

Range, quartiles and interquartile range

About 50 minutes Calculator allowed 38 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-range-quartiles-and-interquartile-range/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

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| <p>A1 Needed today [2 marks]</p> <p>A final mark is worked out from the practical, worth 60%, and the written paper, worth 40%. Ella scored 77 in the practical. What mark does Ella need in the written paper to get a final mark of 65?</p> | <p>A2 From chapter 2 [2 marks]</p> <p>Femi wants to know how the adults in a city travel to work. Femi asks people at the main train station at 8 am on a weekday. Give two reasons why the sample may not be representative.</p> |
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Answer

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| <p>A3 From chapter 3 [2 marks]</p> <p>Noor's hypothesis is "More girls than boys choose tea as their favourite hot drink." The data collection sheet has rows Tea, Coffee, Hot chocolate, Other and columns Tally and Frequency. Is the sheet appropriate? Give a reason.</p> | <p>A4 From chapter 3 [2 marks]</p> <p>Femi records four students' spelling test marks out of 40 before and after a month of using a spelling app. Before: 14, 32, 22, 14. After, in the same order: 10, 26, 20, 16. Work out the mean change from before to after.</p> |
|--|---|

Answer

B Example, then your turn

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

EXAMPLE 1

Here are the numbers of emails received by 11 office workers one morning.

14, 9, 22, 17, 6, 31, 12, 19, 8, 25, 15

Work out the range and the interquartile range.

Hint Put the values in order. With n values the lower quartile is the $\frac{n+1}{4}$ th value.

B1 Here are the heights, in cm, of 15 sunflowers. [3 marks]

152, 168, 141, 175, 160, 149, 183,
157, 171, 164, 138, 179, 155, 146,
166

Work out the range and the interquartile range.

Answer Range cm IQR cm

EXAMPLE 2

The table shows the numbers of goals a hockey team scored in 23 matches. Find the median and the interquartile range.

Goals	Frequency
0	4
1	7
2	5
3	4
4	2
5	1

Hint Add a running total down the table. With 23 values the quartiles are the 6th and 18th values.

B2 The table shows the numbers of books borrowed by 39 library members in a month. [3 marks]

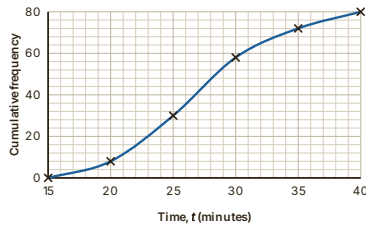
Work out the interquartile range.

Books	Frequency
0	5
1	8
2	9
3	7
4	5
5	3
6	2

Answer

EXAMPLE 3

The cumulative frequency graph shows the times taken by 80 runners in a 5 km race. Work out an estimate of the interdecile range of the times.



Hint The interdecile range runs from the 10th percentile to the 90th. Read across at 10% and 90% of 80, not at 10 and 90.

EXAMPLE 4

Here are the numbers of minutes that 9 buses were late on Monday.

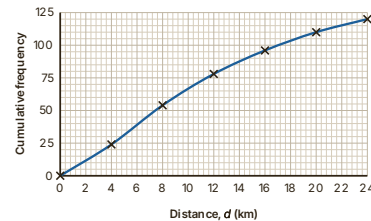
2, 0, 5, 3, 41, 1, 4, 6, 3

Give a reason why the interquartile range is a better measure of spread than the range for these times.

Hint Look for a value that is very different from the others, and ask which measure uses it.

B3 The cumulative frequency graph shows the distances travelled to work by 120 workers. [3 marks]

Work out an estimate of the range between the 20th and the 80th percentiles of the distances.



Answer

B4 Here are the prices, in £, of 9 bikes in a shop. [2 marks]

240, 310, 275, 1890, 260, 295, 330, 285, 250

Explain why the interquartile range is a more suitable measure of spread than the range for these prices.

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c Practice**C1** Here are the numbers of cars passing a school gate in eleven 10-minute periods, in order. [2 marks]

12, 15, 17, 20, 21, 24, 26, 29, a , 35, 40

12, 15, 17, 20, 21, 24, 26, 29, a , 35, 40

The interquartile range is 15. Find a .

Answer

C2 The interquartile range of the times that Year 10 students took to run 400 m is 18 seconds. [1 mark]

Explain what this tells you about the times.

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- C3** The stem-and-leaf diagram shows the ages of the 19 members of a choir. The 10th percentile is the $\frac{n+1}{10}$ th value. Work out the interquartile range and the interdecile range of the ages. [3 marks]

1	4 7 9
2	3 6
3	1 4 5 8
4	1 2 5 9
5	2 5 8
6	3 7
7	1

Key: 2 | 3 means 23 years

- C4** A table groups the masses of 200 parcels into classes $0 < m \leq 1$, $1 < m \leq 2$, and so on up to $5 < m \leq 6$ kg. Explain why the range of the masses cannot be found from the table. [1 mark]

Answer IQR Interdecile

D Exam-style questions

- D1** The prices of 7 phone cases in two shops are: [3 marks]
- Shop A: £4, £9, £10, £12, £13, £15, £38
- Shop B: £6, £8, £11, £14, £17, £20, £22
- Leo says, "The prices in Shop A are more spread out than the prices in Shop B, because the range for Shop A is bigger."

Is Leo correct? You must give a reason for your answer.

- D2** A science teacher times 15 Year 7 students and 15 Year 11 students solving a puzzle. For the Year 7 students the median time is 41 seconds and the interquartile range is 14 seconds. Here are the times, in seconds, of the Year 11 students. [3 marks]
- 23, 35, 29, 44, 31, 26, 38, 33, 27, 30, 36, 25, 40, 32, 28
- (a) Work out the median and the interquartile range of the Year 11 times.

Answer Median s IQR s

- (b) Compare the times of the Year 7 and Year 11 students. [2 marks]

Total for D2: 5 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** Seven positive whole numbers have a lower quartile of 5, a median of 9 and an upper quartile of 13. Their range is 14, their mean is 9 and their only mode is 13. [4 marks]
- Find the seven numbers.

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** With 7 values the quartiles are the 2nd and 6th values. Write the list in order as $a, 5, b, 9, c, 13, d$.
- Hint 2** For 13 to be the mode, two values must be 13. The largest, d , is $a + 14$, which is at least 15, so $c = 13$. The total is $7 \times 9 = 63$.
- Hint 3** $a + b + d = 63 - 5 - 9 - 13 - 13 = 23$ and $d = a + 14$, so $2a + b = 9$ with $5 \leq b \leq 9$. That gives $a = 1, b = 7$ or $a = 2, b = 5$. With $b = 5$, the value 5 would also be a mode, so the numbers are 1, 5, 7, 9, 13, 13, 15.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can find the range, quartiles and interquartile range from a list, a table or a stem-and-leaf diagram. ☐ ☐ ☐
- I can estimate interdecile and interpercentile ranges from a cumulative frequency graph. ☐ ☐ ☐
- I can explain why the interquartile range is not affected by extreme values. ☐ ☐ ☐