

Exercise walk-through

E9.6

Cumulative frequency diagrams

IGCSE Mathematics

You must be able to

- complete a cumulative frequency table
- read the median and quartiles from a cumulative frequency curve
- find the interquartile range

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The method

Method — Reading a cumulative frequency curve

- **Cumulative frequency** : add each frequency to the running total; plot at the **upper** end of each class.
- **Median** at $\frac{1}{2}$ of the total; **LQ** at $\frac{1}{4}$; **UQ** at $\frac{3}{4}$.
- **IQR** = UQ – LQ.

Answer shapes: **M1** a correct method, **A1** the correct answer.

Exercises 2.1·2.3

2.1 The frequencies of four classes are 5, 8, 10, 7. Write down the cumulative frequencies.[2]

2.2 A data set has a total cumulative frequency of 80. At what cumulative frequency do you read the median? [1]

2.3 At what cumulative frequency do you read the lower quartile if the total is 80? [1]

Exercises 2.1·2.3

2.1 The frequencies of four classes are 5, 8, 10, 7. Write down the cumulative frequencies.[2]

2.1

- running total
- **5, 13, 23, 30**

2.2 A data set has a total cumulative frequency of 80. At what cumulative frequency do you read the median? [1]

2.2

- at $\frac{80}{2} = \mathbf{40}$

2.3 At what cumulative frequency do you read the lower quartile if the total is 80? [1]

2.3

- at $\frac{80}{4} = \mathbf{20}$

Exercise 3.1 (a)

3.1 A cumulative frequency curve is drawn for 200 students' test marks.

(a) State the cumulative frequency at which you read the upper quartile.

[1]

Exercise 3.1 (a)

3.1 A cumulative frequency curve is drawn for 200 students' test marks.

(a) State the cumulative frequency at which you read the upper quartile. [1]

(a)

- at $\frac{3}{4} \times 200 = \mathbf{150}$

Exercise 3.1 (b)

3.1 A cumulative frequency curve is drawn for 200 students' test marks.

(b) From the curve, the lower quartile is 42 and the upper quartile is 63. Find the interquartile range. [2]

Exercise 3.1 (b)

3.1 A cumulative frequency curve is drawn for 200 students' test marks.

(b) From the curve, the lower quartile is 42 and the upper quartile is 63. Find the interquartile range. [2]

(b)

- $\text{IQR} = 63 - 42 = \mathbf{21}$

Exercise 3.2

3.2 The cumulative frequencies 0, 6, 20, 45, 60 are given for five class boundaries. Find the total frequency, and the cumulative frequency used to read the median. [2]

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3.2

- total frequency = **60**
- median is read at $\frac{60}{2} = \mathbf{30}$

Exercise 3.3 (a)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(a) Complete a cumulative frequency table and draw the cumulative frequency diagram.^[4]

Exercise 3.3 (a)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(a) Complete a cumulative frequency table and draw the cumulative frequency diagram.^[4]

(a)

- cumulative frequencies **6, 24, 54, 74, 80**
- points plotted at the **upper** class boundaries 10, 20, 30, 40, 50
- a smooth increasing curve through them

Exercise 3.3 (b)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(b) Use your diagram to estimate the median and the interquartile range. [4]

Exercise 3.3 (b)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(b) Use your diagram to estimate the median and the interquartile range. [4]

(b)

- median at the 40th value, about **27** minutes
- LQ at the 20th, about 18 min; UQ at the 60th, about 32 min
- $\text{IQR} \approx 32 - 18 = \mathbf{14}$ minutes

Exercise 3.3 (c)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(c) Estimate how many students took longer than 35 minutes.

[2]

Exercise 3.3 (c)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(c) Estimate how many students took longer than 35 minutes. [2]

(c)

- reading up from 35 gives a cumulative frequency of about 64
- about $80 - 64 = \mathbf{16}$ students took longer

Exercise 3.3 (d)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(d) Explain why every value read from this diagram is an **estimate**.

[2]

Exercise 3.3 (d)

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(d) Explain why every value read from this diagram is an **estimate**. [2]

(d)

- the original data were **grouped**, so individual times are no longer known
- the curve assumes values are spread evenly within each class – every reading is an **estimate**