

GCSE Maths – Statistics

Grouped Discrete Data and Continuous Data

(Higher Only)

Worksheet

WORKED SOLUTIONS

This worksheet will show you how to work out different types of questions related to grouped data. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

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Section A

Worked Example

100 people were timed while completing a puzzle. Their results are shown in the table. Create a histogram displaying their times.

Time (minutes)	Frequency
$0 < t \leq 10$	10
$10 < t \leq 15$	15
$15 < t \leq 20$	30
$20 < t \leq 30$	20
$30 < t \leq 45$	25

Step 1: Calculate class width and frequency density.

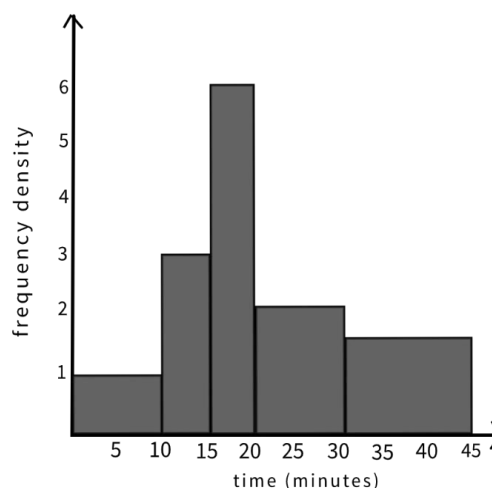
Time (minutes)	Frequency	Class Width	Frequency Density
$0 < t \leq 10$	10	10	$10 \div 10 = 1$
$10 < t \leq 15$	15	5	$15 \div 5 = 3$
$15 < t \leq 20$	30	5	$30 \div 5 = 6$
$20 < t \leq 30$	20	10	$20 \div 10 = 2$
$30 < t \leq 45$	25	15	$25 \div 15 = 1.67$

Step 2: Plot the histogram.

Draw the x and y axis. Label the x-axis with the time variable and the y-axis with frequency density.

Draw each bar by plotting the length of time against the frequency density.

For example, the first group is 10 minutes long, and has a frequency density of 1. The bar that represents it should be 10 units wide and 1 unit tall.



Guided Example

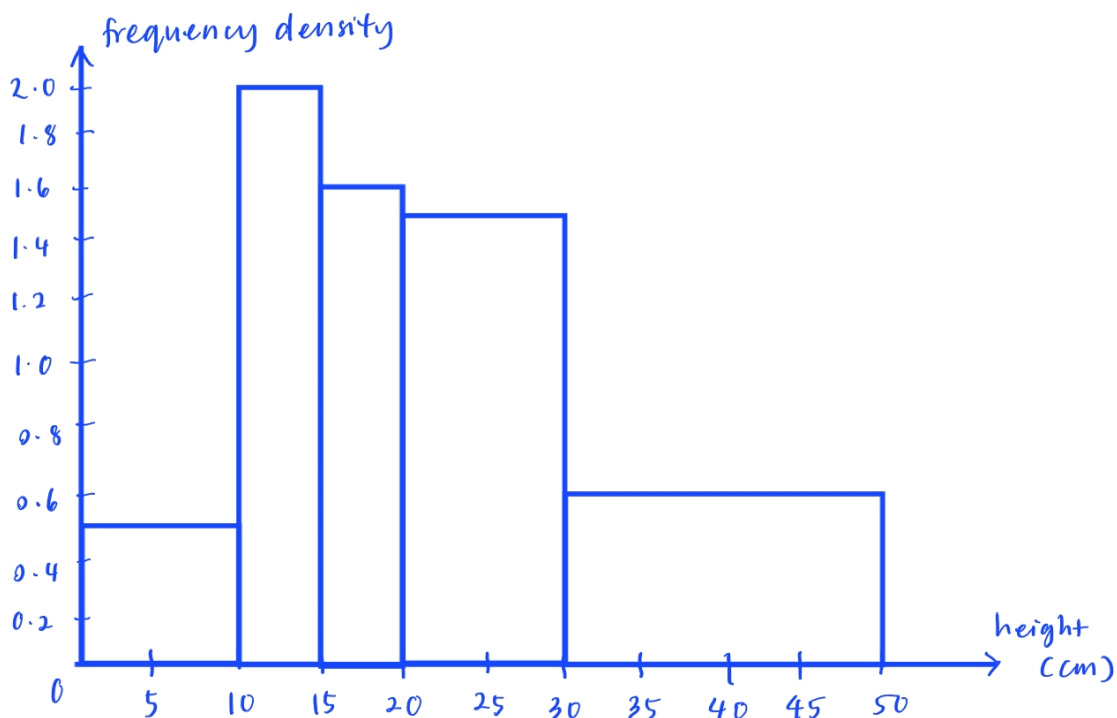
Below is a grouped frequency table showing the heights of flowers growing in a garden. Create a histogram displaying the heights of the flowers.

