Exercise 1.1

1 (i) 18 (ii) 66

2 (i) **Key:** 5 | 2 means 52 kg

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

(ii) 68

3 (i) **Key:** 5 | 3 means 5.3 cm

3	9
4	
5	3 4 5 5
6	1 1 5 7 8
7	0 0 1 3 4 5 6 6 8 9
8	0 1 2 2 4 8
9	2 6
10	0 1

(ii) 47%

4 **Key:** 7 | 3 means 7.3 hours

0	0 2 6 8
1	6
2	4 6
3	
4	3 8
5	6 6 8
6	1 2 8
7	0 3 5 5 6 8
8	3 4
9	7 8
10	4
11	1 3 6
12	5 9

5 (i) **Key:** 201 | 5 means 2.015 litres

198	2 5 6 8
199	0
200	1 3 4 8
201	1 5 7 7 8 9 9
202	2 3 4
203	3

(ii) 25%

6 (i) **Key:** 4 | 6 | 9 means 64 Before exercise
69 After exercise

Before exercise		**After exercise**
8	4	
7 3 1 1 0	5	
9 9 6 6 4	6	9
9 5 3 3 0 0	7	0 5 5 7 7
1	8	0 0 1 4 4 6
3 3 3 3 1 0 0	9	5 6 7
5 5	10	4 4 4 6 8 9
1 1 0	11	7
	12	5
	13	0 0 1 7 7
	14	3 5

(ii) Pulse rate much faster after exercise

7 (i) **Key:** 1 | 3 | 4 means age 31 in School A
age 34 in School B

School A		**School B**
9 8 7 5 3 3	2	3 5 9
9 9 9 7 7 7 4 3 3 1 1	3	4 6 6 8 8
8 8 8 8 6 6 5 5 5 0 0	4	0 1 2 2 3 4 5 5 6 7 7 9
9 4 4 3 3 1 1	5	0 0 2 2 4 4 6 6 6 7 8 8 9 9 9
1	6	0

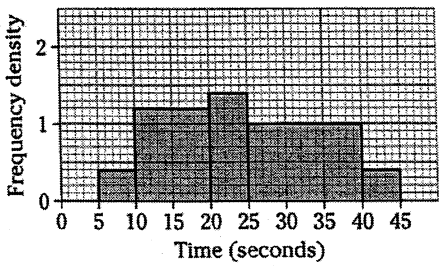
(ii) Older teachers in School B

Exercise 1.2

1 (i) 5

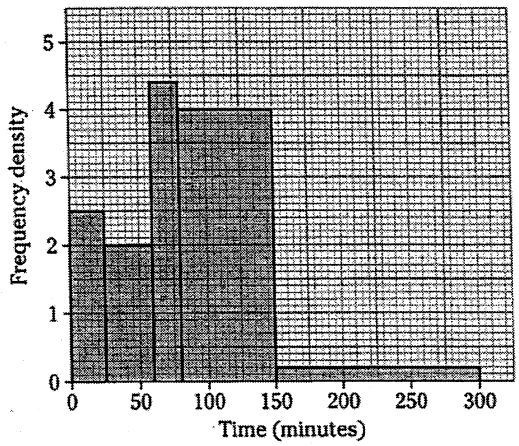
(ii) 0.4, 1.2, 1.4, 1, 0.4

(iii)



(iv) $20 \leqslant t < 25$

2

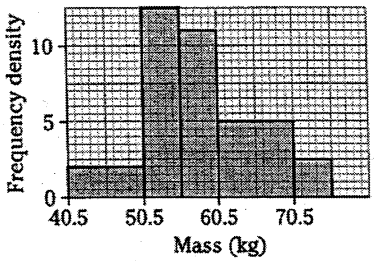


(ii) $60 \leqslant t < 80$

3 (i) 40.5, 50.5

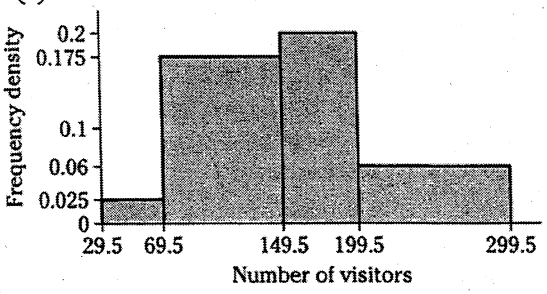
(ii) 10

(iii)



4 (i) 29.5, 69.5

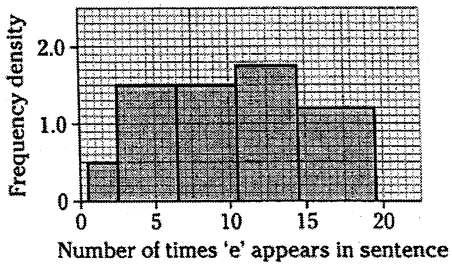
(ii)



