Lesson 9

GCSE Mathematics
Statistics

9.1 Cumulative Frequency Polygons

Having previously looked at how to calculate the mean from a grouped frequency table, obtaining the median and the quartiles will next be considered. This is often done by first plotting a **Cumulative** Frequency Polygon.

9.2 Example

In a sponsored swim the number of lengths swum by 200 children were recorded.

Number of lengths	Frequency	Cumulative Frequency
$1 \leqslant l \leqslant 10$	3	
$11 \leqslant l \leqslant 20$	16	
$21 \leqslant l \leqslant 30$	21	
$31 \leqslant l \leqslant 40$	22	
$41 \leqslant l \leqslant 50$	27	
$51 \leqslant l \leqslant 60$	32	
$61 \leqslant l \leqslant 70$	33	
$71 \leqslant l \leqslant 80$	18	
$81 \leqslant l \leqslant 90$	21	
$91 \leqslant l \leqslant 100$	7	

(a) Complete the table by filling in the column headed 'Cumulative Frequency'.

(b) On the graph paper on the next page, plot a Cumulative Frequency Polygon. Be sure to plot the points at the ***ends of the intervals***.

(c) Use your part **(b)** graph (*leave evidence*) to give estimates of

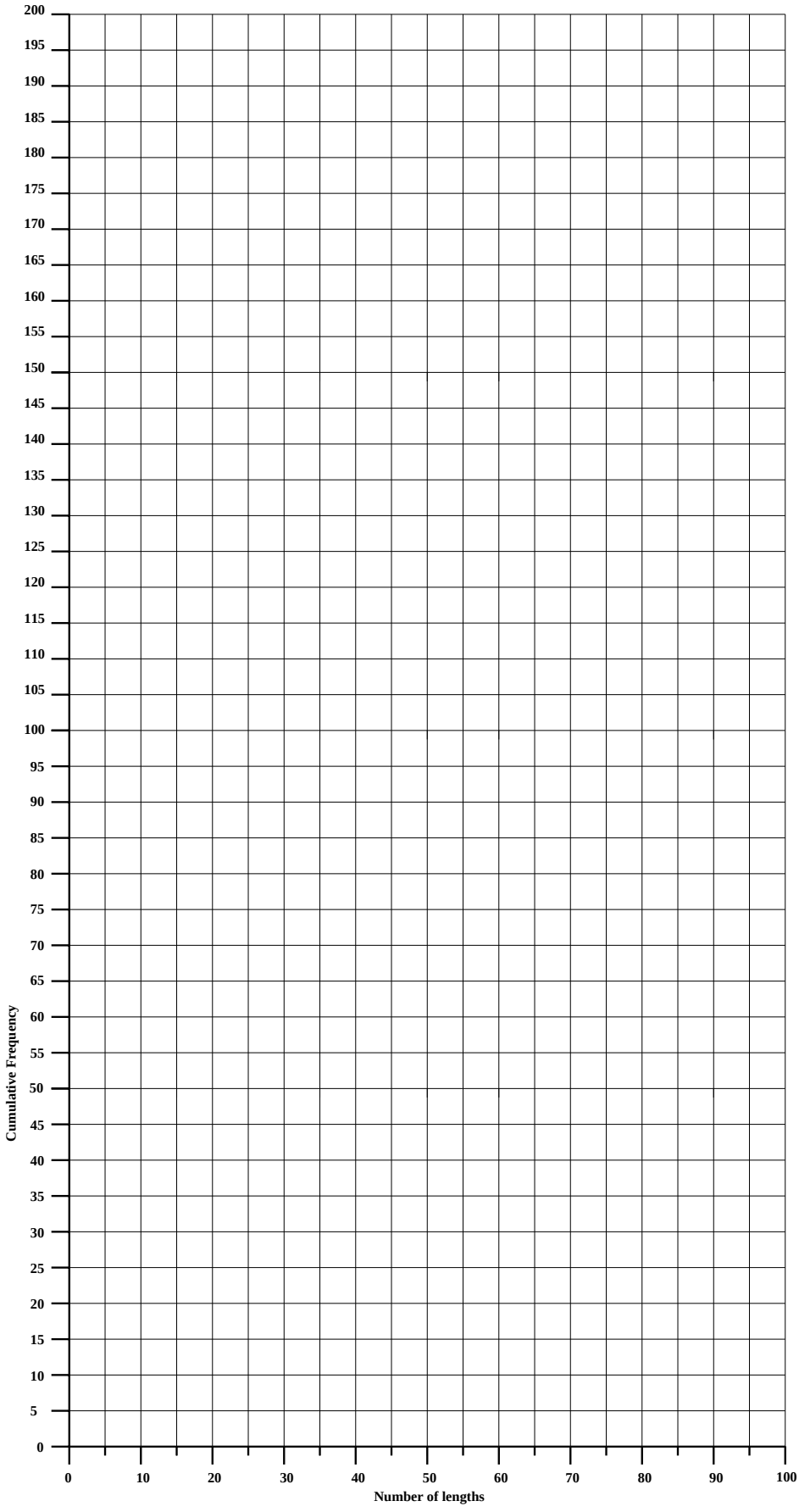
(i) The median.

