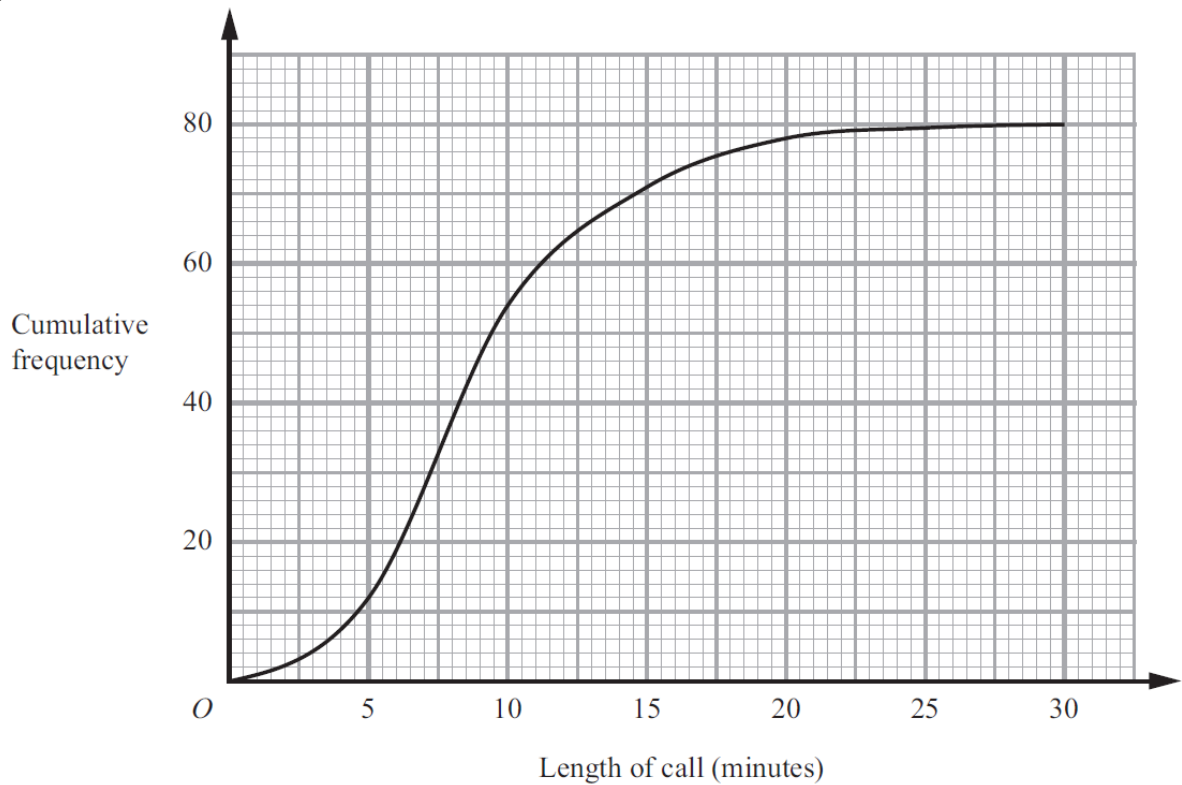


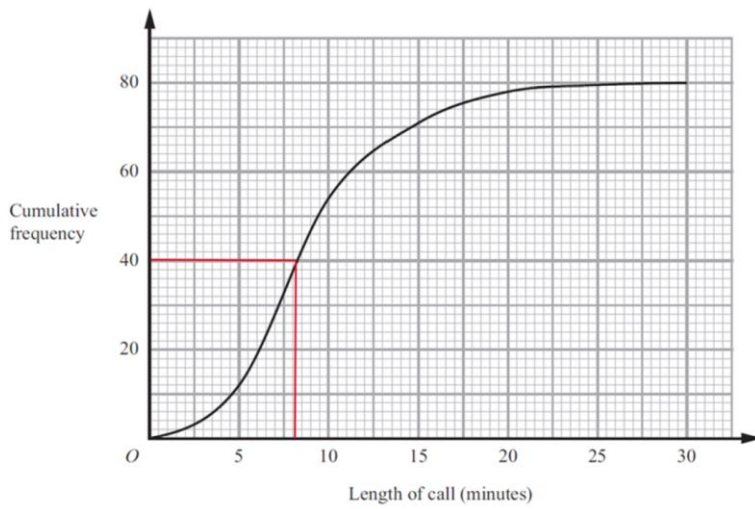
The cumulative frequency graph gives information about the lengths, in minutes, of 80 telephone calls.