Height, h (cm)	Frequency
$0 < h \leq 10$	5
$10 < h \leq 15$	10
$15 < h \leq 20$	8
$20 < h \leq 30$	15
$30 < h \leq 50$	12

Step 1: Calculate the frequency densities for each height grouping.

Height, h (cm)	Frequency	Class width	Frequency Density
$0 < h \leq 10$	5	10	$5 \div 10 = 0.5$
$10 < h \leq 15$	10	5	$10 \div 5 = 2$
$15 < h \leq 20$	8	5	$8 \div 5 = 1.6$
$20 < h \leq 30$	15	10	$15 \div 10 = 1.5$
$30 < h \leq 50$	12	20	$12 \div 20 = 0.6$

Step 2: Draw the histogram by plotting height (cm) on the x-axis against frequency density on the y-axis.



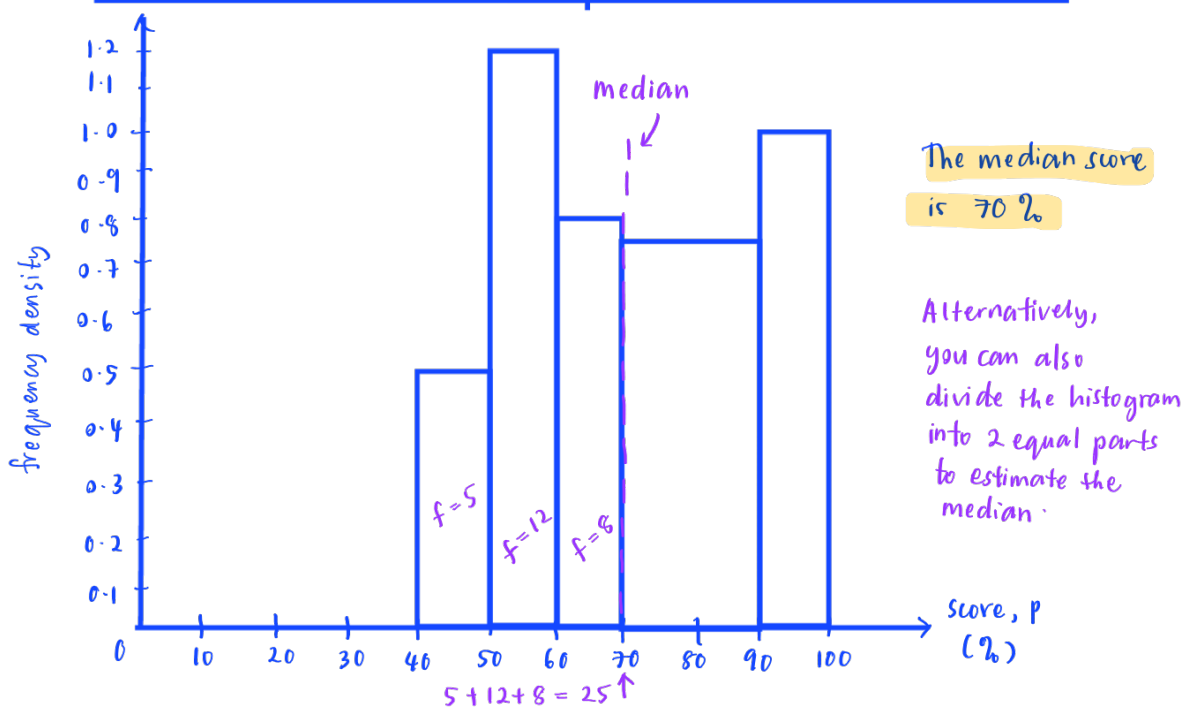
Now it's your turn!

