6.10 Statistical Enquiry and Misleading Graphs: Test Pack

Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State whether each term refers to the whole group being studied, or to a smaller group chosen to represent the whole.

(a) The whole group of pupils at a school **(1)**

2 A bar chart shows the number of books read by pupils each month, but the y axis starts at 20 instead of 0 and the bars look very different heights. Identify two ways this presentation could mislead the reader.

(a) Give two separate ways the chart could mislead **(2)**

3 A bar chart shows the sales of a phone: 2022 = 44, 2023 = 48. The vertical axis starts at 40 instead of 0, so the 2023 bar is drawn 2 times as tall as the 2022 bar.
Explain why the chart is misleading and work out how many times larger 2023 really is than 2022, to 2 decimal places.

(3)

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4 Use the grouped frequency table to estimate the mean number of minutes pupils spend on homework each evening.
Classes (minutes): 0-19, 20-39, 40-59
Frequencies: 8, 12, 5

(a) Estimate the mean using class midpoints **(3)**

5 A survey of ice cream flavours found 15 chose vanilla out of 75 pupils. What is the relative frequency of vanilla?

(a) Give the relative frequency as a fraction **(1)**

6 Describe how you would select a stratified sample of 80 pupils from a school with 4 year groups that have sizes 120, 150, 130 and 100. Give the number of pupils you would sample from each year group and one brief reason why stratified sampling is useful here.

(a) Give numbers from each year group and a reason **(3)**

7 Stretch question. A local paper reports that 'most pupils prefer studying at home' based on a survey of 12 pupils and a bar chart that starts the y axis at 50. Write two criticisms of this report and suggest two improvements to make the enquiry more reliable.

(a) Give two criticisms and two improvements **(3)**

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8 Put these steps of a statistical enquiry in the most sensible order. Write the correct order as numbers 1 to 5.
Steps: A Collect data, B Decide how to sample, C State the question, D Analyse the data, E Present conclusions.

Write the letters in the correct order, for example C then B then A then D then E. **(2)**

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9 Here are summary statistics for marks.
Class 8X: mean 26, range 4.
Class 8Y: mean 24, range 14.
Compare the two sets of data.

(2)

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10 A researcher stands outside a cinema on Friday evening and asks the first 40 people who leave whether they prefer action films or comedies. Identify one likely bias in this sampling method.

(a) Give one likely bias **(1)**

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11 A list has 800 names. A systematic sample of 20 names is wanted, starting from a random name. How many names are skipped between each selected name, and what is the gap between selected positions?

(2)

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12 A list has 600 names. A systematic sample of 30 names is wanted, starting from a random name. How many names are skipped between each selected name, and what is the gap between selected positions?

(2)

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13 Decide whether each variable is categorical or quantitative.

(a) Favourite school subject **(1)**

(b) Number of books read in a month **(1)**

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14 A bar chart shows the pupils at a school: June = 55, July = 64. The vertical axis starts at 50. Explain why this could be misleading, and compare the visible height ratio with the real ratio of the two values, each as July ÷ June. Give both as decimals to 1 dp.

(3)

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15 Find the mean of these ages of pupils in a club: 12, 13, 14, 13, 12.

(a) Calculate the mean age **(2)**

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16 A bar chart shows the profits of a shop: Year 1 = 34, Year 2 = 40. The vertical axis starts at 30. Explain why this could be misleading, and compare the visible height ratio with the real ratio of the two values, each as Year 2 ÷ Year 1. Give both as decimals to 1 dp.

(3)

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17 Find the median of this set of test scores: 7, 8, 9, 6, 10.

(a) Calculate the median score **(1)**

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18 A line of best fit for temperature (x) and ice creams sold (y) has equation y = 6x + 15. Write down what the gradient 6 means in this context.

(2)

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19 A line of best fit for temperature (x) and ice creams sold (y) has equation y = 4x + 30. Use the line to estimate y when x = 9.

(2)

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20 Find the mode of this dataset of shoe sizes: 5, 6, 6, 7, 5, 6.

(a) Write the mode **(1)**

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21 Hamza wants to find the mean number of hours of sleep of pupils at a school of 785 pupils. He asks the 34 members of the school football team. Give a reason why this might not give a reliable answer.

(2)

22 The scatter graph for hours of revision (x) and test mark (y) uses data with x values from 6 to 24. The line of best fit is $y = 6x + 23$. Katie uses the line to predict y when $x = 34$. Is this prediction likely to be reliable? Give a reason.