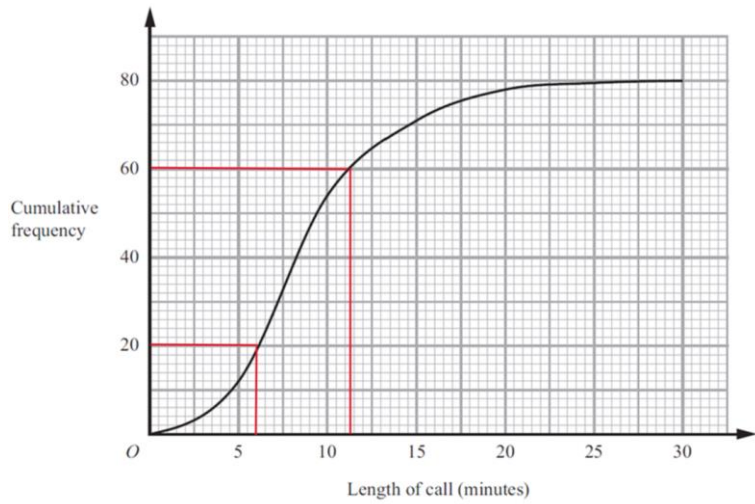
- Find the median length of a phone call
- Find the interquartile range of the length of a phone call
- Find the number of phone calls that were more than 10 minutes in length
- The frequency table below shows the lengths of the 80 phone calls. Find values a , b and c .

Time, t in minutes	frequency
$0 \leq t < 5$	12
$5 \leq t < 10$	a
$10 \leq t < 15$	b
$15 \leq t < 20$	c
$20 \leq t < 25$	1
$25 \leq t < 30$	1

- These data contain some outliers. How many outliers are there?
- Calculate an estimate of the mean length of a phone call



a. Median = 8

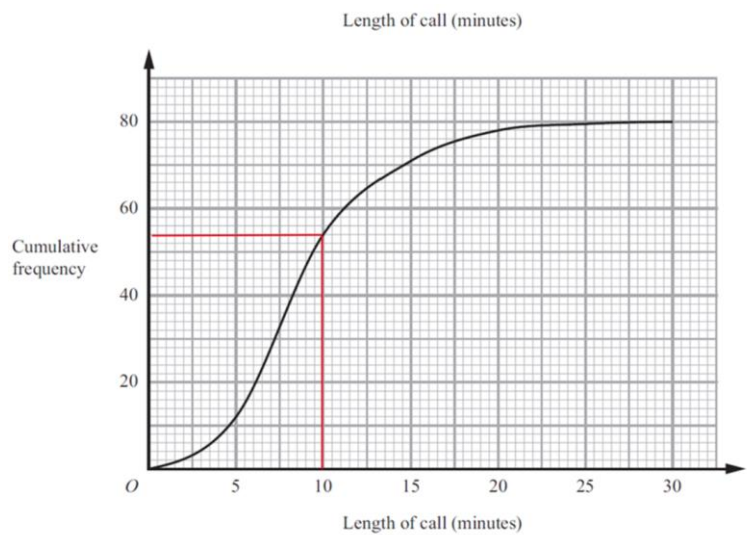


b.

Upper quartile = 11.5

Lower quartile = 6

Interquartile Range = $11.5 - 6 = 5.5$



c.

Number of calls more than 10 mins = $80 - 54 = 26$

Here are the cumulative frequency and frequency tables from the graph

Time, t in minutes	Cumulative frequency	Time, t in minutes	frequency
t < 5	12	0 ≤ t < 5	12
t < 10	54	5 ≤ t < 10	42
t < 15	71	10 ≤ t < 15	17
t < 20	78	15 ≤ t < 20	7
t < 25	79	20 ≤ t < 25	1
t < 30	80	25 ≤ t < 30	1

$$\text{Lower Outlier} = Q_1 - 1.5 \times \text{IQR} = 6 - 1.5 \times 5.5 = -2.25$$

$$\text{Upper Quartile} = Q_3 + 1.5 \times \text{IQR} = 11.5 + 1.5 \times 5.5 = 19.75$$

midpoint	frequency
2.5	12
7.5	42
12.5	17
17.5	7
22.5	1
27.5	1

$$\text{Mean} = \frac{2.5 \times 12 + 7.5 \times 42 + 12.5 \times 17 + 17.5 \times 7 + 22.5 \times 1 + 27.5 \times 1}{80} = \frac{730}{80}$$

You can use your GDC in statistics mode to calculate this

d.

$$a = 42$$

$$b = 17$$

$$c = 7$$

e.

There are no outliers at the lower end

Any values over 19.75 are outliers. There are 2 values ≥ 20

There are **2 outliers**

f.

$$\text{Mean} = 9.125$$

or

$$\text{Mean} = 9.13 \text{ (3 s.f.)}$$