S1·2

Measures of central tendency

CHAPTER ASSIGNMENT · 77 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given, showing all your working. Give answers to 3 significant figures unless otherwise specified. Fractions are written a/b, with brackets where needed.

Practice questions from *Cambridge International AS & A Level Mathematics: Probability & Statistics 1 Coursebook* (Cambridge University Press, Dean Chalmers), Chapter 2 (Measures of central tendency), Exercises 2A to 2E and End-of-chapter review exercise 2, for classroom use. Where a question needs a diagram, the diagram is described in words or given as a table. The Check yourself and Chapter quiz questions are Guru Jazzy's own.

Exercise 2A · The mode and the modal class

2A.1 Find the mode(s) of the following sets of numbers:

(a) 12, 15, 11, 7, 4, 10, 32, 14, 6, 13, 19, 3

(b) 19, 21, 23, 16, 35, 8, 21, 16, 13, 17, 12, 19, 14, 9

2A.2 Which of the eleven words in this sentence is the mode?

2A.3 Identify the mode of x and of y in the following tables:

x	4	5	6	7	8
f	1	5	5	6	4

y	−4	−3	−2	−1	0
f	27	28	29	27	25

2A.4 Find the modal class for x and for y in the following tables:

x	0–	4–	14–20
f	5	9	8
y	3–6	7–11	12–20
f	66	80	134

2A.5 A small company sells glass, which it cuts to size to fit into window frames. How could the company benefit from knowing the modal size of glass its customers purchase?

2A.6 Four classes of continuous data are recorded as 1–7, 8–16, 17–20 and 21–25. The class 1–7 has a frequency of 84 and there is no modal class. Find the total frequency of the other three classes.

2A.7 Data about the times, in seconds, taken to run 100 metres by n adults are given in the following table:

Time x (s)	$13.6 \leq x < 15.4$	$15.4 \leq x < 17.4$	$17.4 \leq x < 19.8$
No. adults (f)	a	b	27

By first investigating the possible values of a and of b, find the largest possible value of n, given that the modal class contains the slowest runners.

2A.8 Three classes of continuous data are given as 0–4, 4–10 and 10–18. The frequency densities of the classes 0–4 and 10–18 are in the ratio 4 : 3 and the total frequency of these two classes is 120. Find the least possible frequency of the modal class, given that the modal class is 4–10.

Exercise 2B · The mean

2B.1 Calculate the mean of the following sets of numbers:

(a) 28, 16, 83, 72, 105, 55, 6 and 35

(b) 7.3, 8.6, 11.7, 9.1, 1.7 and 4.2

(c) −3(1/2), 5(1/4), 9(3/4), −4(1/4) and 7(3/8)

2B.2 (a) The mean of 15, 31, 47, 83, 97, 119 and p^2 is 63. Find the possible values of p.

(b) The mean of 6, 29, 3, 14, q, (q + 8), q^2 and (10 – q) is 20. Find the possible values of q.

2B.3 Given that:

(a) n = 14 and $\Sigma x = 325.5$, find $\bar{x}$.

(b) n = 45 and $\bar{y} = 23.6$, find the value of Σy.

(c) $\Sigma z = 4598$ and $\bar{z} = 52.25$, find the number of values in the set of data.

(d) $\Sigma xf = 86$ and $\bar{x} = 7(1/6)$, find the value of Σf.

(e) $\Sigma f = 135$ and $\bar{x} = 0.842$, find the value of Σxf.

2B.4 Find the mean of x and of y given in the following tables:

(a)

x	18.0	18.5	19.0	19.5	20.0
f	8	10	17	24	1

(b)

y	3.62	3.65	3.68	3.71	3.74
f	127	209	322	291	251

2B.5 For the data given in the following table, it is given that $\bar{q} = 8(5/9)$:

q	7	8	9	10
f	9	13	a	11

Calculate the value of a.

2B.6 Calculate an estimate of the mean of x and of y given in the following tables:

(a)

x	$0 \leq x < 2$	$2 \leq x < 4$	$4 \leq x < 8$	$8 \leq x < 14$
f	8	9	11	2

(b)

y	$13 \leq y < 16$	$16 \leq y < 21$	$21 \leq y < 28$	$28 \leq y < 33$	$33 \leq y < 36$
f	7	17	29	16	11

2B.7 An examination was taken by 50 students. The 22 boys scored a mean of 71% and the girls scored a mean of 76%. Find the mean score of all the students.