If you get stuck, look back at the worked and guided examples.

1. Below is a grouped frequency table showing the results of an English test.
 - a) Draw a histogram showing the results of the test.
 - b) Calculate an estimate for the median score using the histogram.

Score, p (%)	Frequency
$40 < p \leq 50$	5
$50 < p \leq 60$	12
$60 < p \leq 70$	8
$70 < p \leq 90$	15
$90 < p \leq 100$	10

Score, p (%)	Frequency	Class width	Frequency Density
$40 < p \leq 50$	5	10	$5 \div 10 = 0.5$
$50 < p \leq 60$	12	10	$12 \div 10 = 1.2$
$60 < p \leq 70$	8	10	$8 \div 10 = 0.8$
$70 < p \leq 90$	15	20	$15 \div 20 = 0.75$
$90 < p \leq 100$	10	10	$10 \div 10 = 1.0$



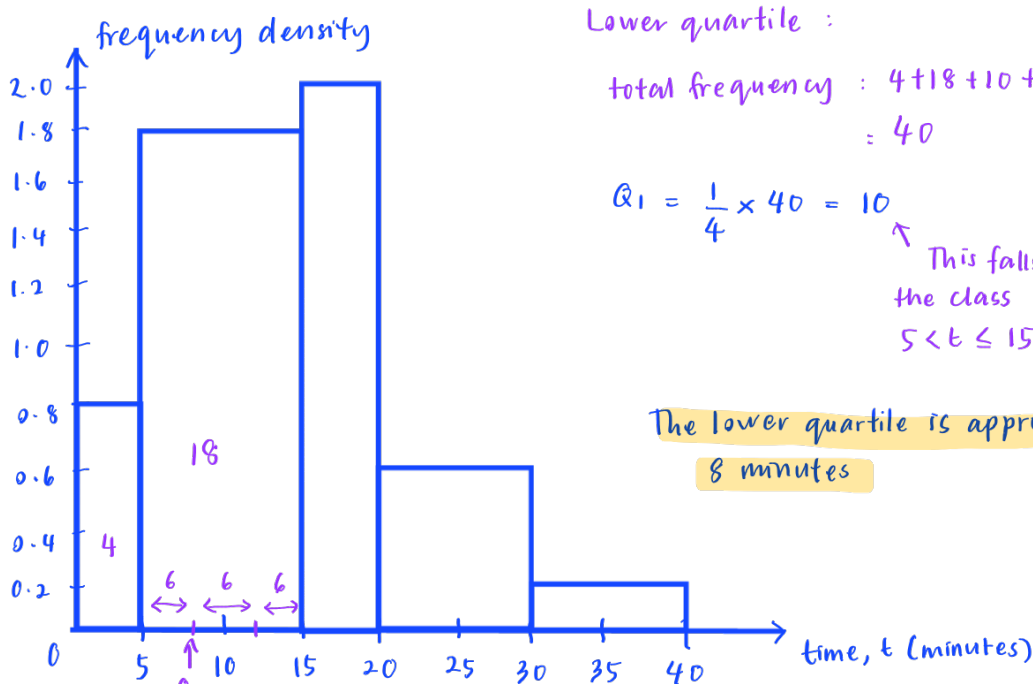
$$\text{median} : \frac{\text{total frequency}}{2} = \frac{50}{2} = 25 \rightarrow \text{find the class with the } 25^{\text{th}} \text{ frequency}$$



2. The table below shows information about how long it takes a group of children to get to school.
- Draw a histogram to show this data.
 - Using the histogram, calculate an estimate for the lower quartile.

