St. Patrick's High School, Keady

Mathematics Department

GCSE Mathematics Practice Booklet

M4

Topic 8 –Handling Data 2

Box Plots

Cumulative Frequency Graphs

Histograms

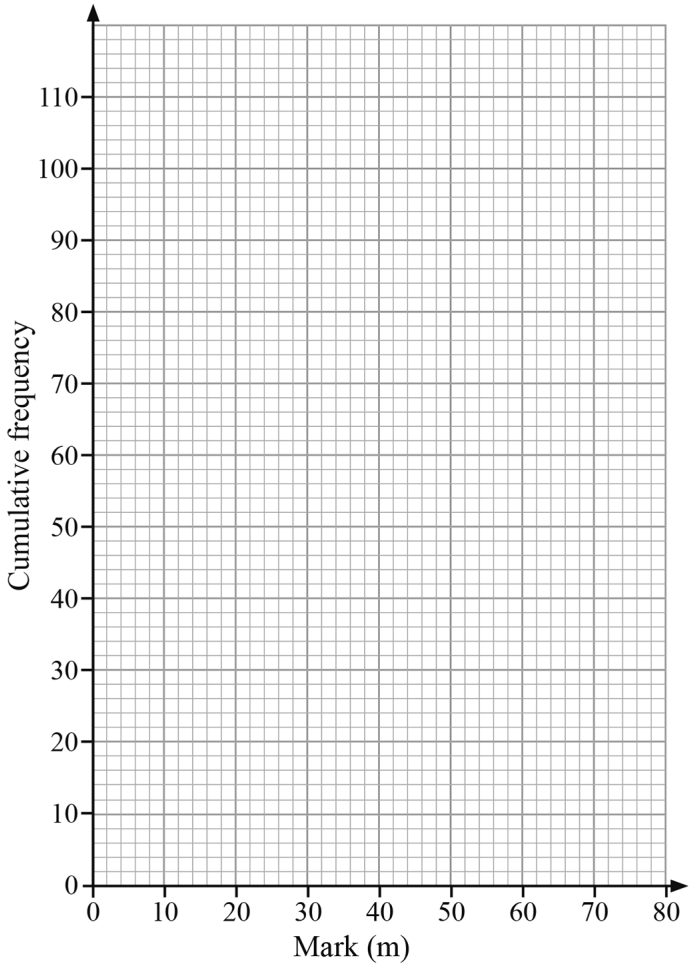
Questions taken from CCEA Past Papers

Mark Scheme included at the end of this booklet

Q1 **(a)** The marks in an examination are recorded. Complete the cumulative frequency column in the table below. [1]

Mark (m)	Frequency	Cumulative Frequency
$0 < m \leqslant 10$	4	
$10 < m \leqslant 20$	6	
$20 < m \leqslant 30$	16	
$30 < m \leqslant 40$	24	
$40 < m \leqslant 50$	30	
$50 < m \leqslant 60$	16	
$60 < m \leqslant 70$	12	
$70 < m \leqslant 80$	4	

(b) On the axes provided draw a cumulative frequency graph.



[2]

(c) Use the cumulative frequency graph to estimate

(i) the median,

Answer _____ [1]

(ii) the interquartile range.

Answer _____ [2]

(d) The pass mark is 36

Use the cumulative frequency graph to estimate the percentage of the candidates who pass.