2B.8 A company employs 12 drivers. Their mean monthly salary is \$1950. A new driver is employed and the mean monthly salary falls by \$8. Find the monthly salary of the new driver.

2B.9 The mean age of the 16 members of a karate club is 26 years and 3 months. One member leaves the club and the mean age of those remaining is 26 years. Find the age of the member who left the club. Give a reason why your answer might not be very accurate.

2B.10 The following table shows the hourly rates of pay, in dollars, of a company's employees:

Hourly rate ($)	6	7	8	109
No. employees (f)	8	11	17	1

(a) Is the mean a good average to use here? Give a reason for your answer.

(b) Find the mean rate of pay for the majority of the employees.

2B.11 A train makes a non-stop journey from one city to another and back again each day. Over a period of 30 days, the mean number of passengers per journey is exactly 61.5. Exact one-way ticket prices paid by these passengers are given by percentage in the following table:

Price ($)	34	38	45
Passengers (%)	30	41	29

(a) Calculate the total revenue from ticket sales, and explain why your answer is an approximation.

(b) The minimum and maximum possible revenues differ by $k. Find the value of k.

2B.12 The heights, in centimetres, of 54 children are represented in a histogram with intervals 140–144 (fd = 3), 144–150 (fd = 2.5), 150–156 (fd = 3.5) and 156–159 (fd = 2). The children are split into two equal-sized groups: a 'tall half' and a 'short half'. Calculate an estimate of the difference between the mean heights of these two groups of children.

2B.13 The following table summarises the number of tomatoes produced by the plants in the plots on a farm:

No. tomatoes	20–29	30–49	50–79	80–100
No. plots (f)	329	413	704	258

(a) Calculate an estimate of the mean number of tomatoes produced by these plots.

(b) The tomatoes are weighed accurately and their mean mass is found to be 156.50 grams. At market they are sold for $3.20 per kilogram and the total revenue is $50 350. Find the actual mean number of tomatoes produced per plot.

(c) Why could your answer to part b be inaccurate?

2B.14 Twenty boys and girls were each asked how many aunts and uncles they have. The entry 4 / 5 in the following table, for example, shows that 4 boys and 5 girls each have 3 aunts and 2 uncles:

Uncles \ Aunts	0 aunts	1 aunt	2 aunts	3 aunts
0 uncles	1 / 0	0 / 2	2 / 1	1 / 1
1 uncle	0 / 0	3 / 4	0 / 4	0 / 0
2 uncles	0 / 0	1 / 0	7 / 11	4 / 5
3 uncles	1 / 0	0 / 0	0 / 1	0 / 1

(a) Find the mean number of uncles that the boys have.

(b) For the boys and girls together, calculate the mean number of: (i) aunts (ii) aunts and uncles.

(c) Suggest an alternative way of presenting the data so that the calculations in parts a and b would be simpler to make.

2B.15 A calculated estimate of the mean capacity of 120 refrigerators stored at a warehouse is 348 litres. The capacities are given in the following table:

Capacity (litres)	160–	200–	320–	400–p
No. refrigerators (f)	12	28	48	32

A delivery of n new refrigerators, all with capacities between 200 and 320 litres arrives at the warehouse. This causes the mean capacity to decrease by 8 litres. Find the value of n and state what assumptions you are making in your calculations.

2B.16 A carpet fitter is employed to fit carpet in each of the 72 guest bedrooms at a new hotel. The following table shows how many rooms were completed during the first 10 days of work:

No. rooms completed	5	6 or 7
No. days (f)	2	8

Based on these figures, estimate how many more days it will take to finish the job. What assumptions are you making in your calculations?

2B.17 In a geometric figure, a square of side 8 cm has vertices X and Y at the top corners, joined edge-to-edge to a semicircle with centre O. Point P is 2 cm from O on the axis of symmetry. Points X and Y are fixed (distance XY = 8 cm) but the position of Z is variable on the semicircle perimeter.

(a) Find the mean distance from P to X, Y and Z when angle POZ is equal to: (i) 180° (ii) 135°.

(b) Find obtuse angle POZ, so that the mean distance from P to X, Y and Z is identical to the mean distance from P to X and Y.