5 (i)

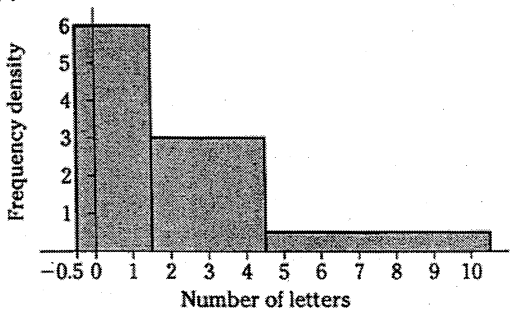
Number of times 'e' appears	1–2	3–6	7–10	11–14	15–19
Frequency	1	6	6	7	6

(ii)



6 (i) $-0.5, 1.5$

(ii)

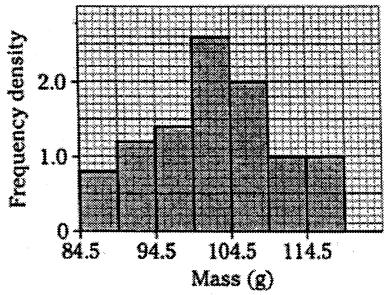


7 (i)

Mass (g)	Frequency	f.d.
85–89	4	0.8
90–94	6	1.2
95–99	7	1.4
100–104	13	2.6
105–109	10	2
110–114	5	1
115–119	5	1

(ii) 89.5

(iii)



Modal class is 100–104

(iv) **Key:** 10 | 3 means 103

8	6 6 7 8
9	2 2 2 2 3 3
9	5 6 6 7 8 9 9
10	0 0 0 1 1 1 1 1 2 2 3 3 4
10	5 5 5 6 6 7 7 8 8 9
11	0 1 3 3 4
11	6 6 7 8 8

mode = 101 g

8 (i) Frequencies are 20, 24, 24, 16, 12, 10, 6
(ii) 112

9 (i) 49.5, 53.5, width 4 (ii) 20, 26, 12
(iii) 88

10 (i) 0.5, 10.5, width 10 (ii) 60
(iii) 380 (iv) 100

Exercise 1.3

1 (i) 9.7 (ii) 154.8 (iii) 50.875
(iv) $1775\frac{5}{7}$ (v) 0.908 (3 s.f.)
(vi) 4 (vii) 29.54

2 35.05

3 43.35

4 (i) 33 (ii) 44.875

5 14.96 m (2 d.p.)

6 (i) 28.1 seconds (ii) 30–31

7 60.9

8 $a = 12$

9 (i) 16 (ii) 40

10 $x = 15, y = 7$

11 19

12 4

13 8

14 7

Exercise 1.4

1 (a) 5, 2 (b) 8.5, 1.80 (c) 18.8, 6.46
(d) $10\frac{5}{6}$, 4.10 (e) 3.42, 1.91 (f) 205, 3.16

2 14.39, 1.08

3 11.52, 0.827

4 69.3, 1.7

5 6.8, 1.11

6 (i) 10 (ii) 3.42

7 (i) 0.6 (ii) 0.24

8 207.62, 77.93

9 115.8, 7.58

10 12.4, 3.87

11 (i) −0.5, 2.5 (ii) 5.29, 3.58

12 (i) Frequencies 5, 18, 22, 28, 22, 18, 5
(ii) The histogram is symmetrical, with a line of symmetry through 111, so an estimate of the mean is 111. This may not be the true mean as the mid-interval values have been taken to represent the intervals.
(iii) 3.71

13 (i) 63.87 (ii) 29.47 (iii) 133, 144

Exercise 1.5

1 1.014, 0.0102

2 (i) 29 (ii) 2.429 (iii) 5.9

3 (i) 5.84 (ii) 203.7

4 5.099

5 (i) 2.236 (ii) 4.33

6

	n	$\sum x$	$\sum x^2$	$\bar{x}$	s.d.
(i)	63	7623	924 800	**121**	**6.194**
(ii)	**14**	152.6	**1703.8**	10.9	1.7
(iii)	52	**1716**	57 300	33	**3.595**
(iv)	18	**1026**	**58 770**	57	4

7 (i) 49.85 (ii) 0.5275

8 3.838

9 3.742

10 (i) 5, 2.739 (ii) 5, 11

11 $a = 4, b = 6$

12 (i) 1800 (iii) 17.436
13 (i) 4.6, 2 (ii) 4.56, 2.043
14 2.3, 0.871
15 51.235, 0.927
16 (i) more than 25 kg (ii) 25.34
(iii) 0.974
17 (i) 15.83 (ii) 0
18 (i) 2500 (ii) 500 (iii) −200
(iv) 63 400 (v) 3400 (vi) 1300