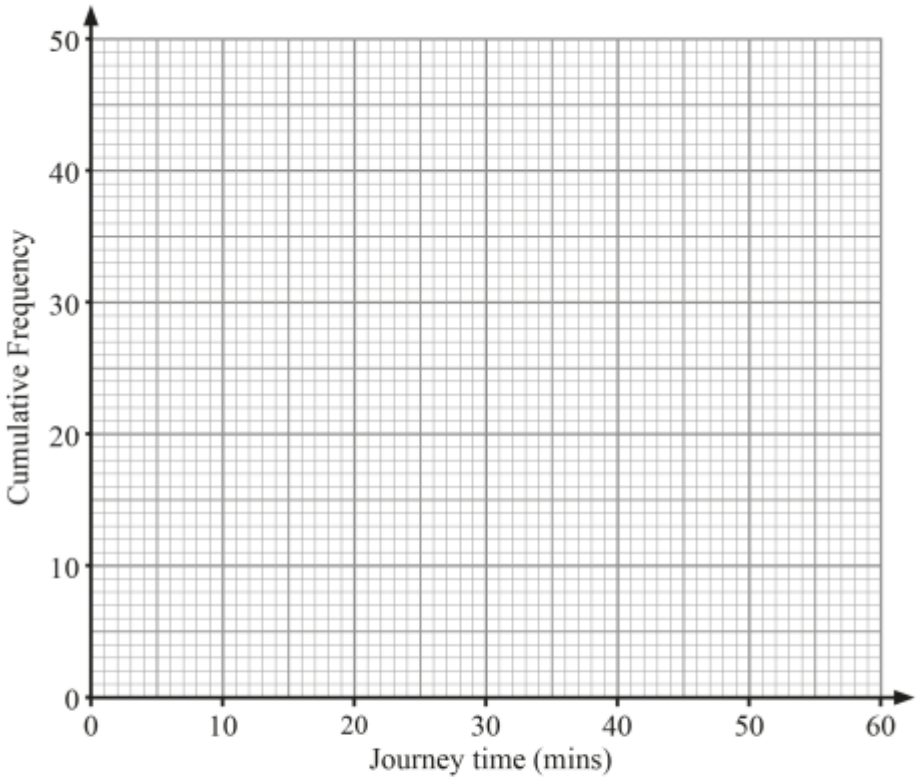
Answer _____ % [2]

Q2

The cumulative frequency table gives data about the length of time it takes for 50 workers to travel to work one morning.

Journey time (t minutes)	**Cumulative Frequency**
$t \leqslant 20$	7
$t \leqslant 25$	22
$t \leqslant 30$	36
$t \leqslant 35$	45
$t \leqslant 45$	49
$t \leqslant 60$	50

(a) On the graph paper below, draw a cumulative frequency graph to illustrate the data.



[3]

(b) Use the graph to estimate the percentage of workers whose journey time was longer than 40 minutes.

Answer _____ % [2]

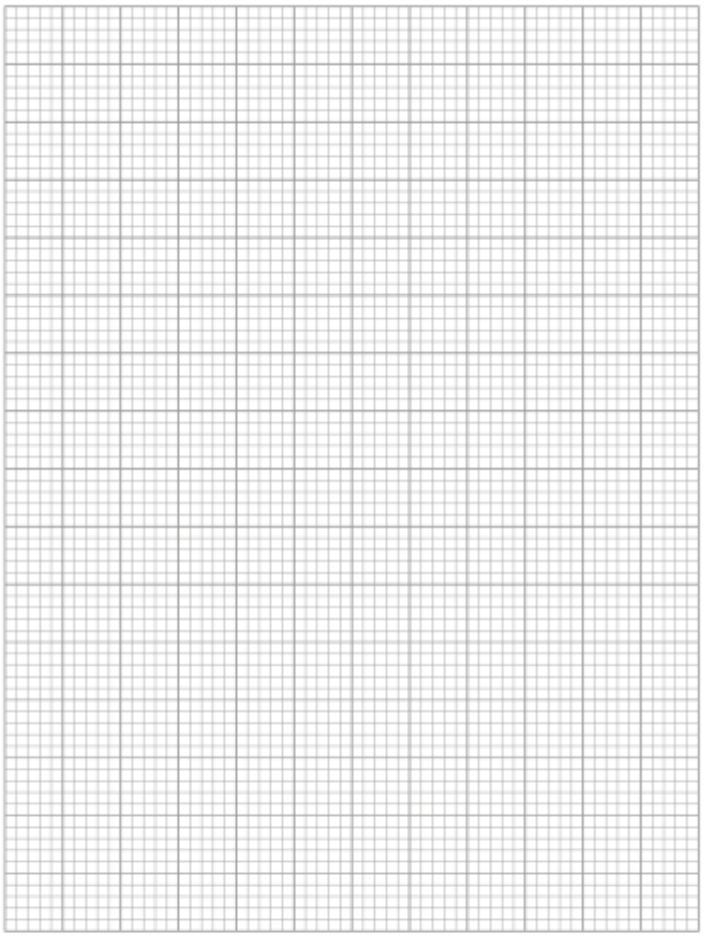
Q3

160 pupils in Year 8 sat a Science examination at the end of the year.