Exercise 2C · Coded data: translations

2C.1 For 10 values denoted x, it is given that $\bar{x} = 7.4$. Find:

(a) Σx

(b) $\Sigma(x + 2)$

(c) $\Sigma(x - 1)$

2C.2 Twenty-five values of z are such that $\Sigma(z - 7) = 275$. Find $\bar{z}$.

2C.3 Given $\bar{q} = 22$ and $\Sigma(q - 4) = 3672$, find the number of values of q.

2C.4 The lengths of 2500 bolts, x mm, are summarised by $\Sigma(x - 40) = 875$. Find the mean length of the bolts.

2C.5 Six data values are coded by subtracting 13 from each. Five of the coded values are 9.3, 5.4, 3.9, 7.6 and 2.2, and the mean of the six data values is 17.6. Find the sixth coded value.

2C.6 The SD card slots on digital cameras are designed to accommodate a card of up to 24 mm in width. Due to low sales figures, a manufacturer suspects that the machine used to cut the cards needs to be recalibrated. The widths, w mm, of 400 of these cards were measured and are coded in the following table, where $x = w - 24$:

$w - 24$ (mm)	$-0.15 < x < -0.1$	$-0.1 \leq x < 0$	$0 \leq x < 0.1$	$0.1 \leq x < 0.2$
No. cards (f)	32	360	6	2

(a) Suggest a reason why the widths have been coded in this way.

(b) What percentage of the SD cards are too wide to fit into the slots?

(c) Use the coded data to estimate the mean width of these 400 cards.

2C.7 Sixteen bank accounts have been accidentally under-credited by the following amounts, denoted by $x:

917.95, 917.98, 918.03, 917.97, 918.01, 917.94, 918.05, 918.07, 918.02, 917.93, 918.01, 917.88, 918.10, 917.85, 918.11, 917.94.

To calculate $\bar{x}$ manually, Fidel and Ramon code these figures using $(x - 917)$ and $(x - 920)$, respectively. Who has the simpler maths to do? Explain your answer.

2C.8 Throughout her career, an athlete has been timed in 120 of her 400-metre races. Her times, denoted by t seconds, were recorded on indoor tracks 45 times and are summarised by $\Sigma(t - 60) = 83.7$, and on outdoor tracks where $\Sigma(t - 65) = -38.7$. Calculate her average 400-metre running time and comment on the accuracy of your answer.

2C.9 All the interior angles of n triangular metal plates, denoted by y°, are measured.

(a) State the number of angles measured and write down the value of $\bar{y}$.

(b) Hence, or otherwise, find the value of $\Sigma(y - 30)$.

2C.10 A dataset of 20 values is denoted by x where $\Sigma(x - 1) = 58$. Another dataset of 30 values is denoted by y where $\Sigma(y - 2) = 36$. Find the mean of the 50 values of x and y.

2C.11 Students investigated the prices in dollars ($) of 1 litre bottles of a certain drink at 24 shops in a town and at 16 shops in surrounding villages. Denoting the town prices by t and the village prices by v, the students' data are summarised by the totals $\Sigma(t - 1.1) = 1.44$ and $\Sigma(v - 1.2) = 0.56$. Find the mean price of 1 litre of this drink at all the shops at which the students collected their data.

Exercise 2D · Coded data: linear transformations

2D.1 The masses, x kg, of 12 objects are such that $\bar{x} = 0.475$. Find the value of $\Sigma(1000x)$ and state what it represents.

2D.2 The total mass of gold extracted from a mine is denoted by Σx, which is measured in grams. Find an expression in x for the total mass in:

(a) carats, given that 1 carat is equivalent to 200 milligrams

(b) kilograms.

2D.3 The area of land used for growing wheat in a region is denoted by Σw hectares. Find an expression in w for the total area in square kilometres, given that 1 hectare is equivalent to 10 000 m^2.

2D.4 Speeds, measured in metres per second, are denoted by x. Find the constant k such that kx denotes the speeds in kilometres per hour.

2D.5 The wind speeds, x miles per hour (mph), were measured at a coastal location at midday on 40 consecutive days and are presented in the following table:

Speed (x mph)	15 ≤ x < 17	17 ≤ x < 20	20 ≤ x < 24	24 ≤ x < 25
No. days (f)	9	13	14	4

Abel wishes to calculate an estimate of the mean wind speed in kilometres per hour (km/h). He knows that a distance of 5 miles is approximately equal to 8 km.