Time, t (minutes)	Frequency
$0 < t \leq 5$	4
$5 < t \leq 15$	18
$15 < t \leq 20$	10
$20 < t \leq 30$	6
$30 < t \leq 40$	2

Time, t (minutes)	Frequency	Class width	Frequency Density
$0 < t \leq 5$	4	5	$4 \div 5 = 0.8$
$5 < t \leq 15$	18	10	$18 \div 10 = 1.8$
$15 < t \leq 20$	10	5	$10 \div 5 = 2.0$
$20 < t \leq 30$	6	10	$6 \div 10 = 0.6$
$30 < t \leq 40$	2	10	$2 \div 10 = 0.2$



Lower quartile :

$$\begin{aligned} \text{total frequency} &: 4 + 18 + 10 + 6 + 2 \\ &= 40 \end{aligned}$$

$$Q_1 = \frac{1}{4} \times 40 = 10$$

↑ This falls in the class $5 < t \leq 15$

The lower quartile is approximately 8 minutes

$$4 + 6 = 10 \quad 18/3 = 6 \quad 10/3 = 3.3 \quad 5 + 3.3 = 8.3 \text{ mins}$$

class width of $5 < t \leq 15$



Section B

Worked Example

The hop length of 100 footballers was collected and recorded in a table. Draw a cumulative frequency graph to display this data.

Length (metres)	Frequency
$0 < m \leq 1$	10
$1 < m \leq 2$	20
$2 < m \leq 2.5$	30
$2.5 < m \leq 3$	30
$3 < m \leq 4$	10

Step 1: Add a column to the table for cumulative frequency

Cumulative frequency is a running total of the frequencies. It is calculated by adding up all the frequency totals that have been recorded so far.

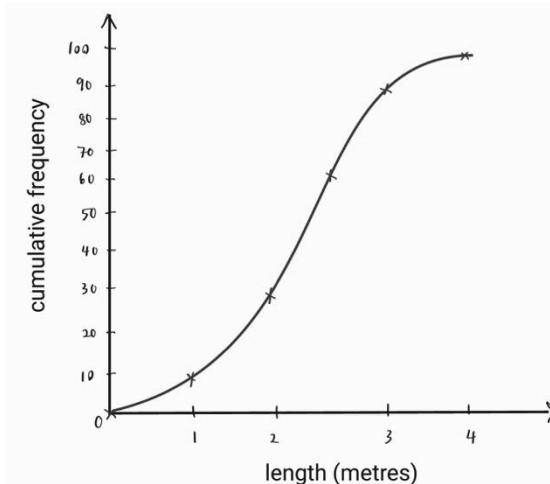
Length (metres)	Frequency	Cumulative frequency	Upper boundary
$0 < m \leq 1$	10	10	1
$1 < m \leq 2$	20	$20 + 10 = 30$	2
$2 < m \leq 2.5$	30	$30 + 30 = 60$	2.5
$2.5 < m \leq 3$	30	$60 + 30 = 90$	3
$3 < m \leq 4$	10	$90 + 10 = 100$	4

Step 2: Plot cumulative frequency graph.

Plot a point showing the cumulative frequency on the upper bound of each group.

For example, the first point would be at 10 (the cumulative frequency) and 1 (the upper bound of the first group). Draw this point on the graph at (1,10).

Join all the points with a smooth curve, making sure your line passes through the origin (0,0).



Guided Example

Andrew collected data on the time it took a group of people to complete a short race. The times have been summarised in the grouped frequency table below. Draw a cumulative frequency graph to display this data.

