

Name	Date started	Target end date

WJEC GCSE Mathematics and Numeracy (Double Award) – Question Pack

Sampling techniques in context: random, systematic, stratified, opportunity and quota samples. Sourced from legacy WJEC GCSE Mathematics and Mathematics

REVISE
.wales

1.16 – Sampling techniques in context

Spec 1.7.4 – Unit 1 (calculator allowed)

Sampling techniques in context: random, systematic, stratified, opportunity and quota samples. Sourced from legacy WJEC GCSE Mathematics and Mathematics-Numeracy Higher papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~1 hours 6 minutes

Derived from the GCSE Higher pace of ~1.5 min/mark (44 marks across 12 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

A calculator is allowed on every question in this pack (Unit 1 is the calculator-allowed paper).

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Sampling techniques in context – what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 1: calculator-allowed.

Random sampling 1.7.4

- Every member equally likely to be chosen.
- Use random numbers / random number tables.
- Reduces selection bias; needs a sampling frame.

Systematic sampling 1.7.4

- Pick every k -th item from an ordered list.
- $k = N/n$ where N = population, n = sample size.
- Watch for periodicity in the underlying list.

Stratified sampling 1.7.4

- Divide population into strata (subgroups).
- Sample from each stratum proportionally:
(stratum/total) $\times n$.
- Round sensibly so the strata sizes sum to n .

Opportunity & quota 1.7.4

- Opportunity: ask whoever is convenient – cheap, biased.
- Quota: fix subgroup targets, fill them however.
- Always explain limitations and likely bias.

Sampling techniques in context in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

Random sample

Every member of the population has an *equal* chance of being picked.

Use random numbers or a hat draw.

Best for avoiding bias.

Systematic sample

Pick every k -th person from an ordered list.

k = population \div sample size.

Risk: hidden patterns aligned with k cause bias.

Stratified sample

$$\text{stratum size} = \frac{\text{stratum}}{\text{total}} \times n$$

Sample proportionally from each subgroup.

Each stratum contributes its fair share.

Opportunity (convenience)

Ask whoever is easy to reach.

Quick and cheap but heavily biased.

E.g. people in the local shop \neq whole town.

Quota sampling

Fix targets for each subgroup (e.g. 10 men, 10 women) then ask whoever fits.

Not random but ensures coverage.

Common traps

- Confusing systematic with random.
- Rounding stratified counts wrongly – check totals add to n .
- Not stating WHY a method is biased.

9. Circle TRUE or FALSE for each of the following statements.

[2]

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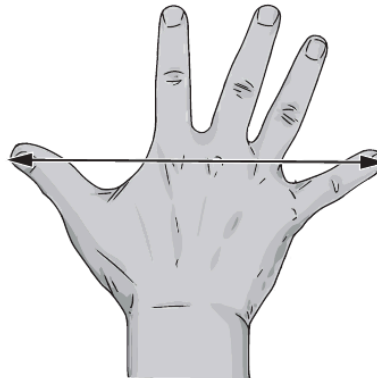
Selecting the first name on each class register will give a random sample.	TRUE	FALSE
The ratio of boys to girls in a school is 2 : 3. The pupil committee of 30 pupils is selected using a gender stratified sample. There are 10 boys and 20 girls on the school committee.	TRUE	FALSE
A telephone survey is carried out to find which political party people support. The sample of people surveyed is not a random sample of the whole population.	TRUE	FALSE
A stratified sample always considers proportions according to given criteria.	TRUE	FALSE
A random sample of people means everyone has an equal chance of being selected.	TRUE	FALSE



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7. Simon plans to make gloves.

(a) One morning, Simon decided to carry out a survey to find the mean hand span of people in Wales.



He decided to sample systematically.
He decided to sample from the first 240 people who pass him in the street during the morning.

He wanted to take 20 people's hand span measurements.
Explain how Simon could use systematic sampling to obtain 20 measurements. [1]

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Examiner
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9. An engineering company employs 85 staff.
The company plans to carry out a survey on staff health.
It will conduct the survey using a sample of 15 of its staff, stratified by job type.

(a) Circle either TRUE or FALSE for each statement given below.