(ii) The lower quartile.

(iii) The upper quartile.

(d) What is the interquartile range ?

(e) How many children swum more than 75 lengths ?


Cumulative Frequency
200
195
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
Number of lengths

9.3 Exercise

Question 1

The grouped frequency table gives information about the ages of the birds in a flock of 200 African Grey parrots.

Age (t years)	Frequency	Cumulative Frequency
$0 < t \leqslant 10$	55	
$10 < t \leqslant 20$	60	
$20 < t \leqslant 30$	40	
$30 < t \leqslant 40$	22	
$40 < t \leqslant 50$	13	
$50 < t \leqslant 60$	10	

(a) Complete the table by filling in the column headed 'Cumulative Frequency'.

(b) On the graph paper on the next page, plot a Cumulative Frequency Polygon. Be sure to plot the points at the ***ends of the intervals***.

(c) Use your part **(b)** graph (*leave evidence*) to give estimates of

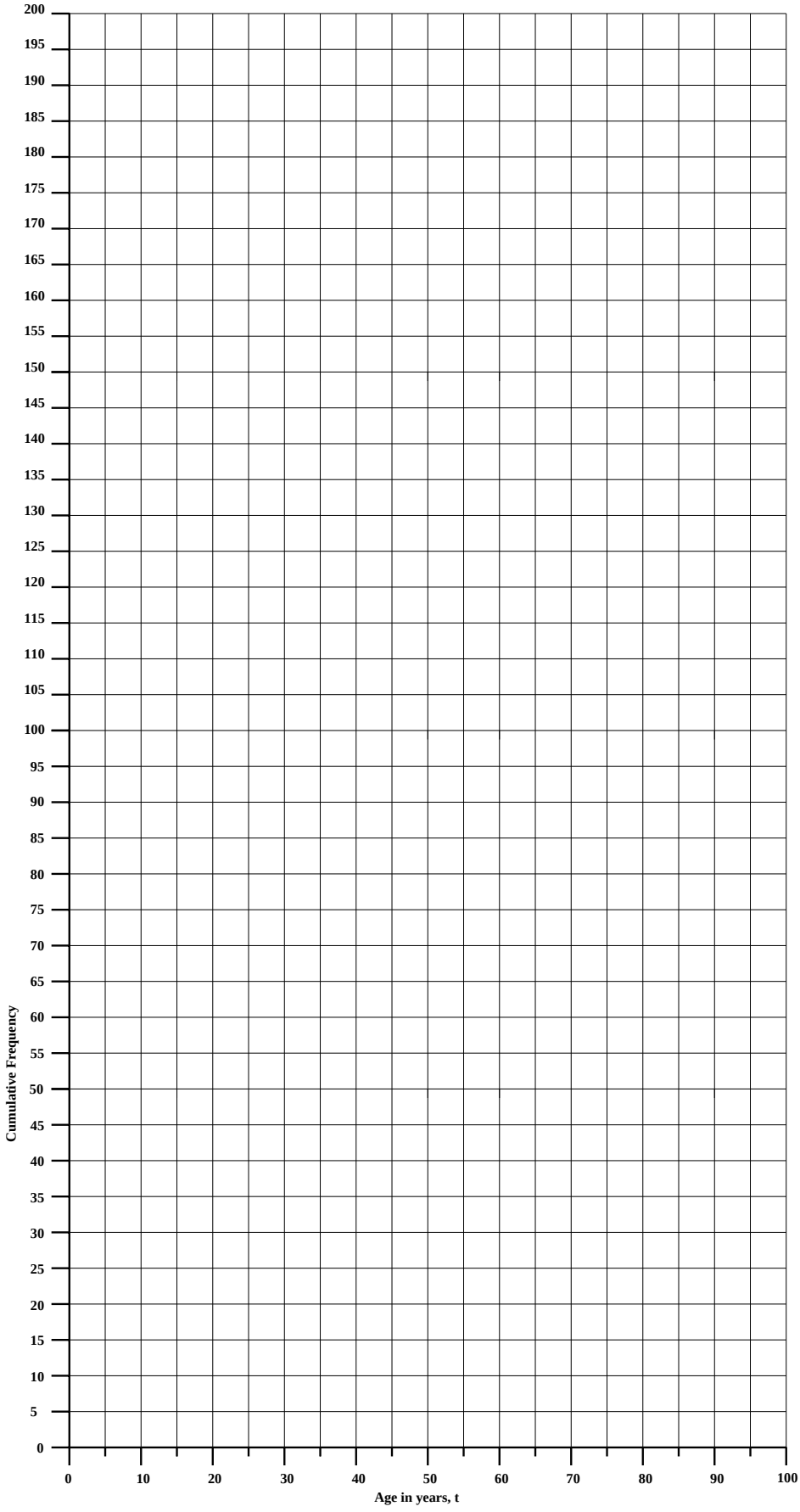
(i) The median.