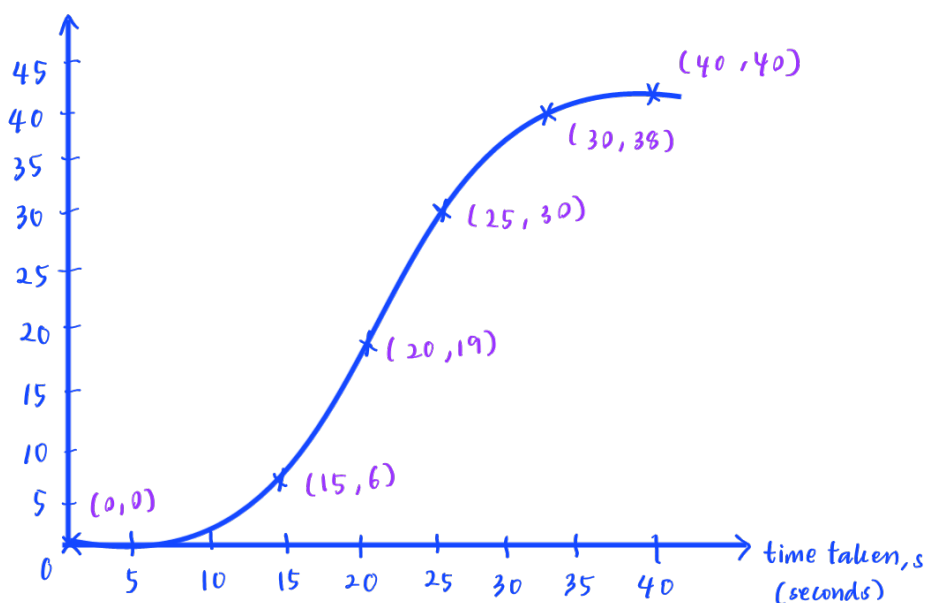
Time taken, s (seconds)	Frequency
$10 < s \leq 15$	6
$15 < s \leq 20$	13
$20 < s \leq 25$	11
$25 < s \leq 30$	8
$30 < s \leq 40$	2

Step 1: Add a column to the table for cumulative frequency and calculate the running total for each row.

time taken, s (seconds)	Frequency	Cumulative frequency	upper class boundary
$10 < s \leq 15$	6	6	15
$15 < s \leq 20$	13	19	20
$20 < s \leq 25$	11	30	25
$25 < s \leq 30$	8	38	30
$30 < s \leq 40$	2	40	40

Step 2: Plot a cumulative frequency graph.

cumulative frequency



Now it's your turn!

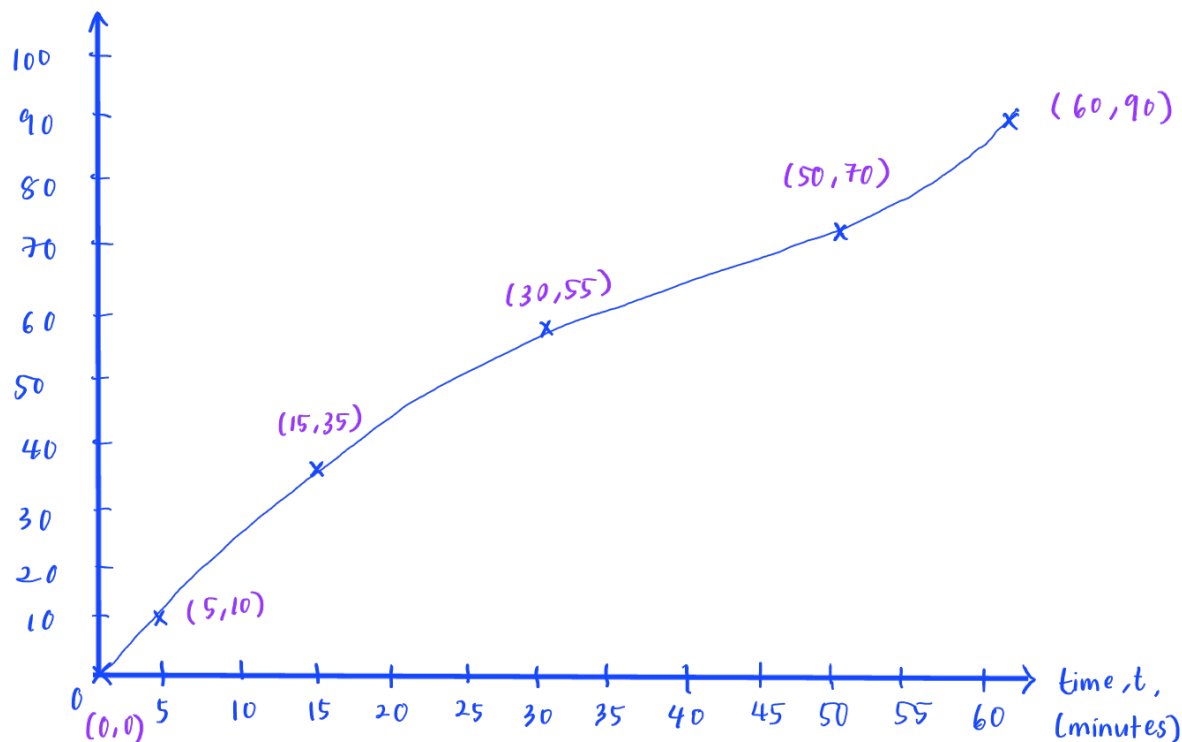
If you get stuck, look back at the worked and guided examples.