(a) Explain how Abel can calculate his estimate without converting the given boundary values from miles per hour to kilometres per hour.

(b) Use the wind speeds in mph to estimate the mean wind speed in km/h.

2D.6 Given that 15 values of x are such that $\Sigma(3x - 2) = 528$, find $\bar{x}$ and find the value of b such that $\Sigma(0.5x - b) = 138$.

2D.7 For 20 values of y, it is given that $\Sigma(ax - b) = 400$ and $\Sigma(bx - a) = 545$. Given also that $\bar{x} = 6.25$, find the value of a and of b.

2D.8 The midpoint of the line segment between A and B is at (5.2, −1.2). Find the coordinates of the midpoint after the following transformations have been applied to A and to B:

(a) T: Translation by the column vector $(-7, 4)^{T}$.

(b) E: Enlargement through the origin with scale factor 5.

(c) Transformations T and E are carried out one after the other. Investigate whether the location of the midpoint of AB is independent of the order in which the transformations are carried out.

2D.9 Five investors are repaid, each with their initial investment increased by p% plus a fixed 'thank you' bonus of $q. The woman who invested $20 000 is repaid double her investment and the man who invested $7500 is repaid triple his investment. Find the total amount that the five people invested, given that the mean amount repaid to them was $33 000. Do you think the method of repayment is fair? Give a reason for your answer.

2D.10 One of the units used to measure pressure is pounds per square inch (psi). The mean pressure in the four tyres of a particular vehicle is denoted by $\bar{x}$ psi. Given that 1 pound is approximately equal to 0.4536 kg and that 1 metre is approximately equal to 39.37 inches, express the sum of the pressures in the four tyres of this vehicle in grams per cm^2.

Exercise 2E · The median and comparing averages

2E.1 The number of patients treated each day by a dentist during a 20-day period is shown in the following stem-and-leaf diagram:

Stem	Leaf
0	4 4 4 5 6 6 6 7
1	4 5 5 6 6 7 7 8 8 9
2	0 1

Key: 1 | 5 represents 15 patients.

(a) Find the median number of patients.

(b) On eight of these 20 days, the dentist arrived late to collect their son from school. If they decide to use their average number of patients as a reason for arriving late, would they use the median or the mean? Explain your answer.

(c) Describe a situation in which it would be to the dentist's advantage to use a mode as the average.

2E.2 (a) Find the median for the values of t given in the following table:

t	7	8	9	10	11	12	13
f	4	7	9	14	16	41	9

(b) What feature of the data suggests that $\bar{t}$ is less than the median? Confirm whether or not this is the case.

2E.3 (a) Find the median and the mode for the values of x given in the following table:

x	4	5	6	7	8
f	14	13	4	12	15

(b) Give one positive and one negative aspect of using each of the median and the mode as the average value for x.

(c) Some values in the table have been incorrectly recorded as 8 instead of 4. Find the number of incorrectly recorded values, given that the true median of x is 5.5.

2E.4 A cumulative frequency graph illustrates the times taken by 112 people to complete a puzzle. The curve passes through (0, 0), (2, 16), (4, 44), (6, 72), (8, 98) and (10, 112):

(a) Estimate the median time taken.

(b) The median is used to divide these people into two groups. Find the median time taken by each of the groups.

2E.5 The masses, m kilograms, of 148 objects are summarised in the following table:

Mass (m kg)	m < 0	m < 0.2	m < 0.3	m < 0.5	m < 0.7	m < 0.8
cf	0	16	28	120	144	148

Construct a cumulative frequency polygon on graph paper, and use it to estimate the number of objects with masses that are:

(a) within 0.1 kg of the median

(b) more than 200 g from the median.

2E.6 A teacher recorded the quiz marks of eight students as 11, 13, 15, 15, 17, 18, 19 and 20. They later realised that there was a typing error, so they changed the mark of 11 to 1. Investigate what effect this change has on the mode, mean and median of the students' marks.

2E.7 The following table shows the lifetimes, to the nearest 10 days, of a certain brand of light bulb:

Lifetime (days)	90–100	110–120	130–140	150–160	170–190	200–220	230–260
No. light bulbs (f)	12	28	54	63	41	16	6

(a) Use upper class boundaries to represent the data in a cumulative frequency graph and estimate the median lifetime of the light bulbs.