[2]

STATEMENT		
Choosing every 4th person on an alphabetical list of office staff is a suitable method of randomly choosing the office staff required for the sample.	TRUE	FALSE
Numbering the cleaning staff, placing the numbers in a hat and drawing out numbers at random is a suitable method of choosing the cleaners required for the sample.	TRUE	FALSE
There are 9 managers employed by the company. The calculation to find the number of managers in the sample is $\frac{9}{85} \times 15 = 1.59$. This answer means there will definitely be 2 managers in the sample.	TRUE	FALSE
The proportion of the staff in each job type in the sample will be exactly the same as the proportion of the staff in each job type in the company as a whole.	TRUE	FALSE

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- (b) 50 engineers are employed by the company.
Use the following extract from a table of random digits to choose 9 engineers for the sample.
You must start with the first number in the list.
Describe clearly how you are using the numbers to select the sample. [3]

29974 55479 07248 33999 17038 02475 49979 01218

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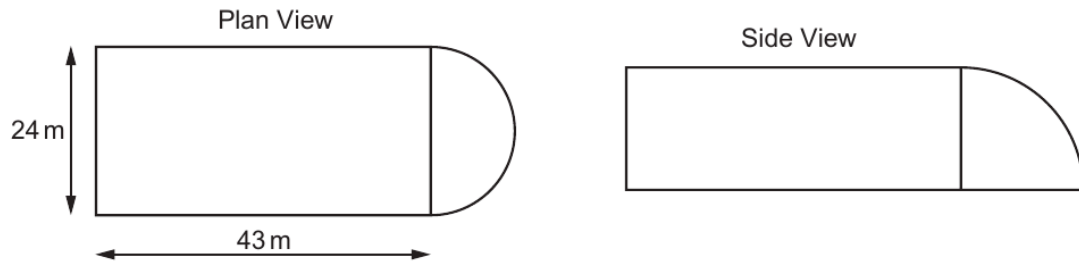
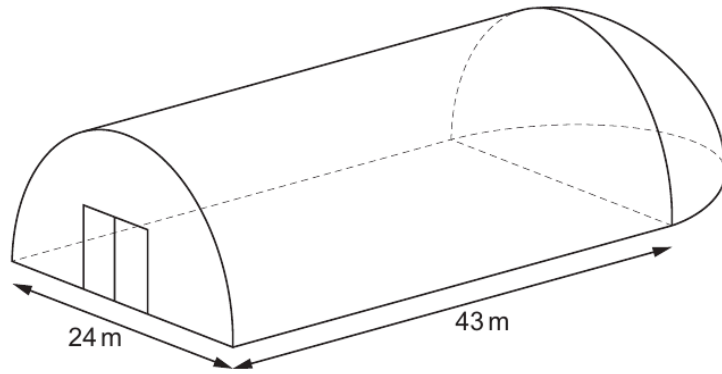
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- (c) The engineering company has a storage building, as shown below. The building is in the form of half a cylinder, with half a hemisphere attached at one end.



Diagrams not drawn to scale

The company needs to paint all the exterior surfaces of the building, including the doors.

The measurements on the diagram are given **correct to the nearest metre**.
The paint comes in tins that cover an area of 40 m^2 , **correct to the nearest m^2** .

Calculate the smallest number of tins that would guarantee having enough paint to cover these exterior surfaces. [8]

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10. Each of the 250 Year 10 pupils in Blaengwyn school study one foreign language at GCSE. The table below shows how many pupils chose to study French, German and Spanish.

French	German	Spanish
75	55	120

The Languages department is planning to take a group of 30 pupils on an educational trip to Europe.

Use a stratified sampling method to calculate the number of Year 10 pupils from each language group that should be taken on the trip. You must show all your working. [4]

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Language	French	German	Spanish
Number in sample			



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6. The Anglesey Show is a two-day event held every August.

(a) On the first day, a random sample of 2000 visitors at the show were asked:



640 of them answered 'Yes'.

What was the relative frequency of those who answered 'Yes'?
Give your answer as a decimal.

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(b) On the second day a random sample of 3000 visitors at the show were asked the same question.
The relative frequency of those who answered 'Yes' on this day was 0.42.

Calculate the relative frequency of those who said they lived on Anglesey when the samples for **both** days were combined.
Give your answer as a decimal.

[4]

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(c) Which of the following is most likely to give the best estimate for the relative frequency of visitors to the show living on Anglesey?
Circle your answer.

Your answer
to part (a)

0.42

Your answer
to part (b)

You **must** give an explanation for your choice.

[1]

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11. (a) Alun is a jeweller.
He is designing a symmetrical pendant, as shown below.

