample of 25 people, 15 said yes. Estimate how many of the whole population of 250 would say yes.

Answer: 150
The sample proportion is 15 ÷ 25 = 0.6. Applying it to 250: 0.6 × 250 = 150.

29 In a sample of 60 people, 24 said yes. Estimate how many of the whole population of 300 would say yes.

Answer: 120

The sample proportion is 24 ÷ 60 = 0.4. Applying it to 300: 0.4 × 300 = 120.

30 In a sample of 30 people, 18 said yes. Estimate how many of the whole population of 600 would say yes.

Answer: 360

The sample proportion is 18 ÷ 30 = 0.6. Applying it to 600: 0.6 × 600 = 360.

31 In a sample of 20 people, 9 said yes. Estimate how many of the whole population of 200 would say yes.

Answer: 90

The sample proportion is 9 ÷ 20 = 0.45. Applying it to 200: 0.45 × 200 = 90.

32 A sample of 30 is taken from a population of 300. What fraction of the population is that? Give the denominator when the fraction is written as 1 over a number.

Answer: 10

30 ÷ 300 = 1 ÷ 10, so the fraction is 1 over 10.

33 A sample of 45 is taken from a population of 450. What fraction of the population is that? Give the denominator when the fraction is written as 1 over a number.

Answer: 10

45 ÷ 450 = 1 ÷ 10, so the fraction is 1 over 10.

34 A sample of 12 is taken from a population of 240. What fraction of the population is that? Give the denominator when the fraction is written as 1 over a number.

Answer: 20

12 ÷ 240 = 1 ÷ 20, so the fraction is 1 over 20.

35 A sample of 36 is taken from a population of 720. What fraction of the population is that? Give the denominator when the fraction is written as 1 over a number.

Answer: 20

36 ÷ 720 = 1 ÷ 20, so the fraction is 1 over 20.

36 A sample of 24 is taken from a population of 120. What fraction of the population is that? Give the denominator when the fraction is written as 1 over a number.

Answer: 5

24 ÷ 120 = 1 ÷ 5, so the fraction is 1 over 5.

37 A survey samples 5% of a population of 400. How many people are in the sample?

Answer: 20

5% of 400 = 20.

38 A survey samples 10% of a population of 350. How many people are in the sample?

Answer: 35

10% of 350 = 35.

39 A survey samples 25% of a population of 160. How many people are in the sample?

Answer: 40

25% of 160 = 40.

40 A survey samples 20% of a population of 450. How many people are in the sample?

Answer: 90
20% of 450 = 90.

41 A survey samples 2% of a population of 5500. How many people are in the sample?

Answer: 110
2% of 5500 = 110.

42 A survey samples 50% of a population of 84. How many people are in the sample?

Answer: 42
50% of 84 = 42.

B · Reasoning — Sample size, bias and what they do and do not fix.

43 What is a population, in statistics?

- ☐ Everyone in a country
- ☐ Every member of the group being studied
- ☐ The people you actually ask
- ☐ The largest group in the data

Answer: Every member of the group being studied
If you are studying Year 7 at your school, that year group is the population — it need not be a country.

44 Why take a sample instead of asking everyone?

- ☐ Samples give better answers
- ☐ Asking everyone is often too slow, too expensive or impossible
- ☐ Samples are always accurate
- ☐ There is no good reason

Answer: Asking everyone is often too slow, too expensive or impossible
A census asks everyone. It gives the most reliable answer but is rarely practical.

45 What happens to the reliability of a result as the sample gets larger?

- ☐ It gets worse
- ☐ It generally gets better
- ☐ It does not change
- ☐ It becomes exact

Answer: It generally gets better
A larger sample is less affected by unusual individuals. It never becomes exact, though — only a census can be that.

46 A sample of 5 learners is used to describe a school of 800. What is the main problem?

- ☐ The sample is too large
- ☐ The sample is far too small to represent the school
- ☐ The learners might lie
- ☐ Nothing is wrong

Answer: The sample is far too small to represent the school
Five people cannot capture the variety in 800. One unusual answer would swing the result completely.

47 What does it mean for a sample to be biased?

- ☐ It is too small
- ☐ Some members of the population are more likely to be chosen than others
- ☐ The data is wrong
- ☐ The question is hard

Answer: Some members of the population are more likely to be chosen than others
A biased sample systematically over-represents part of the population, so the result is misleading however large it gets.

48 You survey favourite sports by asking members of the football club. What is wrong?

- ☐ Nothing
- ☐ The sample is biased towards people who like football
- ☐ The sample is too large
- ☐ Football is not a sport

Answer: The sample is biased towards people who like football
This bias does not go away if you ask more football players — a bigger biased sample is just as wrong.

49 You survey how people travel to work by standing at a bus stop. What is wrong?

- ☐ Nothing
- ☐ Everyone you ask is already a bus user
- ☐ It is too slow
- ☐ Travel is continuous data

Answer: Everyone you ask is already a bus user
Where you sample from decides who can be sampled.

