Worksheet - Charts, averages and cumulative frequency

Year: Year 11 · 20

Show your working.

Question 1

Question 1 – Averages from a list *(Section A · Skills practice)*

Nine pupils recorded how many minutes they spent on homework one evening: 7, 3, 9, 3, 12, 5, 3, 8, 10.

a. Write the numbers in order. [1 mark]
b. Work out the mean, to 2 decimal places. [2 marks]
c. Find the median and the mode. [2 marks]
d. Work out the range. [1 mark]
e. Which average would you quote to show that most pupils did very little homework? Explain. [1 mark]

Question 2

Question 2 – A frequency table of pets *(Section A · Skills practice)*

Thirty pupils were asked how many pets they have.

Pets	0	1	2	3	4
Frequency	6	9	7	5	3

a. Work out the total number of pets. [2 marks]
b. Work out the mean number of pets, to 2 decimal places. [2 marks]
c. Find the median. [2 marks]
d. Write down the modal number of pets. [1 mark]

Question 3

Question 3 – Estimating a mean from grouped data *(Section A · Skills practice)*

The table shows the time 30 pupils take to travel to school.

Time, t (minutes)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$
Frequency	4	9	12	5

a. Write down the modal class. [1 mark]
b. Work out an estimate of the mean time. [4 marks]
c. Which class contains the median? Show how you know. [2 marks]

d. Explain why your answer to (b) is only an estimate. [1 mark]

Question 4

Question 4 – Drawing a pie chart *(Section A · Skills practice)*

A survey of 40 pupils asked for their favourite sport.

Sport	Football	Netball	Swimming	Tennis
Pupils	18	12	6	4

a. Work out the angle for each sport. [3 marks]
b. Check that your angles add to 360°. [1 mark]
c. What fraction of the pupils chose football? Give the fraction in its simplest form. [1 mark]

Question 5

Question 5 – A stem and leaf diagram *(Section A · Skills practice)*

Here are the times, in seconds, that 12 runners took to complete a 200 m race: 21, 24, 25, 25, 31, 33, 36, 38, 42, 45, 47, 52.

Stem	Leaf
2	1 4 5 5
3	1 3 6 8
4	2 5 7
5	2

a. Write the key for the diagram. [1 mark]
b. Find the median. [2 marks]
c. Find the range and the mode. [2 marks]
d. Which stem has the most leaves? [1 mark]

Question 6

Question 6 – Frequency density (Higher) *(Section A · Skills practice)*

The table shows how long people waited in a doctor's surgery.

Waiting time, t (min)	Frequency	Class width	Frequency density
$0 < t \leq 10$	20		
$10 < t \leq 30$	50		
$30 < t \leq 60$	45		
$60 < t \leq 100$	40		

a. Complete the class width and frequency density columns. [3 marks]
b. Work out the total number of people. [1 mark]
c. What percentage waited more than 30 minutes? Give your answer to 1 decimal place. [2 marks]

Question 7

Question 7 – Comparing two classes *(Section B · Real-life practice)*

Two Year 11 classes sat the same mock exam. The summary statistics are in the table.

	Class 11A	Class 11B
Lowest mark	20	12
Lower quartile	55	44
Median	62	58
Upper quartile	69	69
Highest mark	88	92

a. Work out the range and the interquartile range for each class. [4 marks]
b. Compare the performance of the two classes. [2 marks]
c. Class 11B says "We have the highest mark, so we did better." Comment on this. [2 marks]

Question 8

Question 8 – Heights of pupils (Higher) *(Section B · Real-life practice)*

The heights of 80 pupils are recorded in the table.

Height, h (cm)	$140 < h \leq 150$	$150 < h \leq 160$	$160 < h \leq 170$	$170 < h \leq 180$	$180 < h \leq 190$
Frequency	6	22	34	15	3

a. Complete a cumulative frequency table. [2 marks]
b. Use linear interpolation to estimate the median height. [2 marks]
c. Estimate the lower and upper quartiles and the interquartile range. [4 marks]
d. Estimate how many pupils are taller than 175 cm. [2 marks]

Question 9

Question 9 – Two runners and box plots (Higher) *(Section B · Real-life practice)*

Ben and Tara train for a 100 m race. Their times, in seconds, over 20 races are summarised.

	Ben	Tara

	Ben	Tara
Fastest	12.1	12.4
Lower quartile	12.5	12.6
Median	12.9	12.7
Upper quartile	13.4	12.9
Slowest	14.2	13.1

a. Draw (or describe) a box plot for each runner on the same scale. [4 marks]
b. Work out the range and IQR for each. [4 marks]
c. Who is the better runner? Give two reasons. [2 marks]

Question 10

Question 10 – Test scores and a new mean *(Section B · Real-life practice)*

After five tests, Sarah has a mean score of 64.

a. Work out the total of her five scores. [1 mark]
b. Her sixth test score is 70. Work out her new mean. [2 marks]
c. What score would she need in a seventh test for her mean after seven tests to be 67? [3 marks]
d. Her teacher says "Your median is higher than your mean." Her scores are 48, 59, 62, 73, 78 and 70. Is this true? [3 marks]

Question 11

Question 11 – Salaries in a small firm *(Section B · Real-life practice)*

A small firm has ten workers. Their yearly salaries, in thousands of pounds, are: 18, 20, 20, 22, 22, 24, 25, 28, 31 and 150 (the owner).

a. Work out the mean salary. [2 marks]
b. Find the median and the modes. [3 marks]
c. The owner says "The average salary here is £36 000." Explain why this is misleading. [2 marks]
d. Which average should the firm use in a job advert to give a fair picture? [1 mark]

Question 12

Question 12 – Cafe sales *(Section B · Real-life practice)*

A cafe recorded the number of cups of tea sold each day for 20 days.