Exercise 1.6

1 (i) 61 (ii) 52
(iii) 73 (iv) 21
2 (i) (a) 10 (b) 207 (c) 2104.5
(d) 0.595 (e) −1.5
(ii) (a) 12 (b) 22 (c) 765.5
(d) 0.38 (e) 3.35
3 (i) 4 (ii) 2, 5 (iii) 3
4 (i) 4.6, 3.5 (ii) 0.138, 0.012
5 (i) 8 (ii) 7 (iii) 7.36
6 (i) 4 (ii) 3 (iii) 1.228
7 (i) 2 (ii) 2
8 (i) 2 (ii) 3
(iii)

Times absent	0	1	2	3	4	5	6	7
Frequency	5	6	9	3	4	1	3	1

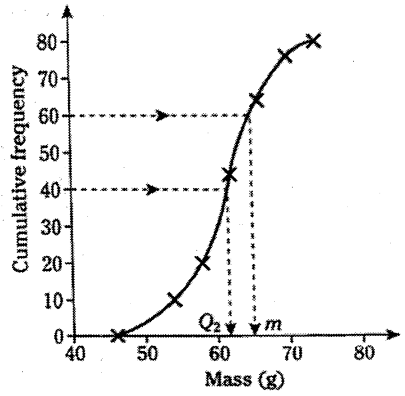
(iv) 2.47 (v) 1.936
9 (i) 24, 16 (ii) 5

Exercise 1.7

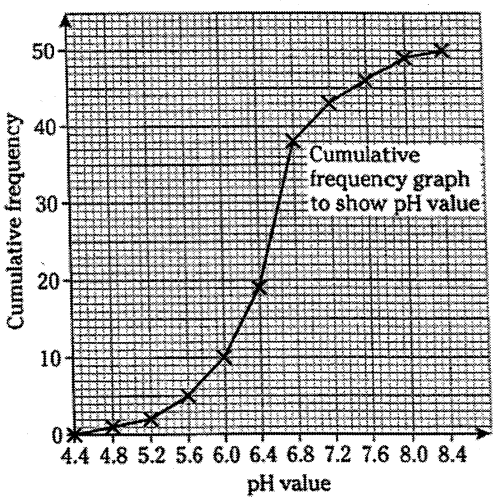
When reading from cumulative frequency graphs, answers will depend on your graph.

1 (i) 22 (ii) 26 (iii) 23
(iv) 25 mins (v) 9 mins
2 (i)

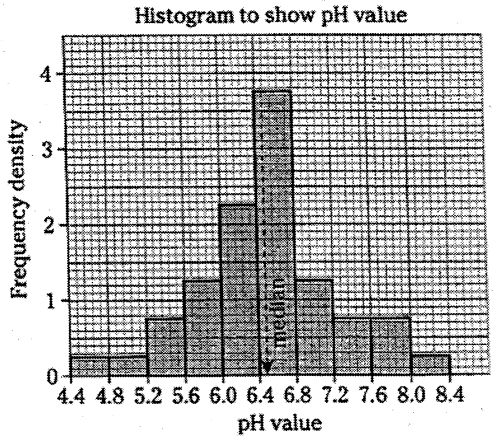
Mass (x grams)	<50	<54	<58	<62	<66	<70	<74
Cumulative frequency	6	10	20	44	64	76	80



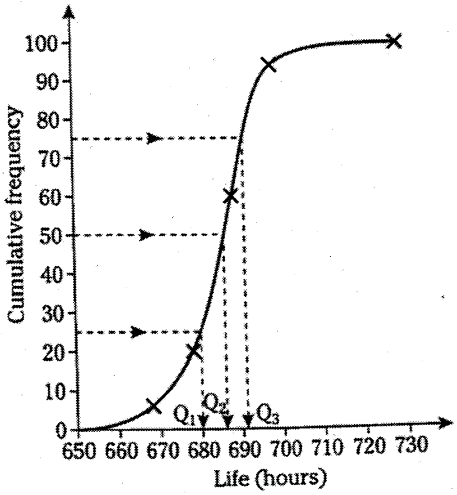
(ii) 62 g
(iii) 65
3 (i)



(ii) 82%
(iii) 6.5
(iv)

