



Enquiry cycle, data types and grouping

About 85 minutes

Calculator allowed 97 marks

Date _____

A Do Now

The first two are what this chapter needs. The rest bring back earlier chapters so nothing is forgotten.

A1 Needed today [2 marks]

A class has 8 boys and 16 girls. The boys' mean test mark is 62 and the girls' mean test mark is 71. Find the mean mark for the whole class.

Answer

A2 Needed today [2 marks]

In a sale, all prices are reduced by 10%. A coat costs £234 in the sale. What was its price before the sale?

Answer

A3 Maths skill [2 marks]

A bag holds only red, blue and green counters. $P(\text{red}) = 0.4$ and $P(\text{blue}) = 0.55$. There are 300 counters in the bag. How many are green?

Answer

Given that $34 \times 15 = 510$, work out $510 \div 0.15$.

Answer

Write 0.375 as a fraction in its simplest form.

Answer

B Examples, then your turn

Your teacher works through each example with you. Then try the one beside it on your own.

EXAMPLE 1

A library manager thinks children borrow more books in the school holidays than in term time. Write a hypothesis she can test, and say what data she should collect.

Hint A hypothesis is a statement that data can show to be true or false.

B1 A sports centre manager [2 marks]

thinks the pool is busier on wet days than on dry days. Write a hypothesis he can test, and say what data he should collect.

EXAMPLE 2

Hypothesis: a greater proportion of Riverside gym members than Hillside gym members go at least twice a week. 84 of 240 Riverside members and 66 of 165 Hillside members do. Does this support the hypothesis?

Hint The groups are different sizes, so compare percentages.

B2 Hypothesis: a smaller [3 marks]

proportion of drivers over 60 than of drivers aged 17 to 30 break the speed limit. A camera records 18 of 150 drivers over 60 and 39 of 260 drivers aged 17 to 30 breaking it. Does this support the hypothesis? Show your working.

EXAMPLE 3

A garden centre records, for each plant, its type, its height in cm, its number of flowers and its quality grade (A, B or C). Give the type of data for each.

Hint Words or numbers? If numbers: counted or measured?

B3 A dentist records, for each patient, the number of fillings, the time in the chair in minutes, the blood group, and how nervous they are (not, a little, very). Give the type of data for each. [2 marks]

EXAMPLE 4

12 waiting times at a bank, in minutes:
3.5, 7.2, 12.0, 4.8, 9.6, 15.3, 6.0, 11.4, 2.9, 8.0, 13.7, 10.1

Group them into three equal classes from 0 to 18 minutes, using inequality signs, and find each frequency.

Hint Width $18 \div 3 = 6$. Where do 6.0 and 12.0 go?

B4 15 dog walks lasted, in minutes:
22, 35, 48, 30, 27, 41, 56, 33, 40, 25, 52, 38, 45, 29, 31
Group them into four equal classes from 20 to 60 minutes, using inequality signs, and find each frequency. [3 marks]

EXAMPLE 5

The ages of 30 club members are grouped 20–29 (7 members), 30–39 (12), 40–49 (8), 50–59 (3). Can you find the range? What is the greatest it could be?

Hint What are the youngest and oldest ages the table allows?

B5 The numbers of pages in 18 books are grouped 100–149 (4 books), 150–199 (9), 200–299 (5). Explain why the range cannot be found from the table, and work out the greatest it could be. [2 marks]

EXAMPLE 6

Ana uses population figures from the government census website. Give one advantage and one disadvantage of using this secondary data.

Hint Think about cost and time, and about when and why it was collected.

B6 Kofi is investigating how much water households in his town use. He uses a figure from an advert for a water-filter company. Give two reasons why this figure may not be suitable. [2 marks]

C Practice

Each question asks for something different. Show your working.