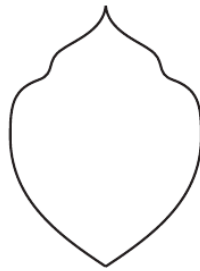
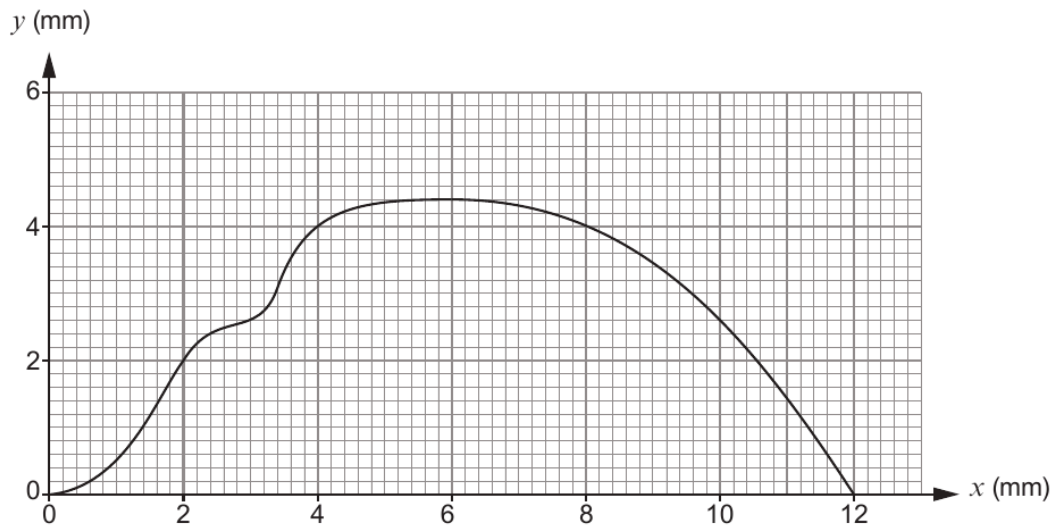
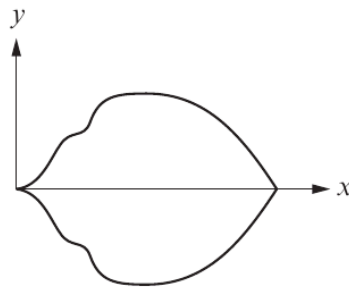


Diagram not drawn to scale

The pendant will be made from solid silver, with a uniform thickness of 3 mm.
In order to calculate the cost of making the pendant, Alun wants to calculate an estimate of the volume of the pendant.

He has accurately drawn one of the symmetrical halves of the shape on graph paper.



Calculate an estimate of the volume of the whole pendant.
Use the graph opposite, with 6 strips of equal width.

[5]

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(c) Alun has 5 identical metal cylinders, each of length 40 mm.

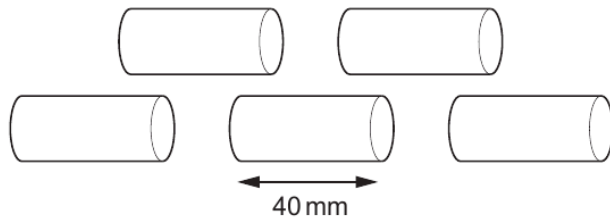


Diagram not drawn to scale

He has been asked to make a solid sphere of radius 30 mm.

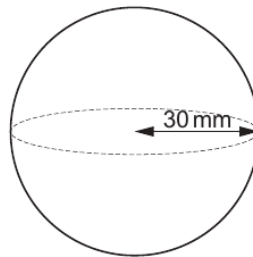


Diagram not drawn to scale

He melts the 5 cylinders and recasts all the metal to make the sphere.

Calculate the radius of each of the cylinders.

Give your answer in mm, in the form $a\sqrt{b}$, where a and b are integers, and b is as small as possible. [6]

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2. Delyth and Ronnie are both students at the local college.
- (a) Their houses and the college are all joined by straight roads, as shown in the diagram.

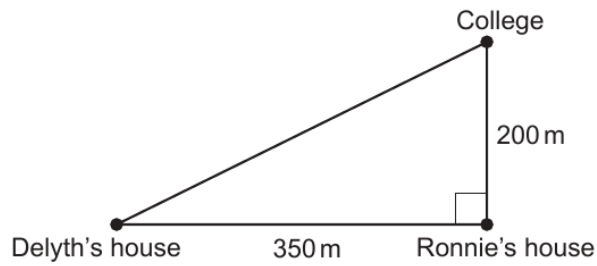


Diagram not drawn to scale

Delyth usually walks directly to college.
Calculate how much further Delyth has to walk if she passes Ronnie's house on her way to college. [5]

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- (b) 35 students were asked how far they travelled to the college. The results are recorded in the table below.