(ii) The lower quartile.

(iii) The upper quartile.

(d) What is the interquartile range ?

(e) How many parrots in the flock are 35 years old, or older ?


Cumulative Frequency
200
195
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
Age in years, t

Question 2
The table shows information about the weights of 800 parcels.

Weight (w kg)	Frequency	Cumulative Freq	
$0 < w \leqslant 2$	82		
$2 < w \leqslant 4$	138		
$4 < w \leqslant 6$	255		
$6 < w \leqslant 8$	173		
$8 < w \leqslant 10$	102		
$10 < w \leqslant 12$	50		

(a) **(i)** Work out an estimate for the total weight of the 800 parcels.

(ii) Estimate the mean weight of a parcel.

(b) Complete the table by filling in the column headed 'Cumulative Freq'.

(c) On the graph paper on the next page, plot a Cumulative Frequency Polygon. Be sure to plot the points at the ***ends of the intervals***.

(d) Use your part **(c)** graph (*leave evidence*) to give estimates of

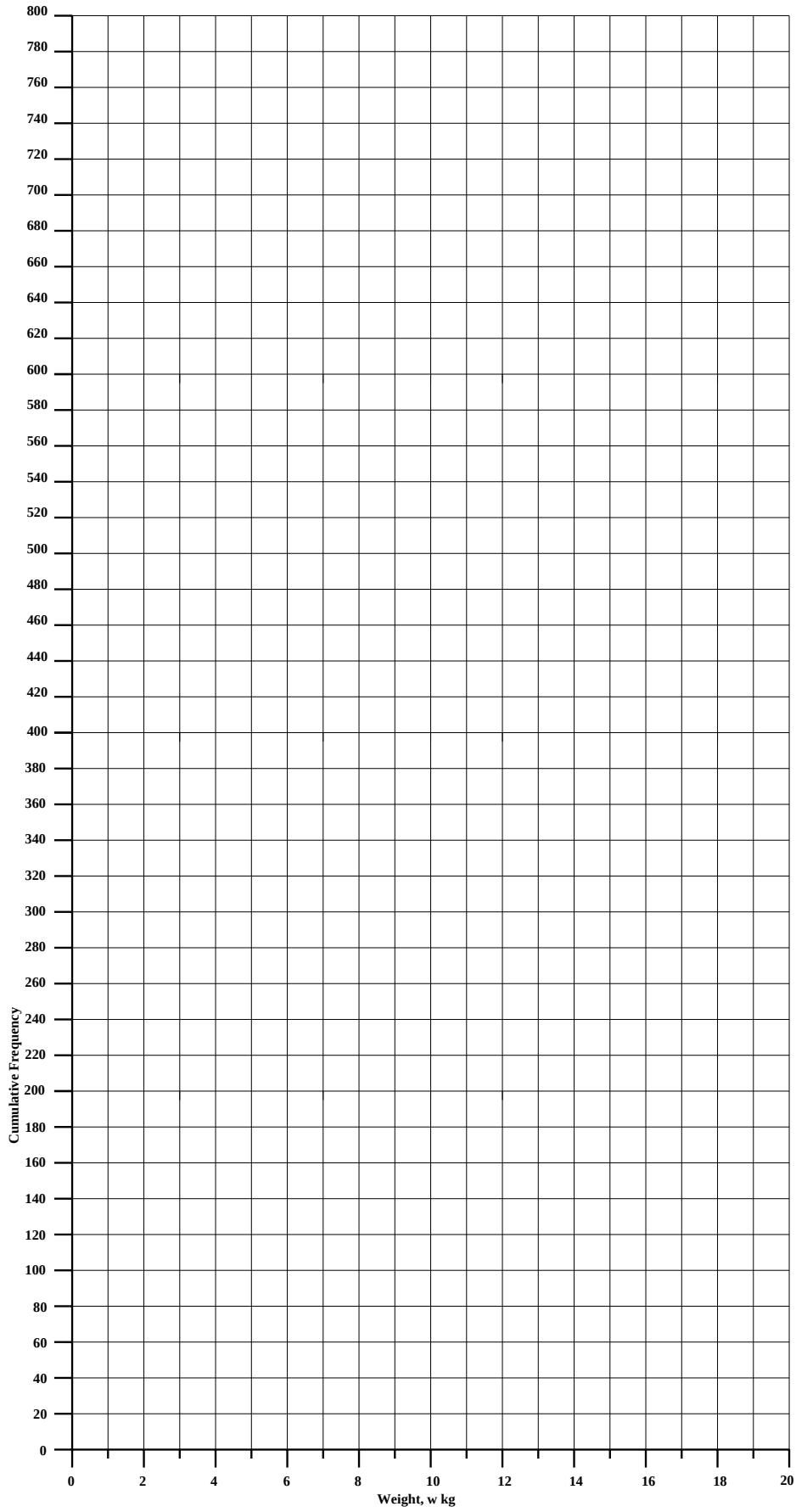
(i) The median.

(ii) The lower quartile.

(iii) The upper quartile.

(e) What is the interquartile range ?

(f) Use your graph to find an estimate for the number of parcels which weighed less than 5.2 kg.