C1 Ifan has collected his data and is now working out the mean for each group. Which stage of the enquiry cycle is he at? Name the stage that comes next. [2 marks]

C2 Erin writes the hypothesis "Do older trees have thicker trunks?" Explain why this is not a suitable hypothesis, and rewrite it. [2 marks]

C3 A school counsellor plans to survey students about bullying. State an ethical problem with this survey, and suggest how the counsellor could deal with it. [2 marks]

C4 Which of these are continuous data? the mass of a cat, the number of goals in a match, the length of a song, the number of siblings, the temperature at noon [2 marks]

Answer

- C5** Nine customers rate a hairdresser: [2 marks]
Fair, Good, Poor, Excellent, Good, Good, Fair, Excellent, Good
Find the median rating. Explain why the mean cannot be found.
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- C6** Write the class "at least 10 seconds but less than 15 seconds" using t and [1 mark]
inequality signs.

Answer

- C7** A table of distances uses the classes $0 < d \leq 5$, $5 < d \leq 10$, $10 < d \leq 20$ and [2 marks]
 $20 < d \leq 50$. Write down the width and the midpoint of the widest class.

Answer Width Midpoint

- C8** 16 values lie in the class $40 < m \leq 60$. Assuming they are spread evenly, [2 marks]
estimate how many are more than 55.

Answer

- C9** A zoo groups the lengths of its snakes, in cm, as 0–40, 40–80, 80–120. Explain [2 marks]
what is wrong, and write better classes.
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D Exam-style questions

Answer every question in the space given. Show your working: most of the marks are for method.

- D1** In Year 9 there are 140 boys and 90 girls. 42 of the boys and 36 of the girls [3 marks]
walk to school. Jo says, "More boys than girls walk, so a boy is more likely
to walk to school than a girl."

Is Jo right? Show your working.

D2 A council officer gives 80 people a step counter for one day and records how far each person walks. She investigates the hypothesis "Most people in the town walk 5 km or less in a day."

Distance, d (km)	Frequency
$0 < d \leq 2$	18
$2 < d \leq 4$	27
$4 < d \leq 5$	13
$5 < d \leq 8$	15
$8 < d \leq 12$	7

(a) Is the distance walked discrete or continuous? [1 mark]

Answer

(b) Is this primary or secondary data for the officer? Give a reason. [1 mark]

(c) Does the table support the hypothesis? Show your working. [2 marks]

(d) Assuming the distances are spread evenly within each class, estimate how many people walked more than 6 km. [2 marks]

Answer

Total for D2: 6 marks

- D3** Ruth wants to test the hypothesis "Students who walk to school are fitter than students who are driven." Her plan is to time the 15 students in the school running club over 400 m on one afternoon, ask each of them how they get to school, and compare the mean time of the walkers with the mean time of the students who are driven. [5 marks]
Assess Ruth's plan.

- D4** A supermarket manager wants to test the hypothesis "Customers spend more on Saturdays than on Tuesdays." Write down two pieces of data she should collect, and give a reason for each. [4 marks]

- D5** Ken investigates the hypothesis "The older a phone is, the shorter its battery lasts." For each of 25 phones he records its age in months and whether its battery is "good" or "poor".

- (a)** Explain why Ken must take both values from the same phone. [1 mark]

- (b)** Write down the type of data "good or poor" is. [1 mark]

Answer

- (c)** Suggest better data for the battery than "good or poor". Give a reason. [2 marks]

Total for D5: 4 marks

D6 Here are the times, in minutes, of 15 bike journeys:
12.4, 18.0, 15.0, 22.6, 13.8, 16.5, 28.1, 19.2, 11.0, 24.9, 17.3, 14.6, 20.0, 15.8, 26.4

(a) Find the frequency of each class: $10 < t \leq 15$, $15 < t \leq 20$, $20 < t \leq 30$. [2 marks]

Answer

(b) Ella looks only at the table and says the quickest journey took 10 minutes. [1 mark]
Explain why she is wrong.

(c) Give one reason why the class $20 < t \leq 30$ is wider than the others. [1 mark]

Total for D6: 4 marks

D7 A shop tests the hypothesis "Brand A batteries last longer than brand B batteries." It tests 6 batteries of each brand in the same torch.