(b) How might the manufacturer choose a value to use as the average lifetime of the light bulbs in a publicity campaign? Based on the figures in the table, investigate whether it would be to the manufacturer's advantage to use the median or the mean.

2E.8 It is claimed on the packaging of a brand of battery that they can run a standard kitchen clock continuously for 'at least 150 days on average'. Tests are carried out to find the length of time, t hours, that a standard kitchen clock runs using one of these batteries. The results are shown in the following table:

Time (t hours)	3000 ≤ t < 3096	3096 ≤ t < 3576	3576 ≤ t < 3768	3768 ≤ t < 3840
No. batteries (f)	34	66	117	33

What could the words on the packaging mean? Test the claim by finding the mean, the median and the modal class. What conclusions, if any, can you make about the claim?

2E.9 Homes in a certain neighbourhood have recently sold for $220 000, $242 000, $236 000 and $3 500 000. A potential buyer wants to know the average selling price in the neighbourhood. Which of the mean, median or mode would be more helpful? Explain your answer.

2E.10 A study was carried out on 60 electronic items to find the currents, x amperes, that could be safely passed through them at a fixed voltage before they overheat. The results are given in the two tables below:

Current (x A)	0.5	1.5	2.0	3.5	5.0
No. items that do not overheat	60	48	20	6	0
Current (x A)	0.5	1.5	2.0	3.5	5.0
No. items that overheat	0	p	q	r	60

(a) Find the value of p, of q and of r.

(b) Cumulative frequency graphs are drawn to illustrate the data in both tables:

(i) Describe the transformation that maps one graph onto the other.

(ii) Explain the significance of the point where the two graphs intersect.

2E.11 The lengths of extra-time, t minutes, played in the first and second halves of 100 football matches are summarised in the following table:

Extra-time (t min)	t ≤ 1	t ≤ 2	t ≤ 4	t ≤ 5	t ≤ 7	t ≤ 9
First halves (cf)	24	62	80	92	97	100
Second halves (cf)	6	17	35	82	93	100

(a) Explain how you know that the median extra-time played in the second halves is greater than in the first halves.

(b) The first-half median is exactly 100 seconds.

(i) Find the upper boundary value of k, given that the second-half median is k times longer than the first-half median.

(ii) Explain why the mean must be greater than the median for the extra-time played in the first halves.

2E.12 Eighty candidates took an examination in Astronomy, for which no candidate scored more than 80%. The examiners suggest that five grades, A, B, C, D and E, should be awarded to these candidates, using upper grade boundaries 64, 50, 36 and 26 for grades B, C, D and E, respectively. In this case, grades A, B, C, D and E, will be awarded in the ratio 1 : 3 : 5 : 4 : 3.

(a) Using the examiners' suggestion, represent the scores in a cumulative frequency polygon and use it to estimate the median score.

(b) All of the grade boundaries are later reduced by 10%. Estimate how many candidates will be awarded a higher grade because of this.

2E.13 The values of x shown in the following table are to be represented in a bar chart:

x	5	6	7	8	9	10	11
Frequency	2	5	9	10	9	5	2

(a) (i) Sketch a curve that shows the shape of the data. (ii) Find the mode, mean and the median of x.

(b) The two smallest values of x (i.e. 5 and 5) are changed to 21 and 31. Investigate the effect that this has on the mode, the mean, the median and on the shape of the curve.

(c) If, instead, the two largest values of x (i.e. 11 and 11) are changed to −9 and b, so that the mean of x decreases by 1, find the value of b and investigate the effect that this has on the mode, the median and the shape of the curve.

2E.14 A histogram is drawn to illustrate a set of continuous data whose mean and median are equal. Make sketches of the different types of curve that could be drawn to represent the shape of the histogram.

2E.15 Students' marks in a Biology examination are shown by percentage in the following table:

Marks (%)	20–	30–	40–	50–	60–	70–	80–90
Frequency (%)	5	10	20	30	20	10	5

(a) Without drawing an accurate histogram, describe the shape of the set of marks. What does the shape suggest about the values of the mean, the median and the mode?

(b) Information is provided about the marks in examinations in two other subjects:

Chemistry: mode > median > mean

Physics: mean > median > mode

Sketch a curve to show the shape of the distribution of marks in each of these exams.