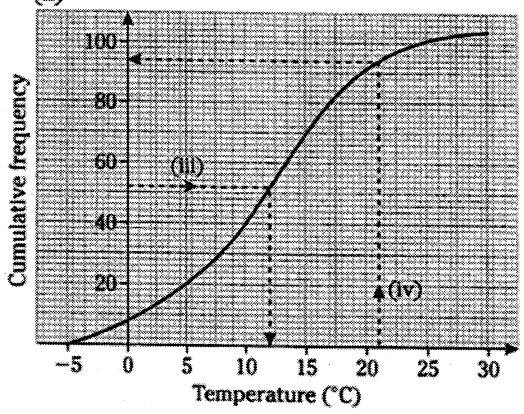


4 (i) 688, 11



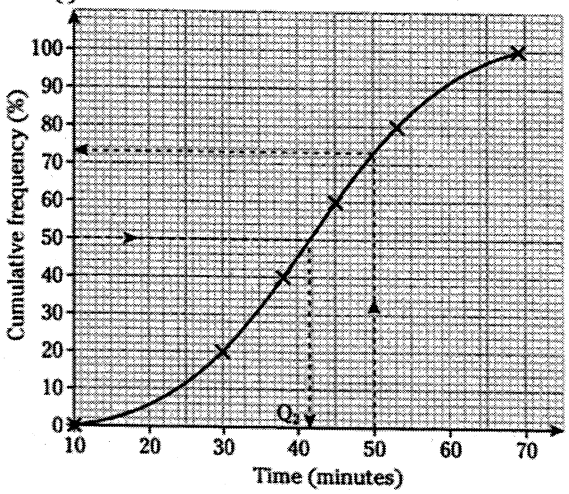
(ii) 686.8, 11.58
5 (i) −0.5, 4.5, 5

(ii)



(iii) 12 °C (iv) ≈10%

6 (i)

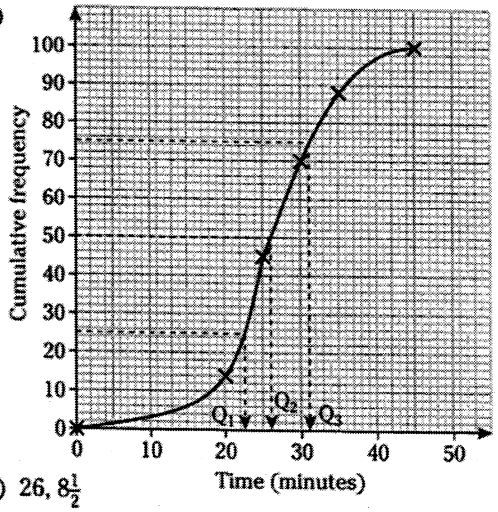


(ii) 41.5 mins (iii) 73%

7 (i) Frequencies: 14, 31, 25, 18, 12

(ii) $25 \leqslant x < 30$

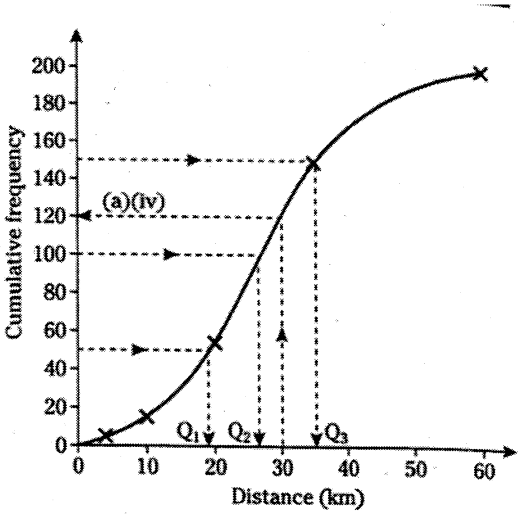
(iii)



(iv) 26, $8\frac{1}{2}$

8 (a) (i)