50 Which sample is most likely to represent a whole school fairly?

- ☐ The first 30 learners to arrive
- ☐ 30 learners chosen at random from the register
- ☐ 30 learners from one class
- ☐ Your 30 friends

Answer: 30 learners chosen at random from the register
Random selection gives every learner the same chance, so no group is systematically left out.

51 Does doubling the sample size remove bias?

- ☐ Yes
- ☐ No

Answer: No
Bias comes from **who** is chosen, not how many. Doubling a biased sample doubles the bias.

52 Is a census a sample?

- ☐ Yes
- ☐ No

Answer: No
A census collects data from every member of the population, so nothing is left out.

53 Can a small sample ever give the right answer?

- ☐ Yes
- ☐ No

Answer: Yes
It can, by luck — but you have no way of knowing, which is exactly the problem. A larger sample makes a good answer likely rather than lucky.

54 Two learners survey the same question. Ana asks 20 people and Ben asks 200. Whose result should you trust more, and why?

- ☐ Ana's, because it was quicker
- ☐ Ben's, because a larger sample is less affected by unusual answers
- ☐ Ana's, because small samples are more accurate
- ☐ Neither — sample size does not matter

Answer: Ben's, because a larger sample is less affected by unusual answers
Provided both samples are chosen fairly, the larger one is the more reliable.

C · Challenge — Scaling a sample up to a population.

55 A school has 750 learners. A sample of 1 in 25 is taken. How many learners are in the sample?

Answer: 30
750 ÷ 25 = 30.

56 A sample of 45 is taken from a population of 900. What percentage of the population is that?

Answer: 5
45 ÷ 900 = 0.05 = 5%.

57 In a sample of 80 people, 60% said yes. How many people said yes?

Answer: 48
60% of 80 = 0.6 × 80 = 48.

58 A sample of 200 finds 35% own a bicycle. Estimate how many of the 3000 people in the town own one.

Answer: 1050
35% of 3000 = 0.35 × 3000 = 1050.

59 A sample of 60 learners contains 24 who play an instrument. Estimate the number in a school of 900.

Answer: 360
24 ÷ 60 = 0.4, and 0.4 × 900 = 360.

60 You want a sample of 5% from a population of 1400. How many people should you ask?

Answer: 70
5% of 1400 = 70.

61 A club has 240 members. You take every 8th name. How large is your sample?

Answer: 30
240 ÷ 8 = 30.

62 A survey of shoppers is carried out only on a weekday morning. Name the problem this creates in one word.

Answer: bias
People who work weekdays cannot be sampled, so the sample is biased.

63 A sample of 10 gives 70% yes. A sample of 500 gives 52% yes. Which estimate is more trustworthy?

- ☐ The 70%, because it is a bigger percentage
- ☐ The 52%, because it came from a much larger sample
- ☐ Both equally
- ☐ Neither

Answer: The 52%, because it came from a much larger sample
With only 10 people, one extra yes changes the answer by 10 percentage points.

D · Word problems — Sampling in the real world.

64 A town has 5000 residents. A survey samples 2%. How many people are surveyed?

Answer: 100
2% of 5000 = 100.

65 A factory makes 2000 bulbs a day and tests 1 in 40. How many bulbs are tested?

Answer: 50
2000 ÷ 40 = 50.

66 In a taste test, 18 of 30 people preferred brand A. What percentage preferred brand A?

Answer: 60
18 ÷ 30 = 0.6 = 60%.

67 A survey of 400 households finds 300 have internet. What percentage is that?

Answer: 75
300 ÷ 400 = 0.75 = 75%.

68 A sample of 50 fish from a lake contains 8 trout. Estimate the number of trout in a population of 2000 fish.

Answer: 320
8 ÷ 50 = 0.16, and 0.16 × 2000 = 320.

69 A quality check tests 1 in 20 of the 600 items made. How many items are tested?

Answer: 30
600 ÷ 20 = 30.

70 A school of 1200 surveys 1 in 15 learners. How large is the sample?

Answer: 80
1200 ÷ 15 = 80.

71 Of 250 people asked, 40% walk to work. How many people is that?

Answer: 100
40% of 250 = 100.

72 A poll of 800 voters finds 456 support a plan. What percentage is that?

Answer: 57
456 ÷ 800 = 0.57 = 57%.

73 A farmer weighs 25 of 500 sheep. What percentage of the flock is weighed?

Answer: 5
25 ÷ 500 = 0.05 = 5%.

74 A researcher surveys online only. Which group is likely to be left out?

- ☐ Young people
- ☐ People without internet access
- ☐ People who like surveys
- ☐ Nobody

Answer: People without internet access

The method of contact decides who can possibly answer.

75 A TV show asks viewers to phone in with their opinion. Why might the result be misleading?

- ☐ The phone lines are slow
- ☐ Only people who feel strongly and watch that show will call
- ☐ Too many people call
- ☐ Phoning is expensive

Answer: Only people who feel strongly and watch that show will call

This is self-selection, one of the commonest sources of bias.