

MATHS



MODEL ANSWERS

SAMPLING TECHNIQUES

SCORE

/153

PERCENTAGE

%

STEM UP

- 1 The 160 students are numbered 1 to 160. The first person chosen is number 4, then every 8th person after that is chosen until 20 people have been chosen.
Name the sampling method that has been used.

Systematic sampling: People are chosen at a regular interval (every 8th one) from an ordered list, starting from a random place

Systematic sampling

/ 1

- 2 A systematic sample takes every 24th person from a list of 1440 customers.
Work out the size of the sample.

sample size = $1440 \div 24 = 60$

60

/ 2

- 3 Give one advantage of simple random sampling.

Every member of the population has an equal chance of being chosen, so there is no bias in the selection

Equal chance for everyone

/ 2

- 4 A teacher wants to know how all students in a school travel to school. She asks only the students in her own Year 11 class.

Give a reason why this sample may be biased.

Only one year group (class) is asked, so students of other ages are not represented

Only one class asked

/ 2

- 5 A systematic sample takes every 6th person from a list of 300 customers.

Work out the size of the sample.

sample size = $300 \div 6 = 50$

50

/ 2

- 6 A council surveys residents about a new leisure centre.

Give one disadvantage of stratified sampling.

You need to know the size of every group in the population, and it takes more time and effort to organise

Needs group sizes; more work

/ 2

- 7 A researcher wants the views of all adults in a town. She stands outside a library at 10 am on a Wednesday and asks people as they walk past.
Give a reason why this sample may be biased.

People at a library on a weekday morning are not typical of all adults (for example, people at work are missed)

Not typical of all adults

/ 2

- 8 A raffle has 500 tickets sold and one winner is chosen to win a prize.
Which sampling method (random, systematic or stratified) is most suitable? Give a reason for your answer.

Every ticket must have an equal chance of winning

Random sampling

/ 2

- 9 Give one disadvantage of systematic sampling.

It can be biased if there is a pattern in the list that matches the interval, and a full list is needed

Bias if a pattern matches the interval

/ 2

- 10 A website asks its users to vote online on whether a football match was fair. The votes are counted from the first 100 people who vote.

Give a reason why this sample may be biased.

Only people who visit the site and choose to vote are included, so the sample is self-selected and not representative

Self-selected, not representative

2 / 2

- 11 A computer picks the 20 winners of a prize draw from a list of 8000 customers. Which sampling method (random, systematic or stratified) is most suitable? Give a reason for your answer.

Each customer has an equal chance of being picked

Random sampling

2 / 2

- 12 A company numbers its employees by department. Each department has exactly 10 people and its manager is number 1 in the department list. A sample is taken by choosing every 10th employee, starting at number 1.

Explain why this may not be a suitable sampling method.

Every manager (and nobody else) would be chosen, so the sample is not representative of all employees

Only managers chosen

2 / 2

- 13 A company has a list of 600 employees.

Describe how the company could take a simple random sample of 50 employees.

*give each person a different number from 1 to 600
generate 50 random numbers between 1 and 600, ignoring repeats
select the people with these numbers*

*Number them; random numbers;
choose*

/ 3

- 14 A school has 1000 students: 300 in Year 7, 250 in Year 8, 200 in Year 9, 150 in Year 10 and 100 in Year 11. A survey of 100 students is needed that fairly represents every year.

Which sampling method (random, systematic or stratified) is most suitable? Give a reason for your answer.

Each year group is represented in proportion to its size

Stratified sampling

/ 2

- 15 A cafe manager surveys one customer every 7 days, starting on a Monday, and chooses every 7th day.

Explain why this may not be a suitable sampling method.

Choosing every 7th day always gives the same day of the week, so the sample could be biased because other days are never included

Same weekday every time

/ 3

- 16 A school has 475 students. The numbers in the groups are 175 Year 9, 50 Year 10 and 250 Year 11. A sample of 19 is chosen. The sample has 7 from Year 9, 2 from Year 10 and 10 from Year 11, selected at random from each group.

(a) Name the sampling method that has been used.

(b) Give a reason for your answer.

(b) The sample contains each group in proportion to its size in the population

(a) Stratified sampling

3 / 3

- 17 A school has a list of 800 students.