(2)

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Mark scheme · 6.10 Statistical Enquiry and Misleading Graphs: Test Pack

Question 1

(a) Population (the whole group) stated **B1**

(a) Answer: **Population**

Question 2

(a) First correct issue e.g. y axis not starting at 0 exaggerates differences **B1**

(a) Second correct issue e.g. inconsistent bar widths or missing labels leading to misinterpretation **B1**

(a) Answer: **Starting the y axis at 20 exaggerates differences; missing or unclear labels (or inconsistent bar widths) make comparisons unreliable**

Question 3

the axis does not start at zero, so the difference looks bigger **B1**

48 ÷ 44 **M1**

1.09 times cao **A1**

Answer: **The axis starts at 40, exaggerating the difference; the real ratio is 1.09**

Question 4

(a) Uses midpoints correctly: 9.5, 29.5, 49.5 and multiplies by frequencies **M1**

(a) Adds products correctly to get total minutes **M1**

(a) Estimated mean 27.1 minutes cao **A1**

(a) Answer: **27.1**

Question 5

(a) 15/75 or 1/5 cao **B1**

(a) Answer: **1/5**

Question 6

(a) Shows correct method of proportioning sample by year group (e.g. uses group sizes) **B1**

(a) Gives correct numbers that sum to 80 (e.g. 19, 24, 21, 16) or equivalent proportional allocation **B1**

(a) Gives a sensible reason such as ensures each year is represented or reduces sampling bias **B1**

(a) Answer: **Sample sizes about 19, 24, 21, 16 from the year groups respectively; stratified sampling ensures each year group is represented and reduces bias**

Question 7

(a) Identifies a correct criticism such as sample too small or not representative **M1**

(a) Identifies a second correct criticism such as misleading axis exaggerating effect **M1**

(a) Suggests two reasonable improvements e.g. use a larger random sample and start y axis at 0 or show counts as percentages **A1**

(a) Answer: **Criticisms: sample of 12 is too small and likely unrepresentative; bar chart starting at 50 exaggerates differences. Improvements: use a larger, random or stratified sample; redraw the chart with y axis starting at 0 and report actual percentages or counts**

Question 8

Recognises correct ordering of at least three steps or shows method of sequencing oe **M1**

Correct full order: C, B, A, D, E cao **A1**

Answer: **C, B, A, D, E**

Question 9

comparison of the averages: Class 8X has the higher mean **B1**

comparison of the spread: Class 8X is more consistent (smaller range) **B1**

Answer: **Class 8X has the higher mean; Class 8X is more consistent as it has the smaller range**

Question 10

(a) Identifies a correct bias such as time bias, only cinema-goers asked, or non-random sample (oe) **B1**

(a) Answer: **People leaving a cinema are not representative of the whole population (sampling bias)**

Question 11

800 ÷ 20 **M1**

every 40th name (gap of 40) **A1**

Answer: **every 40th name**

Question 12

600 ÷ 30 **M1**

every 20th name (gap of 20) **A1**

Answer: **every 20th name**

Question 13

(a) Categorical stated **B1**

(a) Answer: **Categorical**

(b) Quantitative stated **B1**

(b) Answer: **Quantitative**

Question 14

axis not starting at zero **B1**

visible ratio 14/5 and real ratio 64/55 **M1**

visible 2.8, real 1.2 **A1**

Answer: **Axis starts at 50; visible ratio 2.8, real ratio 1.2**

Question 15

(a) Correct method shown, e.g. sum of values = 64 or 12+13+14+13+12 **M1**

(a) 12.8 cao **A1**

(a) Answer: **12.8**

Question 16

axis not starting at zero **B1**

visible ratio 10/4 and real ratio 40/34 **M1**

visible 2.5, real 1.2 **A1**

Answer: **Axis starts at 30; visible ratio 2.5, real ratio 1.2**

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Question 17

(a) 8 cao **B1**

(a) Answer: **8**

Question 18

refers to the change in y for each 1 unit increase in x **M1**

y increases by 6 for each extra unit of x **A1**

Answer: **ice creams sold increases by 6 for each extra unit of temperature**

Question 19

substitutes x = 9 **M1**

66 cao **A1**

Answer: **66**

Question 20

(a) 6 cao **B1**

(a) Answer: **6**

Question 21

identifies that the sample is not random or not representative **M1**

only footballers are asked, who may sleep differently, and the sample is small relative to the school **A1**

Answer: **The sample is not representative of all pupils**

Question 22

notes that 34 is outside the range of the data **M1**

No, because it is extrapolation **A1**

Answer: **No, it is outside the range of the data (extrapolation)**

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