End-of-chapter review exercise 2

R2.1 For each of the following sets of data, decide whether you would expect the mean to be less than, equal to or greater than the median and the mode:

(a) The ages of patients receiving long-term care at a hospital. [1]

(b) The numbers of goals scored in football matches. [1]

(c) The heights of adults living in a particular city. [1]

R2.2 The mean mass of 13 textbooks is 875 grams, and n novels have a total mass of 13 706 grams. Find the mean mass of a novel, given that the textbooks and novels together have a mean mass of 716.6 grams. [3]

R2.3 Nine values are 7, 13, 28, 36, 13, 29, 31, 13 and x.

(a) Write down the name and the value of the measure of central tendency that can be found without knowing the value of x. [1]

(b) If it is known that x is greater than 40, which other measure of central tendency can be found and what is its value? [1]

(c) If the remaining measure of central tendency is 25, find the value of x. [2]

R2.4 For the data shown in the following table, x has a mean of 7.15:

x	3	6	10	15
Frequency	a	b	c	d

(a) Find the mean value of y given in the following table: [1]

y	11	14	18	23
Frequency	a	b	c	d

(b) Find a calculated estimate of the mean value of z given in the following table: [2]

z	2–	8–	14–	24–34
Frequency	a	b	c	d

R2.5 The table below shows the number of books read last month by a group of children:

No. books	2	3	4	5
No. children	3	8	15	q

(a) If the mean number of books read is exactly 3.75, find the value of q. [2]

(b) Find the greatest possible value of q if:

(i) the modal number of books read is 4 [1]

(ii) the median number of books read is 4. [1]

R2.6 The following table gives the heights, to the nearest 5 cm, of a group of people:

Heights (cm)	120–135	140–150	155–160	165–170	175–185
No. people	30	p	12	16	21

Given that the modal class is 140–150 cm, find the least possible value of p. [3]

R2.7 A histogram illustrates the masses, m kilograms, of 216 sales of hay that a farmer made to customers last year:

Interval $30 \leq m < 50$ has width 20 and frequency density 5.4.

Interval $50 \leq m < 60$ has width 10 and frequency density 7.2.

Interval $60 \leq m < 80$ has width 20 and frequency density 1.8.

(a) Show that a calculated estimate of the mean is equal to the median. [4]

(b) Estimate the price per kilogram at which the hay was sold, given that these sales generated exactly \$1944. Why is it possible that none of the customers actually paid this amount per kilogram for the hay? [4]

R2.8 An internet service provider wants to know how customers rate its services. A questionnaire asks customers to tick one of the following boxes: excellent, good, average, poor, very poor.

(a) How might the company benefit from knowing each of the available average responses of its customers? [2]

(b) What additional benefit could the company obtain by using the following set of tick boxes instead: excellent = 5, good = 4, average = 3, poor = 2, very poor = 1? [2]

R2.9 The numbers of items returned to the electrical department of a store on each of 100 consecutive days are given in the following table:

No. items	0	1	2	3	4	5	6–p
No. days	49	16	10	9	7	5	4

(a) Write down the median. [1]

(b) Is the mode a good value to use as the average in this case? Give a reason for your answer. [1]

(c) Find the value of p, given that a calculated estimate of the mean is 1.5. [3]

(d) Sketch a curve that shows the shape of this set of data, and mark onto it the relative positions of the mode, the mean and the median. [2]

R2.10 As part of a data collection exercise, members of a certain school year group were asked how long they spent on their Mathematics homework during one particular week. The times are given to the nearest 0.1 hour:

Time spent (t hours)	$0.1 \le t \le 0.5$	$0.6 \le t \le 1.0$	$1.1 \le t \le 2.0$	$2.1 \le t \le 3.0$	$3.1 \le t \le 4.5$
Frequency	11	15	18	30	21

(i) Draw a histogram to illustrate this information. [5]

(ii) Calculate an estimate of the mean time spent on their Mathematics homework by members of this year group. [3]

R2.11 For 150 values of x, it is given that $\Sigma(x - 1) + \Sigma(x - 4) = 4170$. Find $\bar{x}$. [3]

R2.12 On Monday, a teacher asked eight students to write down a number, which is denoted by x. On Tuesday, when one of these students was absent, they asked them to add 1 to yesterday's number and write it down. Find the number written down on Monday by the student who was absent on Tuesday, given that $\bar{x} = 30(1/4)$, and that the mean of Monday's and Tuesday's numbers combined was 27(1/3). [3]