Describe how the company could take a simple random sample of 30 students.

give each person a different number from 1 to 800

generate 30 random numbers between 1 and 800, ignoring repeats

select the people with these numbers

Number them; random numbers; choose

3 / 3

- 18 A factory machine fits a faulty part to every 5th item it makes. A quality controller checks every 5th item, starting with the first item.

Explain why this may not be a suitable sampling method.

The faulty part is on exactly every 5th item, so the sample may always or never include the faulty items

The pattern matches the interval, so the sample is biased

Pattern matches the interval

3 / 3

- 19 A school has many more students in Year 7 than in Year 11. Explain why a stratified sample may be better than a simple random sample for a survey of the whole school.

*A simple random sample might include too few
(or too many) students from one year group
A stratified sample includes each year group in
proportion to its size, so it is more
representative*

Each year fairly represented

/ 3

- 20 A shop has a list of 300 customers.
Describe how the company could take a simple random sample of 30 customers.

*give each person a different number from 1 to
300
generate 30 random numbers between 1 and
300, ignoring repeats
select the people with these numbers*

*Number them; random numbers;
choose*

/ 3

- 21 200 people are chosen at random from the 3000 residents of a town and asked if they support a new bypass. 127 say they support it.
Estimate the number of residents who support the bypass.

$$127 \div 200 \times 3000 = 1905$$

1905

/ 3

- 22 Explain the difference between a simple random sample and a stratified sample.

In a simple random sample everyone in the population has an equal chance of being chosen from the whole list

In a stratified sample the population is split into groups and a random sample is taken from each group in proportion to its size

*Random: whole list; stratified:
groups in proportion*

/ 3

- 23 A company has a list of its 160 employees in alphabetical order.
Describe how to take a systematic sample of 20 employees from the list.

$$k = 160 \div 20 = 8$$

choose a random starting person from the first 8

then every 8th person after that until the end of the list

k = 8; random start; every 8th

/ 3

- 24 A random sample of 40 customers is asked if they like a new flavour of crisps. 23 say yes.
A shop has 1000 customers. Estimate the number of customers who like the new flavour.

$$23 \div 40 \times 1000 = 575$$

575

/ 3

- 25 A manager has a numbered list of 900 customers and needs a sample of 30. Explain why a systematic sample is easier to take than a simple random sample.

A systematic sample only needs one random number to start, then every 30th customer is chosen

A simple random sample needs 30 different random numbers to be generated and checked

Only one random number needed

/ 3

- 26 A shop has a list of its 480 customers in alphabetical order.
Describe how to take a systematic sample of 40 customers from the list.

$$k = 480 \div 40 = 12$$

choose a random starting person from the first 12

then every 12th person after that until the end of the list

$k = 12$; random start; every 12th

/ 3

- 27 The 250 members of a club are numbered 1 to 250.
These random numbers were generated: 983, 059, 245, 270, 059, 221, 180, 167.
Use the numbers, in order, to choose a random sample of 3 members. Ignore any number that cannot be used.

983 and 270 is more than 250 so cannot be used

*059 is a repeat so ignore it
sample = 059, 245, 221*

059, 245, 221

/ 3

- 28 A college has 600 students on four courses. The table shows the numbers in each group. A stratified sample of 24 is to be taken. Complete the table to show the number to be sampled from each group.

	Art	Science	Sport	Total
Number of students	150	325	125	600
Number in sample	6	13	5	24

$$150 \div 600 \times 24 = 6$$

$$325 \div 600 \times 24 = 13$$

$$125 \div 600 \times 24 = 5$$

3 / 3

- 29 A school has a list of its 240 students in alphabetical order. Describe how to take a systematic sample of 30 students from the list.

$$k = 240 \div 30 = 8$$

choose a random starting person from the first 8

then every 8th person after that until the end of the list

$k = 8$; random start; every 8th

3 / 3

- 30 The 400 students of a club are numbered 1 to 400. These random numbers were generated: 209, 640, 272, 209, 453, 180, 070, 233. Use the numbers, in order, to choose a random sample of 3 students. Ignore any number that cannot be used.