Brand	Hours lasted
A	41, 38, 45, 40, 44, 42
B	39, 47, 36, 46, 44, 40

(a) Work out the mean time for each brand. Give your answers to 1 decimal place. [2 marks]

Answer A hours B hours

(b) Does the data support the hypothesis? Give a reason. [1 mark]

(c) Which brand's times are more consistent? Give a reason. [1 mark]

(d) Give one way the shop could make its conclusion more reliable. [1 mark]

Total for D7: 5 marks

D8 Tom is investigating whether house prices in his town rose faster than in the whole country over the last ten years. Explain why he should use secondary data, and give one thing he should check about his source. [2 marks]

D9 50 passengers rate a bus service.

Rating	Frequency
Very poor	6
Poor	9
Satisfactory	14
Good	13
Very good	8

(a) Find the median rating. [2 marks]

Answer

(b) The bus company says, "The mean rating is Good." Explain why it should not give a mean. [1 mark]

Total for D9: 3 marks

D10 Ama wants to test the hypothesis "Tomato plants grown in a greenhouse grow taller than tomato plants grown outside."

(a) Write down the data she should collect. [1 mark]

(b) Is this data discrete or continuous?

[1 mark]

Answer

(c) Give one other thing she should keep the same for every plant, and say why.

[2 marks]

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Total for D10: 4 marks

E Extension

No route is given. Spend five minutes on a problem before you look at a hint. The hints are on the last page of the worksheet, and you can use one at a time.

E1 The same 40 times, in minutes, are grouped in two ways.

[4 marks]

First way: $0 < t \leq 20$: 14, $20 < t \leq 40$: 26

Second way: $0 < t \leq 10$: 5, $10 < t \leq 30$: 23, $30 < t \leq 40$: 12

How many times are more than 10 and at most 20 minutes? How many are more than 20 and at most 30 minutes?

Answer and

E2 Hypothesis: a greater proportion of adults in Ashby than in Brook cycle to work. A survey finds that 30 of 80 adults in Ashby and 27 of 60 adults in Brook cycle to work. The council then asks 40 more adults in Ashby. Work out the least number of these 40 who must cycle to work for Ashby's proportion to be greater than Brook's.

[4 marks]

Answer

E3 Sara needs at least 60 completed questionnaires. A postal questionnaire costs £1.50 to send and 40% are returned. An online questionnaire costs £0.60 to send and 15% are returned. Assume exactly these percentages are returned. Which way gets her 60 replies for less money? Show your working. [4 marks]

Answer

E4 The heights of sunflowers are measured to the nearest cm and grouped 150–154, 155–159, 160–164. The class 155–159 has frequency 20. Write the heights this class really covers, using h and inequality signs, and give its width. Assuming the heights are spread evenly, estimate how many of the 20 are at least 157.5 cm tall. [4 marks]

Answer

F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can write a hypothesis, plan the data to test it, and decide whether data supports it.	☐	☐	☐
I can name the type of any data, choose suitable data and judge a source.	☐	☐	☐
I can group data with no gaps or overlaps and say what grouping loses.	☐	☐	☐

Extension hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

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|-----------|---------------|---|
| E1 | Hint 1 | $0 < t \leq 20$ is made of $0 < t \leq 10$ and $10 < t \leq 20$. |
| | Hint 2 | So $10 < t \leq 20$ holds $14 - 5$ times. |
| | Hint 3 | In the same way $20 < t \leq 30$ holds $26 - 12$. Check the two add to 23. |
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|-----------|---------------|--|
| E2 | Hint 1 | Work out Brook's proportion. |
| | Hint 2 | Ashby will then have 120 adults. What number is that proportion of 120? |
| | Hint 3 | Ashby needs more than $0.45 \times 120 = 54$ cyclists in all. It already has 30. |
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|-----------|---------------|--|
| E3 | Hint 1 | How many must she send each way to get 60 back? |
| | Hint 2 | Postal: $60 \div 0.4$. Online: $60 \div 0.15$. |
| | Hint 3 | Multiply each number sent by its cost, then compare. |
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|-----------|---------------|--|
| E4 | Hint 1 | A height of 154.6 cm is recorded as 155 cm. What is the smallest height recorded as 155? |
| | Hint 2 | The class runs from 154.5 up to, but not including, 159.5. |
| | Hint 3 | From 157.5 to 159.5 is 2 of the 5 cm, so take $\frac{2}{5}$ of 20. |