Cups sold	40	41	42	43	44
Days	3	5	6	4	2

a. Find the modal number of cups. [1 mark]
b. Find the median. [2 marks]
c. Work out the mean number of cups per day. [3 marks]
d. Each cup costs £1.80. Work out the mean daily income from tea. [2 marks]

Question 13

Question 13 – Rainfall in a week *(Section B · Real-life practice)*

The rainfall, in millimetres, on each day of one week in Manchester was: 0, 4, 12, 3, 0, 9, 5.

a. Work out the mean, the median and the range. [4 marks]
b. Draw a bar chart (or describe it) and say which day had the most rain. [2 marks]
c. The following week the mean was 6.0 mm. What was the total rainfall that week? [2 marks]
d. Was the second week wetter on average? Explain. [2 marks]

Question 14

Question 14 – Speeds on a road (Higher) *(Section B · Real-life practice)*

Speeds of 80 cars were measured on a road with a 50 mph limit.

Speed, s (mph)	$20 < s \leq 30$	$30 < s \leq 40$	$40 < s \leq 50$	$50 < s \leq 60$	$60 < s \leq 70$
Frequency	8	24	30	14	4

a. Write down the modal class. [1 mark]
b. Estimate the mean speed. [4 marks]
c. Estimate the percentage of cars exceeding the limit. [2 marks]
d. Explain why you cannot be sure how many cars were doing more than 55 mph. [1 mark]

Question 15

Question 15 – Reading a histogram (Higher) *(Section C · Problem solving)*

The table shows the frequency densities for the ages of customers at a clothes shop.

Age, a (years)	$0 < a \leq 20$	$20 < a \leq 30$	$30 < a \leq 40$	$40 < a \leq 60$	$60 < a \leq 100$
Frequency density	0.5	2.4	3.2	1.4	0.3

a. Work out the frequency of each age group. [3 marks]
b. How many customers are there altogether? [1 mark]
c. Estimate how many customers were aged between 25 and 50. [3 marks]
d. Estimate the median age. [3 marks]

Question 16

Question 16 – Hospital waiting times (Higher) *(Section C · Problem solving)*

The table shows the cumulative frequency of the waiting times of 100 patients at an accident and emergency department.

Waiting time, t (min)	$t \leq 10$	$t \leq 20$	$t \leq 30$	$t \leq 40$	$t \leq 50$
Cumulative frequency	8	30	68	90	100

a. Draw the cumulative frequency graph (or plot the five points). [3 marks]
b. Estimate the median and the interquartile range. [5 marks]
c. The target is for 80% of patients to be seen within 35 minutes. Estimate whether the target was met. [3 marks]

Question 17

Question 17 – Finding a missing frequency *(Section C · Problem solving)*

Thirty pupils took a quiz marked out of 5. The table shows the frequencies for each score. One frequency is missing.

Score	**1**	**2**	**3**	**4**	**5**
Frequency	5	7	x	6	4

a. The mean score is 2.9. Show that $x = 8$. [4 marks]
b. What is the modal score? [1 mark]
c. Find the median score. [2 marks]
d. The teacher says "Over a third of the pupils scored 4 or more." Is this correct? [2 marks]

Question 18

Question 18 – Combined mean and a late arrival *(Section C · Problem solving)*

In Class A, 24 pupils have a mean mark of 62. In Class B, 16 pupils have a mean mark of 72.5.

a. Work out the total marks in each class. [2 marks]
b. Work out the mean mark of all 40 pupils. [3 marks]
c. A pupil from Class A scored 40 and a pupil from Class B scored 85. Both leave. Work out the new mean for the remaining pupils. [4 marks]

Question 19

Question 19 – Misleading pie charts *(Section C · Problem solving)*

The pie charts show favourite sports in Year 9 (60 pupils) and Year 11 (90 pupils). In the Year 9 chart the football sector has an angle of 120°. In the Year 11 chart it has an

angle of 100°.

a. How many pupils chose football in each year? [4 marks]
b. Joel says "More Year 9 pupils like football because the sector is bigger." Is he correct? [2 marks]
c. What information must always be shown with a pie chart so that two pie charts can be compared fairly? [2 marks]

Question 20

Question 20 – Challenge: five whole numbers *(Section D · Challenge)*

Five positive whole numbers have mean 7, median 8, mode 9 and range 7. Find the five numbers. Explain why there is only one possible answer.