640 and 453 is more than 400 so cannot be used

209 is a repeat so ignore it

sample = 209, 272, 180

209, 272, 180

3 / 3

- 31 A supermarket has 640 customers on its loyalty scheme. The table shows the numbers in each group.

A stratified sample of 32 is to be taken.

Complete the table to show the number to be sampled from each group.

	25 to 44	45 to 64	65 or over	Total
Number of customers	200	200	240	640
Number in sample	10	10	12	32

$$200 \div 640 \times 32 = 10$$

$$200 \div 640 \times 32 = 10$$

$$240 \div 640 \times 32 = 12$$

3 / 3

- 32 A hospital has 1280 staff. The numbers in each group are 170 doctors, 400 nurses, 310 porters and 400 admin.

A stratified sample of 80 is to be taken.

Work out the number to be sampled from each group, to the nearest whole number.

$$170 \div 1280 \times 80 = 10.63 = 11$$

$$400 \div 1280 \times 80 = 25.00 = 25$$

$$310 \div 1280 \times 80 = 19.38 = 19$$

$$400 \div 1280 \times 80 = 25.00 = 25$$

$$\text{total} = 80$$

Doctors: 11, Nurses: 25, Porters:
19, Admin: 25

3 / 3

- 33 A club has 195 members. A stratified sample is taken. The sample includes 6 from the Under 18 group and 7 from the other group.

There are 90 members in the Under 18 group.

Work out the total size of the sample.

$$90 \div 6 = 15, \text{ so } 1 \text{ in every } 15 \text{ is sampled}$$

$$195 \div 15 = 13$$

13

3 / 3

- 34 A hospital has 950 staff. The table shows the numbers in each group.
A stratified sample of 38 is to be taken.
Complete the table to show the number to be sampled from each group.

	Doctors	Nurses	Porters	Admin	Total
Number of staff	350	150	150	300	950
Number in sample	14	6	6	12	38

$$350 \div 950 \times 38 = 14$$

$$150 \div 950 \times 38 = 6$$

$$150 \div 950 \times 38 = 6$$

$$300 \div 950 \times 38 = 12$$

3 / 3

- 35 A company has 470 employees. The numbers in each group are 85 sales, 170 admin and 215 production.
A stratified sample of 50 is to be taken.
Work out the number to be sampled from each group, to the nearest whole number.

$$85 \div 470 \times 50 = 9.04 = 9$$

$$170 \div 470 \times 50 = 18.09 = 18$$

$$215 \div 470 \times 50 = 22.87 = 23$$

$$\text{total} = 50$$

Sales: 9, Admin: 18, Production:
23

3 / 3

- 36 A stratified sample is taken from 110 customers. There are 45 customers in the 45 to 64 group and 65 in the other group.
9 of the customers from the 45 to 64 group are in the sample.
Work out the number from the other group in the sample.

$$45 \div 9 = 5 \text{ from each } 5$$

$$\text{other group: } 65 \div 5 = 13$$

13

3 / 3

- 37 The 600 members of a company are numbered 1 to 600.
A systematic sample of 50 is taken. The first person chosen is number 2.
(a) Write down the numbers of the next three people chosen.
(b) Work out the number of the last person chosen.

$$(a) k = 600 \div 50 = 12$$

$$2 + 12 = 14, 14 + 12 = 26, 26 + 12 = 38$$

$$(b) 2 + 12 \times 49 = 590$$

(a) 14, 26, 38 (b) 590

4 / 4

- 38 A sports club has 1230 members. The numbers in each group are 200 under 18, 410 18 to 40, 370 41 to 60 and 250 over 60.
A stratified sample of 50 is to be taken.
Work out the number to be sampled from each group, to the nearest whole number.

$$200 \div 1230 \times 50 = 8.13 = 8$$

$$410 \div 1230 \times 50 = 16.67 = 17$$

$$370 \div 1230 \times 50 = 15.04 = 15$$

$$250 \div 1230 \times 50 = 10.16 = 10$$

$$\text{total} = 50$$

Under 18: 8, 18 to 40: 17, 41 to 60: 15, Over 60: 10

3 / 3

- 39 A stratified sample is taken from 136 staff. There are 56 staff in the Nurses group and 80 in the other group.
7 of the staff from the Nurses group are in the sample.
Work out the number from the other group in the sample.

$$56 \div 7 = 8 \text{ from each } 8$$

$$\text{other group: } 80 \div 8 = 10$$

10

3 / 3

- 40 A school has 400 students. The table shows the number of boys and the number of girls in each year group.