Their results are given in the cumulative frequency table below.

Examination Mark, x	**Cumulative Frequency**
$x \leq 20$	8
$x \leq 30$	18
$x \leq 40$	28
$x \leq 50$	51
$x \leq 60$	96
$x \leq 70$	128
$x \leq 80$	150
$x \leq 90$	160

(a) On the graph paper below draw a cumulative frequency graph for the data given.



[3]

(b) The pass mark for this examination was 55

Use your graph to estimate the number of pupils who passed the examination.

Answer _____ [2]

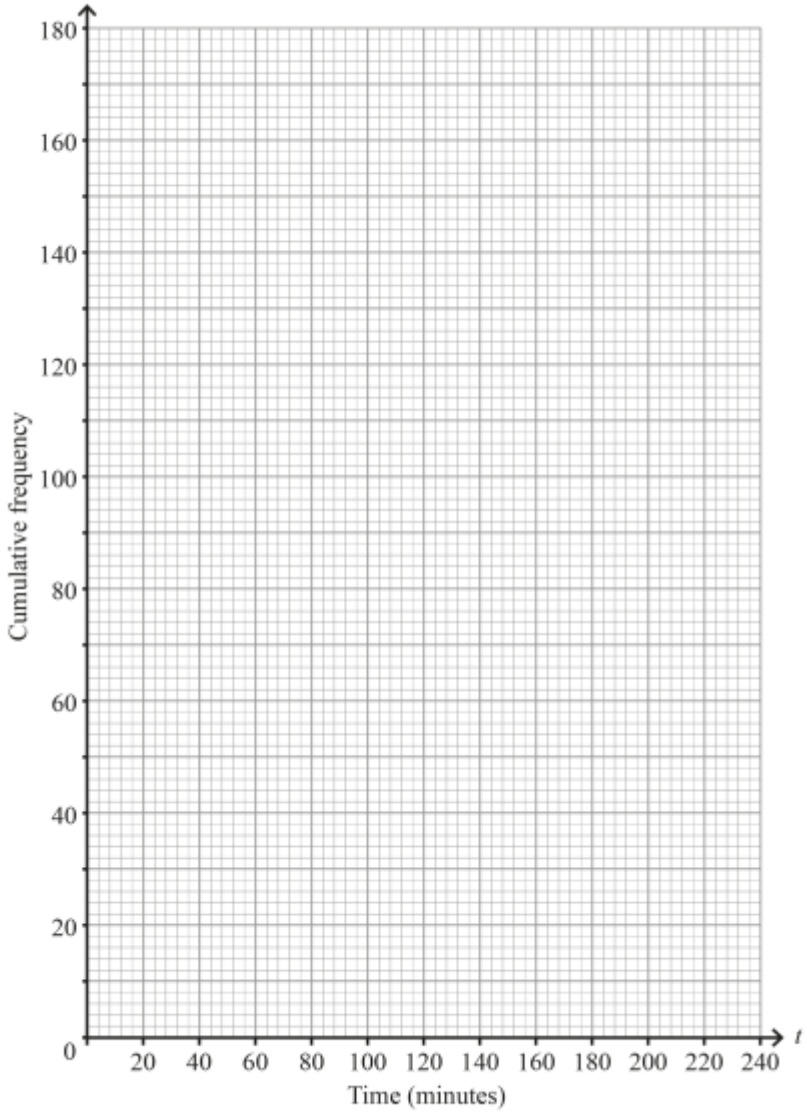
Q4 180 Year 11 pupils in Glasgow High School were asked to record how much time they spent on their phones one Saturday.

The results are shown in the table below.