R2.13 A delivery of 150 boxes, each containing 20 items, is made to a retailer. The numbers of damaged items in the boxes are shown in the following table:

No. damaged items	0	1	2	3	4	5	6 or more
No. boxes (f)	100	10	10	10	10	10	0

(a) Find the mode, the mean and the median number of damaged items. [3]

(b) Which of the three measures of central tendency would be the most appropriate to use as the average in this case? Explain why using the other two measures could be misleading. [2]

R2.14 The monthly salaries, w dollars, of 10 women are such that $\Sigma(w - 3000) = -200$.
The monthly salaries, m dollars, of 20 men are such that $\Sigma(m - 4000) = 120$.

(a) Find the difference between the mean monthly salary of the women and the mean monthly salary of the men. [3]

(b) Find the mean monthly salary of all the women and men together. [3]

R2.15 For 90 values of x and 64 values of y, it is given that $\Sigma(x - 1) = 72.9$ and $\Sigma(y + 1) = 201.6$. Find the mean value of all the values of x and y combined. [5]

Check yourself

C.1 A dataset consists of 14 values with mean 28.5. Two extra values, 32 and 41, are added to the dataset. Calculate the new mean. [2]

C.2 For a set of 30 values of x, it is given that $\Sigma(x - 12) = 165$. Find the value of Σx and calculate $\bar{x}$. [2]

C.3 A frequency distribution of continuous variable t has modal class $20 \leq t < 30$ with frequency 45. Another class, $30 \leq t < 50$, has frequency 60. Explain why $20 \leq t < 30$ is the modal class despite having a smaller frequency. [2]

C.4 Data for the daily travel times (in minutes) of 80 office workers has lower quartile $Q_1 = 22$, median $M = 31$, and upper quartile $Q_3 = 48$. The mean travel time is 38.4 minutes. State the direction of skewness of this distribution, giving two pieces of evidence. [2]

C.5 The continuous variable w is grouped into classes 0–10 (f = 8), 10–25 (f = 24), 25–40 (f = 18). Using linear interpolation, calculate an estimate of the median of w. [3]

Chapter quiz

Q1 What is the mode of the dataset: 3, 7, 8, 5, 12, 7, 9, 3, 7, 4?

A	B	C	D
3	7	8	No mode

Q2 For grouped continuous data with unequal class widths, how is the modal class identified?

A	B	C	D
The class with the highest frequency	The class with the greatest frequency density	The widest class interval	The class containing the median

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Q3 A set of 12 numbers has mean 15, and a set of 8 numbers has mean 25. What is the combined mean?

A	B	C	D
19	20	20.5	18.5

Q4 Why is the mean calculated from a grouped frequency table called an estimate?

A	B	C	D
Frequencies are rounded	Midpoints represent the classes, not exact values	Classes with zero frequency are ignored	Continuous data cannot have a true mean

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Q5 For 20 values of x, $\Sigma(x - 15) = 140$. What is the mean $\bar{x}$?

A	B	C	D
7	22	8	29

Q6 Data x is coded using $y = (x - 50) / 4$. If $\bar{y} = 6.5$, what is the mean of x?

A	B	C	D
26	56.5	76	24

Q7 For 10 values, $\Sigma(2x - 3) = 64$. What is the value of Σx?

A	B	C	D
47	33.5	48.5	35

Q8 In an ordered set of 25 discrete items, at which position is the median located?

A	B	C	D
12th value	12.5th value	13th value	13.5th value

Q9 When estimating the median of n values from a cumulative frequency curve, which rank is used?

A	B	C	D
n / 2	(n + 1) / 2	(n − 1) / 2	n / 4

Q10 A distribution has a long tail to the right (positive skew). How are the averages usually ordered?

A	B	C	D
Mean < median < mode	Mode < median < mean	Median < mode < mean	Mode < mean < median

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Q11 Which measure of central tendency is least affected by an extreme outlier in a dataset?

A	B	C	D
Mean	Median	Mid-range	Sum of values

Q12 Dataset A has 10 values with $\Sigma(x - 5) = 30$. Dataset B has 15 values with $\Sigma(y - 5) = 45$. Combined mean?

A	B	C	D
8	7	6	9

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/as-a-level-mathematics/s1-2-measures-of-central-tendency/