A stratified sample of 80 students is taken. The sample is stratified by year group and by gender.

Work out the number of girls from Year 7 in the sample.

	Year 7	Year 8	Year 9
Boys	80	100	70
Girls	70	60	20

$$70 \div 400 \times 80 = 14$$

14

4 / 4

- 41 The 480 houses of a company are numbered 1 to 480.

A systematic sample of 40 is taken. The first person chosen is number 9.

(a) Write down the numbers of the next three people chosen.

(b) Work out the number of the last person chosen.

$$(a) k = 480 \div 40 = 12$$

$$9 + 12 = 21, 21 + 12 = 33, 33 + 12 = 45$$

$$(b) 9 + 12 \times 39 = 477$$

(a) 21, 33, 45 (b) 477

4 / 4

- 42 There are 70 students in Year 10 and 30 in Year 11.

Iwan wants a stratified sample of 10. Iwan takes 5 from each group at random.

Is the sample stratified? Show how you decide.

$$\text{Year 10: } 70 \div 100 \times 10 = 7$$

$$\text{Year 11: } 30 \div 100 \times 10 = 3$$

5 from each is not in proportion

No: 7 and 3 needed

4 / 4

- 43 A school has 420 students. The table shows the number of boys and the number of girls in each year group.

A stratified sample of 60 students is taken. The sample is stratified by year group and by gender.

Work out the number of boys from Year 9 in the sample.

	Year 7	Year 8	Year 9
Boys	120	20	70
Girls	20	100	90

$$70 \div 420 \times 60 = 10$$

10

4 / 4

- 44 A company has 330 staff. 120 work in Sales and 140 work in Admin. The rest work in Production.

A stratified sample of 33 is taken.

Work out the number of staff who work in Production in the sample.

$$\text{third group} = 330 - 120 - 140 = 70$$

$$70 \div 330 \times 33 = 7$$

7

4 / 4

- 45 There are 120 employees in the sales team and 240 in the office team.

Mari wants a stratified sample of 18. Mari takes 9 from each group at random.

Is the sample stratified? Show how you decide.

$$\text{the sales team: } 120 \div 360 \times 18 = 6$$

$$\text{the office team: } 240 \div 360 \times 18 = 12$$

9 from each is not in proportion

No: 6 and 12 needed

4 / 4

- 46 A college has 130 students. 30 study Arts and 40 study Science. The rest study Sport.
A stratified sample of 26 is taken.

Work out the number of students who study Sport in the sample.

$$\begin{aligned} \text{third group} &= 130 - 30 - 40 = 60 \\ 60 \div 130 \times 26 &= 12 \end{aligned}$$

12

5 / 5

- 47 A college has 800 students. 200 study Arts and 350 study Science. The rest study Sport.
A stratified sample of 32 is taken.

Work out the number of students who study Sport in the sample.

$$\begin{aligned} \text{third group} &= 800 - 200 - 350 = 250 \\ 250 \div 800 \times 32 &= 10 \end{aligned}$$

10

5 / 5

- 48 A company has 750 staff. 175 work in Sales and 275 work in Admin. The rest work in Production.

A stratified sample of 30 is taken.

Work out the number of staff who work in Production in the sample.

$$\begin{aligned} \text{third group} &= 750 - 175 - 275 = 300 \\ 300 \div 750 \times 30 &= 12 \end{aligned}$$

12

5 / 5

- 49 A college has 520 students. 80 study Arts and 260 study Science. The rest study Sport.
A stratified sample of 26 is taken.

Work out the number of students who study Sport in the sample.

$$\text{third group} = 520 - 80 - 260 = 180$$

$$180 \div 520 \times 26 = 9$$

9

5 / 5

- 50 A college has 360 students. 120 study Arts and 150 study Science. The rest study Sport.
A stratified sample of 36 is taken.

Work out the number of students who study Sport in the sample.

$$\text{third group} = 360 - 120 - 150 = 90$$

$$90 \div 360 \times 36 = 9$$

9

5 / 5