3. Below is a frequency table showing the amount of time people spent on social media per day. Plot a cumulative frequency graph to show this data.

Time, t (minutes)	Frequency
$0 < t \leq 5$	10
$5 < t \leq 15$	25
$15 < t \leq 30$	20
$30 < t \leq 50$	15
$50 < t \leq 60$	20

Time, t (minutes)	Frequency	Cumulative frequency	upper class boundary
$0 < t \leq 5$	10	10	5
$5 < t \leq 15$	25	35	15
$15 < t \leq 30$	20	55	30
$30 < t \leq 50$	15	70	50
$50 < t \leq 60$	20	90	60

cumulative frequency



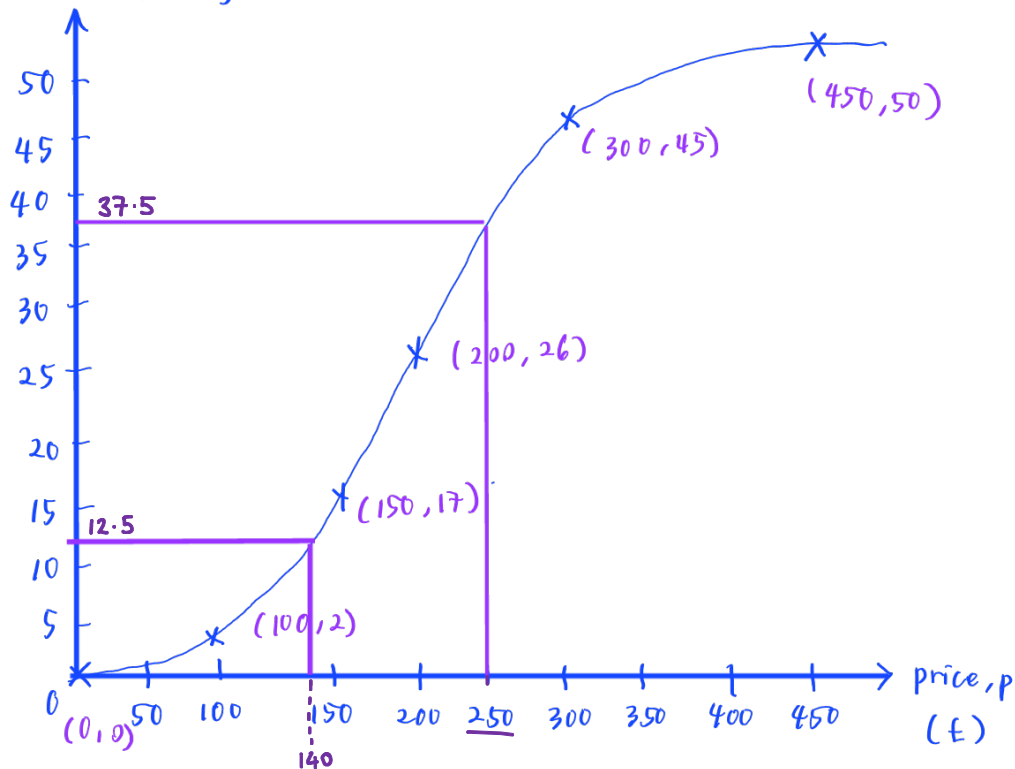
4. Below is a frequency table showing the price brackets that some laptops on sale fall into.
- Plot a cumulative frequency graph to show this data.
 - Using the cumulative frequency graph, calculate the interquartile range.

