6.8 Grouped Data and the Estimated Mean: Test Pack

Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Here are five class intervals and their frequencies for the ages of pupils in a club. State the modal class and give a reason.
Class intervals: 9-11 (5 pupils), 12-14 (12 pupils), 15-17 (9 pupils), 18-20 (3 pupils), 21-23 (1 pupil).

(a) State the modal class and give a brief reason. **(1)**

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2 Longer reasoning: A company records daily faults found on machines over 40 days. Grouped data:
0-1 (12), 2-3 (14), 4-5 (8), 6-7 (6). Estimate the mean number of faults per day and identify the modal class. Comment on whether the modal class is a good indicator of the typical day compared with the mean.

(a) Estimate the mean number of faults per day using midpoints. **(3)**

(b) Identify the modal class and give a short comment comparing modal class with the mean as indicators of a typical day. **(3)**

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3 Stretch problem 1. A science club measures the heights in cm of 28 students and groups the results as follows:
130-134 (4), 135-139 (6), 140-144 (8), 145-149 (6), 150-154 (4).

(a) Estimate the mean height from the original grouped data. **(4)**

(b) Suppose two new students join with heights 160 cm and 162 cm and are added to class 160-163, which has midpoint 161. Recalculate an approximate mean using the same grouped method and comment on how the mean changes. **(3)**

4 Stretch problem 2. A researcher gives grouped marks for a test out of 60: 0-11 (2), 12-23 (5), 24-35 (14), 36-47 (8), 48-59 (1).

(a) Estimate the mean test score using midpoints 5.5, 17.5, 29.5, 41.5, 53.5. **(4)**

(b) The researcher realises that the top group should be 48-60 inclusive and that its midpoint should be 54. Recompute the mean using midpoint 54 for that group and state the difference between the two estimated means. Explain why changing the class boundary affects the mean estimate. **(3)**

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5 The table shows the number of books read for a group of people.
number of books read = 3: frequency 12; number of books read = 4: frequency 10; number of books read = 5: frequency 8; number of books read = 6: frequency 1; number of books read = 7: frequency 6; number of books read = 8: frequency 4.
Work out the total frequency and the mode.

(2)

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6 Use midpoints to estimate the mean for the grouped data. Show your working.
Class intervals: 10-14 (6), 15-19 (10), 20-24 (8).

(a) Use midpoints to estimate the mean age. **(3)**

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7 The grouped frequency table shows the mass in kg of 31 people. 20 to 24: 5; 25 to 29: 8; 30 to 34: 8; 35 to 39: 5; 40 to 44: 5.
Work out an estimate of the mean.

(4)

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8 The scores of 16 players in a game are: 20, 24, 15, 15, 24, 22, 12, 17, 24, 22, 23, 17, 22, 21, 16, 16.
Complete a grouped frequency table using the class intervals 10 to 14, 15 to 19 and 20 to 24.

(3)

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9 A teacher records times in seconds taken by 25 pupils to run 100 m and groups them as follows. Identify the modal class and estimate the mean time.
Class intervals: 10-12 (3), 13-15 (9), 16-18 (8), 19-21 (5).

(a) State the modal class and explain why. **(1)**

(b) Estimate the mean time using midpoints. **(3)**

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10 Complete the grouped frequency table and estimate the mean. The class widths are equal.
Class intervals: 1-3 (4), 4-6 (6), 7-9 (k), 10-12 (5). Total frequency is 25 and total fx is 173. Find k and then the estimated mean.

(a) Find k, the missing frequency for class 7-9. **(1)**

(b) Using the given total fx = 173, state the estimated mean for the table. **(3)**

11 A survey records number of books read by 30 pupils in a term. The grouped data is: 0-1 (4), 2-3 (8), 4-5 (10), 6-7 (6), 8-9 (2).
Find the modal class and estimate the mean. Explain each step.

(a) State the modal class and explain why. **(1)**

(b) Calculate midpoints, fx values and then the estimated mean. Show all working. **(5)**

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Mark scheme · 6.8 Grouped Data and the Estimated Mean: Test Pack

Question 1

(a) 12-14 is modal class, highest frequency — **B1**

(a) Answer: **12-14**

Question 2

(a) midpoints 0.5, 2.5, 4.5, 6.5 used and fx calculated — **M1**

(a) total fx = 0.5*12 + 2.5*14 + 4.5*8 + 6.5*6 = 6 + 35 + 36 + 39 = 116 — **M1**

(a) mean = 116 / 40 = 2.9 faults per day cao — **A1**

(a) Answer: **2.9**

(b) modal class 2-3, highest frequency 14 — **B1**

(b) comment that modal class shows most common class while mean gives average value — **M1**