Distance (x km)	<4	<10	<20	<35	<60
Cumulative frequency	5	15	54	149	200

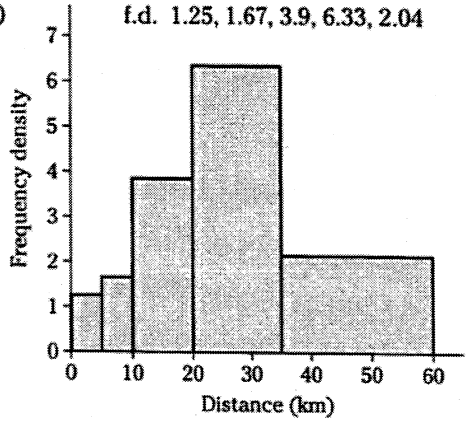


(ii) 27.5 km

(iii) 17 km

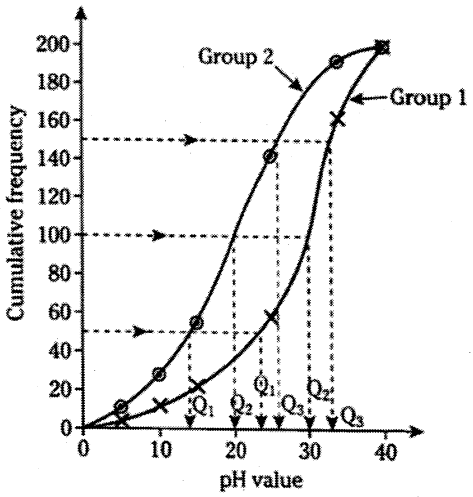
(iv) 40%

(b) (i) f.d. 1.25, 1.67, 3.9, 6.33, 2.04



(ii) 28.5, 13.0

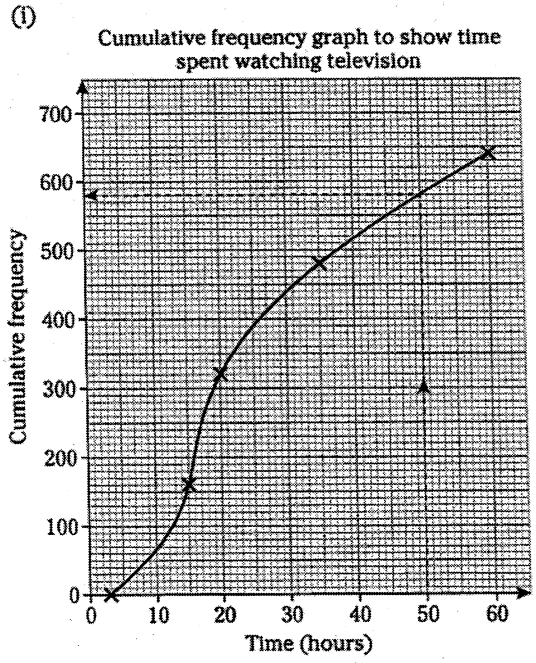
9 (i)



(ii) Group 1: 20, 12; Group 2: 30, 11

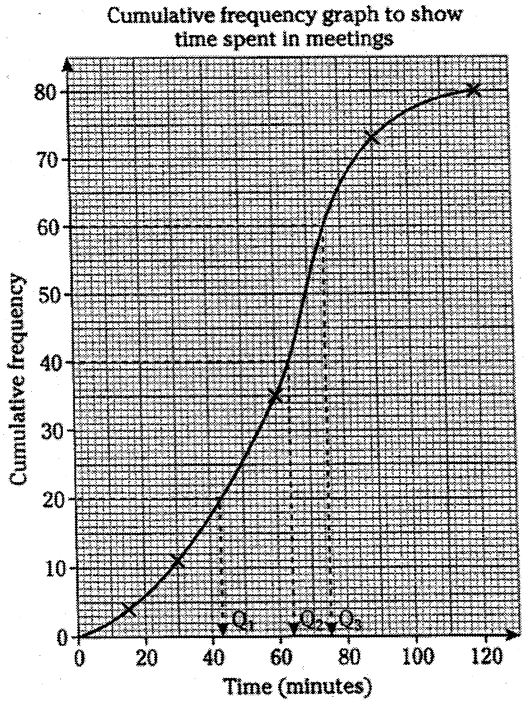
(iii) Group 2 sent more texts

10 (i)



(ii) 60 [40–70 acceptable, depending on graph].

11

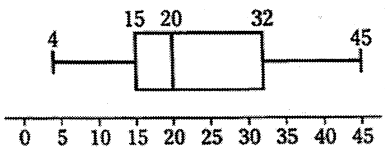


64 mins, 32 mins (depends on graph)

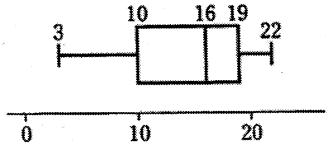
Exercise 1.8

1 (i) 26, 38 (ii) 32 (iii) 32
(iv) 12 (v) Symmetrical

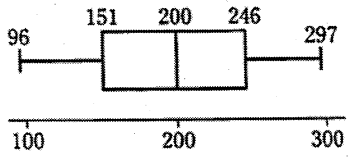
2



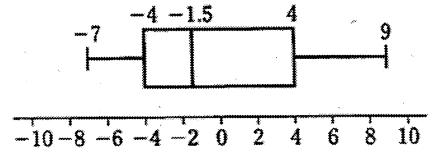
3 (i) Negative skew



(ii) Symmetrical

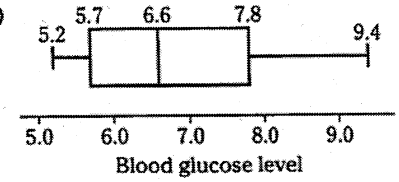


(iii) Positive skew



4 (i) 6.6; 5.7, 7.8

(ii)

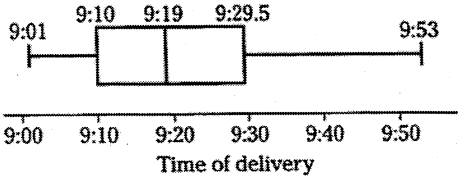


5 (i) **Key:** 4 | 5 means 9:45 (am)