Cumulative Frequency
800
780
760
740
720
700
680
660
640
620
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
Weight, w kg

9.4 A statistical analysis of Scotland's 277 Munros.

A Monroe is a Scottish mountain with a height of 3000 feet or more.
Enthusiastic mountaineers aim to climb them all.

(a) Use the data set of Monroe heights to fill in the column headed 'Frequency' in the following table. ***Make sure you are looking at the heights in feet.***

Height, f, in feet	Frequency	Cumulative Frequency
$3000 \leqslant f < 3100$		
$3100 \leqslant f < 3200$		
$3200 \leqslant f < 3300$		
$3300 \leqslant f < 3400$		
$3400 \leqslant f < 3500$		
$3500 \leqslant f < 3600$		
$3600 \leqslant f < 3700$		
$3700 \leqslant f < 3800$		
$3800 \leqslant f < 3900$		
$3900 \leqslant f < 4000$		
$4000 \leqslant f < 4100$		
$4100 \leqslant f < 4200$		
$4200 \leqslant f < 4300$		
$4300 \leqslant f < 4400$		
$4400 \leqslant f < 4500$		

(b) Complete the column headed “Cumulative Frequency” in the table.

(c) On the graph paper provided, plot a cumulative frequency curve to show the distribution of the heights of the Munroes.

Comment on the distribution.