Distance, d (metres)	Frequency
$100 < d \leq 200$	9
$200 < d \leq 1000$	10
$1000 < d \leq 3000$	15
$3000 < d \leq 7000$	1

- (i) Ronnie is one of these 35 students. He walks 200 m directly to college.

Does Ronnie travel further than the median distance travelled by these 35 students?

Yes No Can't tell

You must give a reason for your answer.

[1]

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- (ii) Calculate an estimate of the mean distance these 35 students travelled to the college.

[4]

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Estimate of the mean distance travelled by these 35 students is m



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(c) There are 140 students who travel by bus to and from college.

Delyth wants to find out why these students do not walk to college. She has decided to use a systematic sampling method to select 7 of these students to form a discussion group.

The names of all the 140 students are in a list. Delyth has randomly selected the 2nd student in the list to join the discussion group.

Complete the table below to give the positions in the list of the 7 students selected to join the discussion group. [2]

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Student	1	2	3	4	5	6	7
Position in the list	2nd



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8. Form-A-Part is a company that makes metal parts for use in engineering.

- (a) A metal part is made from a circular disc with a piece cut out. The part has uniform thickness, a diameter of 60 mm, and centre O. The diagram below shows the cross-section of the metal part.

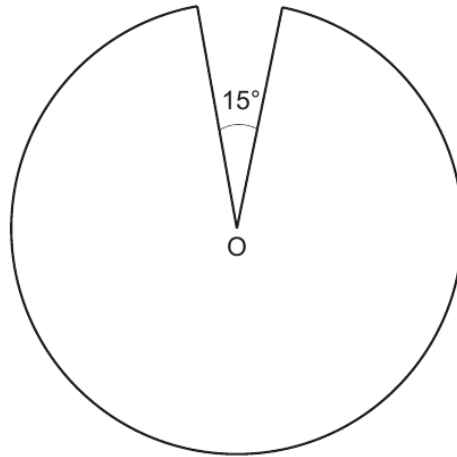


Diagram not drawn to scale

Calculate the perimeter of the cross-section of this metal part.
Give your answer correct to the nearest millimetre.

[3]

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Perimeter of the metal part is mm, correct to the nearest millimetre.



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- (c) Form-A-Part has decided to randomly sample these 20 000 metal parts to check their quality.

Use the following list of random numbers to select the first 5 parts for the sample. You must start with the first number in the list.

Explain clearly how you are using the numbers to select the sample. [3]

66923	01325	58552	86923
48925	72712	58033	18266
95775	51056	01325	81036
05929	10429	26883	45630
88925	24800	02891	38441

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The 5 parts selected will be

1st 2nd 3rd

4th 5th



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7. Isaac and his sister Mari are both going to open savings accounts.
- (a) Isaac decides to invest some of his savings in the Hereford Saver account. Details of the account are shown below.

Hereford Saver account
Monthly interest rate 0.26%

Calculate the AER that the Hereford Saver account offers.
Give your answer as a percentage.

[2]

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- (b) Mari invests £3000 in the Silver Plus savings account.
Details of the account are shown below.

Account name	Nominal annual rate	Interest paid
Silver Plus	2.48%	Quarterly

Mari does not withdraw any money or make any further payments into the account.
Mari closes the account after 10 years.

Calculate the percentage increase in the value of her investment.
You must show all your working.

[5]

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- (ii) The length of wire needed for the hooked part of this hanger is $0.1\dot{3}$ of the total length of wire needed for a hanger.

Write $0.1\dot{3}$ as a fraction in its simplest form.

[3]

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- (b) Hang-Up makes metal hangers in batches of 80. Every 3 hours, it randomly samples 8 hangers from one batch of 80 for quality assurance.

The following numbers are taken from a table of random digits.

299986 890791 810130 955579 268884 301244

Use these numbers to choose 8 hangers from a batch of 80 hangers. You must start with the first number in the list. Describe clearly how you use the numbers to select the sample.

[3]

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Hangers chosen:

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- (c) Hang-Up also makes plastic hangers of various sizes. Two of its plastic hangers have main parts that are mathematically similar. These are shown below.



Diagram not drawn to scale

The total surface area of the larger hanger is 1.44 times the total surface area of the smaller hanger.

The height of the smaller hanger is 9 cm.
Calculate the height of the larger hanger.

[3]

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