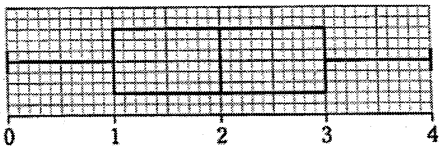
0	1 2 2 5 9
1	0 0 2 3 5 7 9 9
2	2 5 9 9 9
3	0 1
4	5 7 8
5	3

(ii) 9:19 am (iii) 9:10 am, 29.5 minutes after 9

(iv)



6



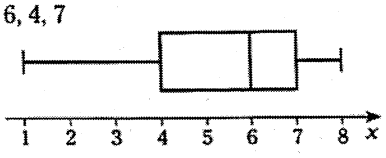
7 (i) 1, 8

(ii)

x	$\leqslant 1$	$\leqslant 2$	$\leqslant 3$	$\leqslant 4$	$\leqslant 5$	$\leqslant 6$	$\leqslant 7$	$\leqslant 8$
Cumulative frequency	3	8	14	20	28	42	54	63

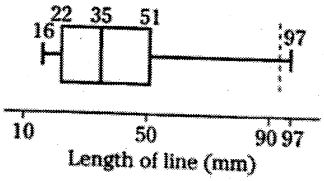
(iii) 6, 4, 7

(iv)



8 (i) 35, 22, 51, 29

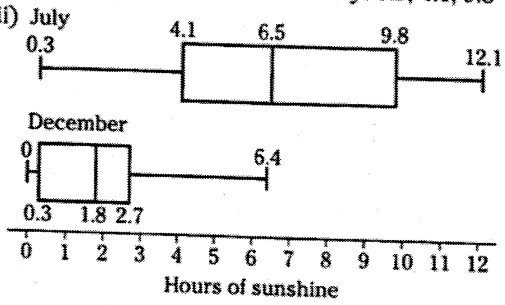
(ii)



(iii) Boundary for outliers 94.5; outlier 97

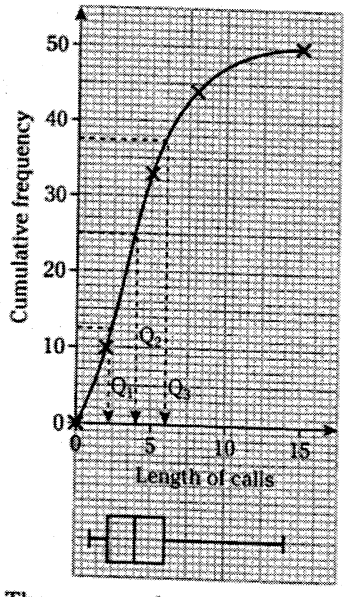
9 (i) December: 1.8; 0.3, 2.7 July: 6.5; 4.1, 9.8

(ii)



(iii) The median number of hours of sunshine in July is greater than the maximum number in December. The mode for December is 0.0 hours and the mode for July is 6.6 hours. There is much greater variation in the number of hours of sunshine in July than in December. In July the hours of sunshine are evenly spread throughout the range, whereas in December there is a long tail to the right with the bulk of values being under 3 hours.

10 (i)



(ii) 4, 2.1, 6

(iii)

There were a few unusually long calls.

11 Surgery B has shorter waiting times on average than Surgery A. Surgery B has a greater variability (spread) of waiting times than Surgery A.

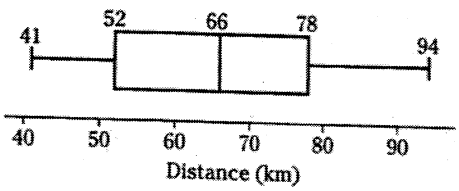
12 (i) **Key:** 4 | 1 means 41 km

Distance travelled (km)

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

(ii) 66, 52, 78

(iii)

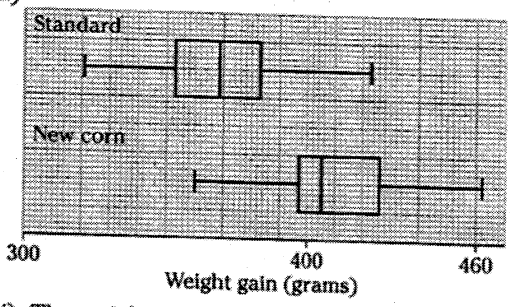


(iv) (a) The stem-and-leaf diagram retains all the original data.

(b) The box-and-whisker plot shows that the distribution is approximately symmetrical with the central 50% lying between 52 and 78 km.

13 (i) New: 450, 397, 426;
Standard: 368.5, 353, 383

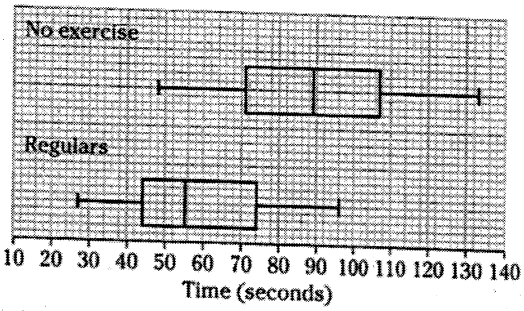
(ii)



(iii) The weight gain was much greater on average in the chicks fed the new strain of corn. The variation in weight gain was similar in the two groups.