(b) conclusion: mean 2.9 is close to modal class 2-3 so both indicate similar typical day, but mean may be influenced by higher classes so mean gives a precise average while modal class indicates most frequent range — **A1**

(b) Answer: **Modal class 2-3; mean 2.9 so both suggest around 2 to 3 faults per day, but mean is an average and modal class only shows most frequent range**

Question 3

(a) midpoints 132, 137, 142, 147, 152 used and fx calculated — **M1**

(a) fx values: 132*4=528, 137*6=822, 142*8=1136, 147*6=882, 152*4=608 — **M1**

(a) sum fx = 528 + 822 + 1136 + 882 + 608 = 3976 — **M1**

(a) mean = 3976 / 28 = 142.0 cm cao — **A1**

(a) Answer: **142.0**

(b) add fx contribution for midpoint 161 * 2 = 322 and new total f = 30 — **M1**

(b) new total fx = 3976 + 322 = 4298 and new mean = 4298 / 30 = 143.266... used — **M1**

(b) conclusion: mean increases to 143.27 (approx) so mean is sensitive to added larger values — **A1**

(b) Answer: **143.27**

Question 4

(a) midpoints used and fx calculated: 5.5*2, 17.5*5, 29.5*14, 41.5*8, 53.5*1 — **M1**

(a) fx values: 11, 87.5, 413, 332, 53.5 and sum fx computed — **M1**

(a) sum fx = 11 + 87.5 + 413 + 332 + 53.5 = 897 — **M1**

(a) mean = 897 / 30 = 29.9 (to 1 dp) cao — **A1**

(a) Answer: **29.9**

(b) replace top group fx contribution with 54 * 1 = 54 and compute new total fx = 897 - 53.5 + 54 = 897.5 — **M1**

(b) new mean = 897.5 / 30 = 29.9166... and difference = 29.9166... - 29.9 = 0.0166... approx 0.02 — **M1**

(b) conclusion: small increase ~0.02; changing class midpoint changes fx and so the mean because mean depends on midpoint values used — **A1**

(b) Answer: **29.92**

Question 5

total 41 — **B1**

mode 3 — **B1**

Answer: **total 41, mode 3**

Question 6

(a) midpoints 12, 17, 22 used and multiplied by frequencies or equivalent method — **M1**

(a) sum of fx calculated: 12*6 + 17*10 + 22*8 = 72 + 170 + 176 = 418 — **M1**

(a) mean = 418 / 24 = 17.416... so 17.4 to 1 dp cao — **A1**

(a) Answer: **17.4**

Question 7

uses midpoints of the classes — **M1**

multiplies midpoints by frequencies — **M1**

total fx = 977 divided by 31 — **M1**

31.5 cao — **A1**

Answer: **31.5**

Question 8

tally or count of at least one class — **M1**

two frequencies correct — **A1**

10 to 14: 1, 15 to 19: 6, 20 to 24: 9 cao — **A1**

Answer: **10 to 14: 1, 15 to 19: 6, 20 to 24: 9**

Question 9

(a) 13-15, highest frequency of 9 — **B1**

(a) Answer: **13-15**

(b) midpoints 11, 14, 17, 20 used and fx calculated — **M1**

(b) total fx = 11*3 + 14*9 + 17*8 + 20*5 = 33 + 126 + 136 + 100 = 395 — **M1**

(b) mean = 395 / 25 = 15.8 seconds cao — **A1**

(b) Answer: **15.8**

Question 10

(a) k = 10 cao — **B1**

(a) Answer: **10**

(b) use total fx 173 and total f 25 in mean calculation — **M1**

(b) mean = 173 / 25 = 6.92 so 6.92 to 2 dp or 6.9 to 1 dp cao — **A1**

(b) final answer stated as 6.92 (or 6.9 to 1 dp) cao — **A1**

(b) Answer: **6.92**

Question 11

(a) 4-5, highest frequency 10 — **B1**

(a) Answer: **4-5**

(b) midpoints 0.5, 2.5, 4.5, 6.5, 8.5 used and multiplied by frequencies — **M1**

(b) fx values: 0.5*4=2, 2.5*8=20, 4.5*10=45, 6.5*6=39, 8.5*2=17 and sum fx computed — **M1**

(b) sum fx = 2 + 20 + 45 + 39 + 17 = 123 — **M1**

(b) total f = 30 used — **M1**

(b) mean = 123 / 30 = 4.1 books cao — **A1**

(b) Answer: **4.1**

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