Price, p (£)	Frequency
$50 < p \leq 100$	2
$100 < p \leq 150$	15
$150 < p \leq 200$	9
$200 < p \leq 300$	19
$300 < p \leq 450$	5

Price, p (£)	Frequency	Cumulative frequency	upper class boundary
$50 < p \leq 100$	2	2	100
$100 < p \leq 150$	15	17	150
$150 < p \leq 200$	9	26	200
$200 < p \leq 300$	19	45	300
$300 < p \leq 450$	5	50	450

cumulative frequency

$$\begin{aligned}
 Q_3 &= \\
 &= \frac{3}{4} \times 50 \\
 &= 37.5 \\
 Q_1 &= \\
 &= \frac{1}{4} \times 50 \\
 &= 12.5
 \end{aligned}$$



$$\text{Interquartile range} = 250 - 140 = 110$$

The interquartile range is approximately £110.

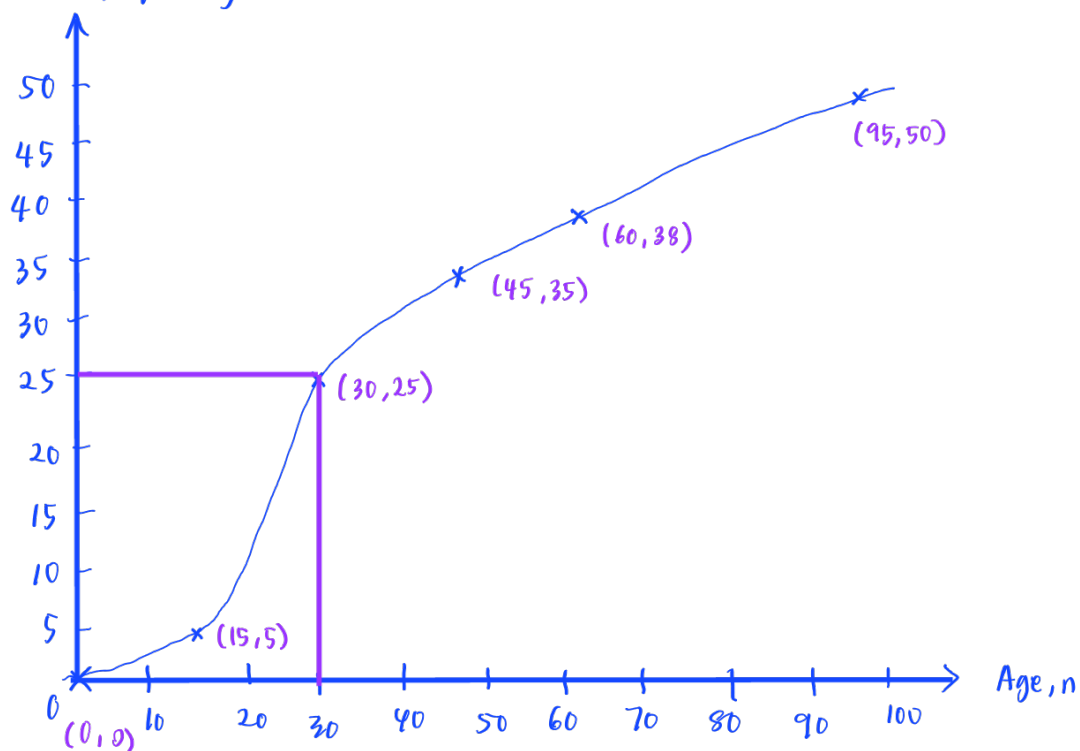


5. Ella gathered data on the ages of people living on her street. Her results are summarised in the frequency table below.
- Plot a cumulative frequency graph to show this data.
 - Use the cumulative frequency graph to calculate the median.

Age, n	Frequency
$0 < n \leq 15$	5
$15 < n \leq 30$	20
$30 < n \leq 45$	10
$45 < n \leq 60$	3
$60 < n \leq 95$	12

Age, n	Frequency	Cumulative frequency	upper class boundary
$0 < n \leq 15$	5	5	15
$15 < n \leq 30$	20	25	30
$30 < n \leq 45$	10	35	45
$45 < n \leq 60$	3	38	60
$60 < n \leq 95$	12	50	95

cumulative frequency



The median is 30.