14 (i) 55, 44, 74 (ii) 89, 71, 107

(iii)



(iv) The breathing rate took much less time to return to normal in the regular gym users than in those who did not exercise regularly.

Exercise 1.9

1 *The intervals could be written 42–45, 46–49, 50–53, 54–57, 58–61 or 42 ⩽ w ⩽ 45, 46 ⩽ w ⩽ 49, 50 ⩽ w ⩽ 53, 54 ⩽ w ⩽ 57, 58 ⩽ w ⩽ 61*

Weight (nearest kg)	Frequency
41.5–45.5	4
45.5–49.5	7
49.5–53.5	10
53.5–57.5	5
57.5–61.5	4

2 38.4 mm, 4.57 mm

3 (i) As the vertical axis does not start at 0, the vertical scale is distorted, making the increase appear larger than it is.

(ii) (a) **Key:** 8 | 6 means 86

Daily ticket sales

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

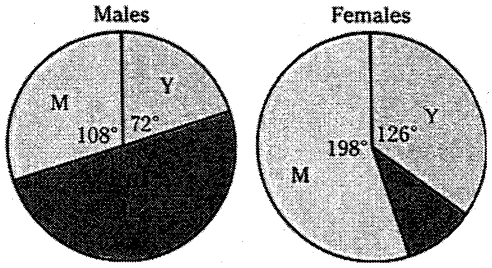
(b) 79

4 (i) Two modes: 3.05, 3.45 (ii) 3.25
(iii) 3.321 (iv) 50%

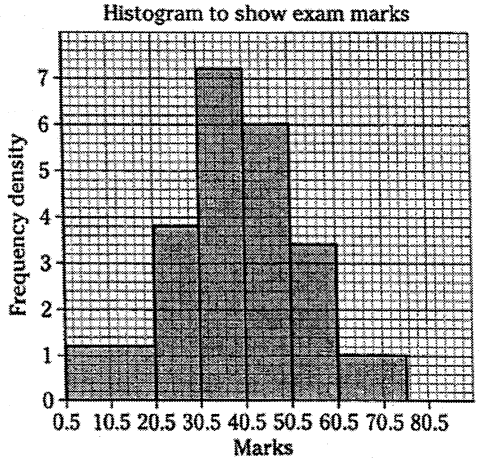
5 (i) 1850 (iii) 74.72, 8.234

6 *Other answers are possible, for example comparative bar charts*

Pie charts to show ages of car drivers



7 (i)



(ii) 38.74, 14.59

8 (i) 61, 73, 83.6
(ii) 181, 21, 42.0
(iii) (a) median (not affected by outlier)
(b) interquartile range (not affected unduly by outliers)

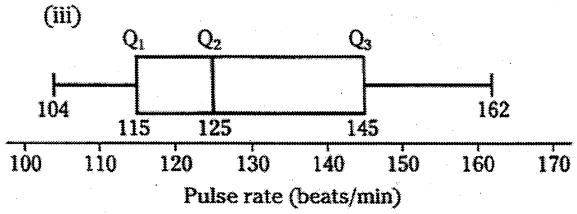
9 (i) **Key:** 13 | 2 means 132 beats/min

Pulse rate (beats per minute)

10	4 4 9
11	5 7
12	0 4 5
13	2 4
14	2 5
15	8
16	0 2

(ii) 125, 115, 145

(iii)



10 0.850, 0.9775

11 (i)

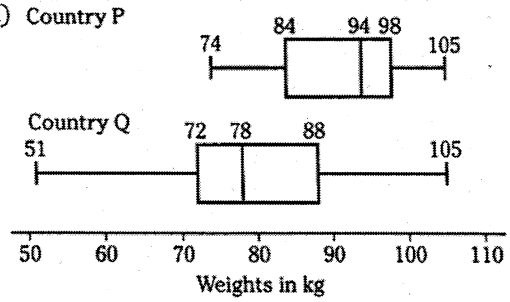
Mass (kg)	<39.5	<44.5	<49.5	<54.5	<59.5	<64.5	<69.5	<74.5
Cumulative frequency	0	3	5	12	30	48	51	52

(ii) 21
(iii) 14
(iv) 62
(v) 58.4 kg
(vi) 7.2 kg

12 33.75 mins, 2.3 mins

13 (i) B
(ii) A
(iii) C

14 (i) 78, 72, 88
(ii) Country P

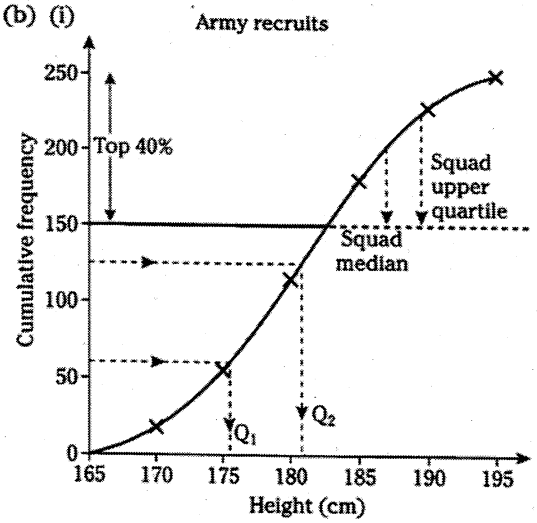


(iii) Males are heavier in country P; weights are more variable in country Q

15 45

16 (a) 180.58 cm, 6.85 cm

(b) (i)

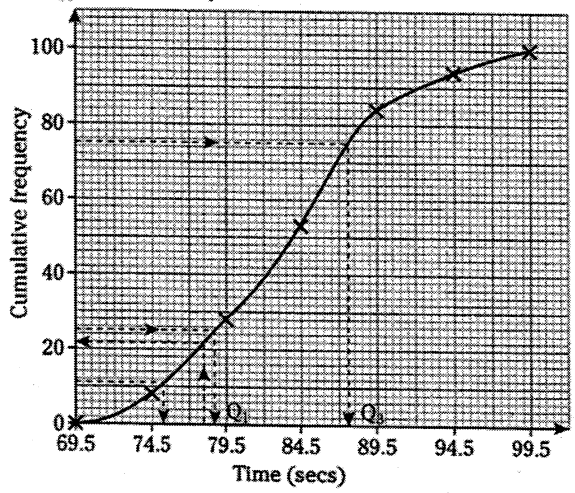


(ii) 180.6 cm, 176 cm

(iii) 187 cm

(iv) 189.5 cm

17 (i) 9 secs



(ii) 22, 75.5 secs

18 (i) **Key:** 7 | 13 | 2 means
13.7 minutes for 16-yr-olds
13.2 minutes for 9-yr-olds

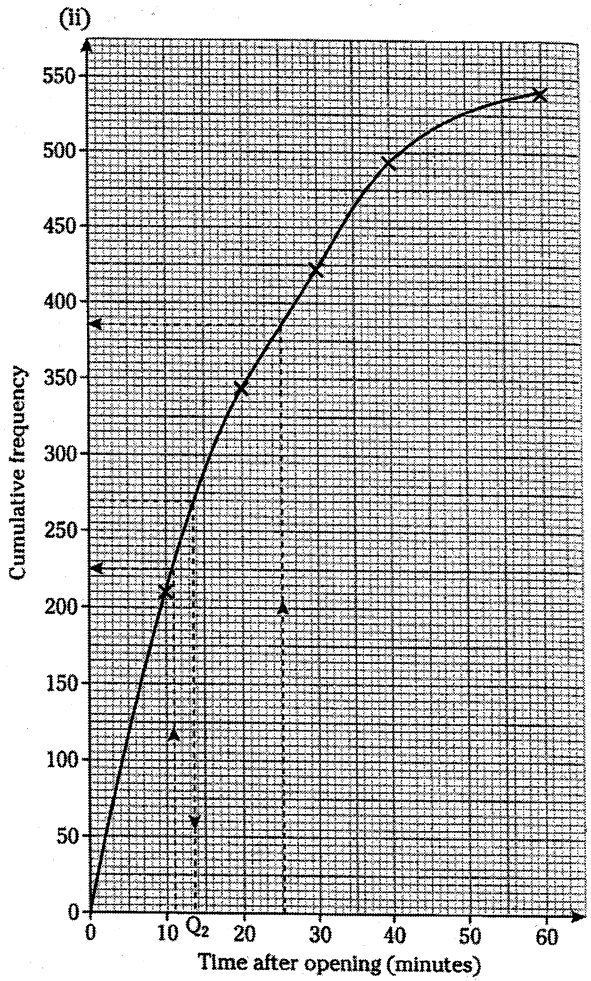
16-yr-olds		**9-yr-olds**
7 4	11	
9 8	12	
7 0	13	0 2 7
8	14	2 4
	15	0 1 9
5	16	0 1 4 7

(ii) 15.6 mins

19 Medians A: 2.0, B: 3.8;
Country B has heavier babies
Interquartile ranges A: 0.9, B: 2.3;
Country B has greater spread of weights

20 (i) $a = 494$, $b = 46$

(ii)



(iii) 14 minutes (13.5 to 14.6 is acceptable)

(iv) $m = 18.204$, $s = 14.168...$

(v) 160