Time, t (minutes)	**Number of pupils**	**Time, t mins ($\leq$)**	**Cumulative frequency**
$0 < t \leq 30$	6		
$30 < t \leq 60$	10		
$60 < t \leq 90$	25		
$90 < t \leq 120$	37		
$120 < t \leq 150$	32		
$150 < t \leq 180$	29		
$180 < t \leq 210$	27		
$210 < t \leq 240$	14		

(a) Complete the cumulative frequency column in the table. [1]

(b) Plot a cumulative frequency graph on the given axes.



[3]

(c) Use your graph to estimate

(i) the median,

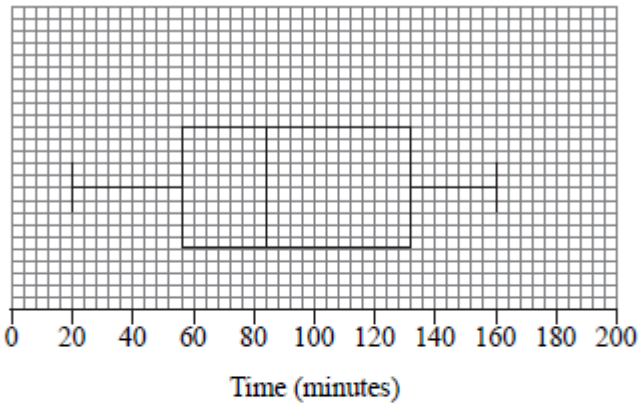
Answer _____ minutes [1]

(ii) the inter-quartile range.

Answer _____ minutes [2]

The staff at the same school were also asked to record the time they spent on their phones on the same Saturday.

Their results are recorded on the box-plot diagram.



(d) Compare the results for the pupils and staff.

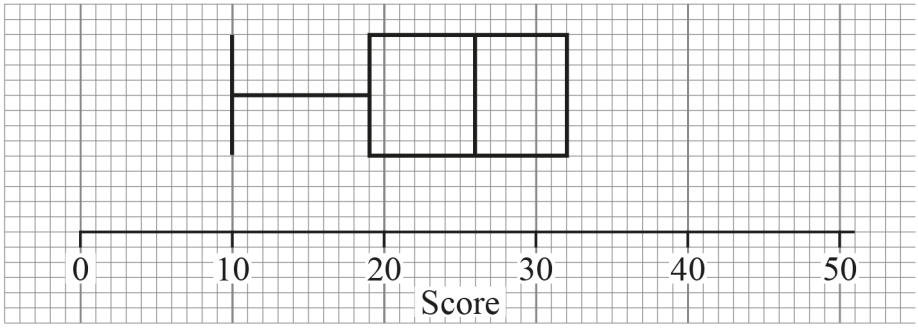
1. _____

2. _____

3. _____ [3]

Q5 Mr Davison's class did a test.

Their scores are shown on the box plot, but the box plot is incomplete.



(a) The range of scores is 25 more than the interquartile range.

Use this information to complete the box plot.

[2]

(b) Explain why the interquartile range may be a better measure of spread for this distribution than the range.

_____

_____ [1]

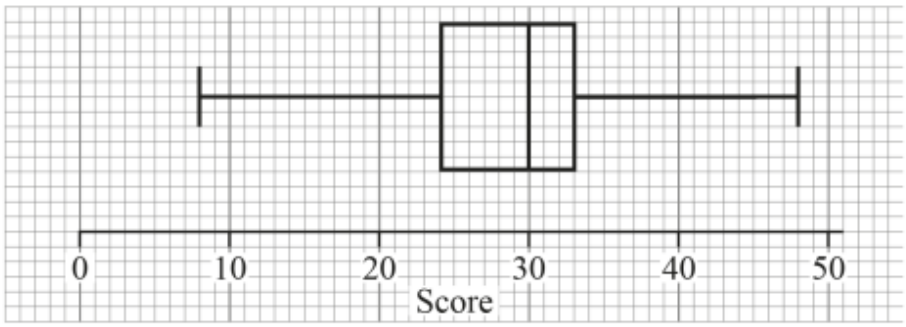
(c) Kevin scored 32 marks in the test.

What percentage of the class scored lower than Kevin?

Answer _____ % [1]

(d) Mrs Clarke's class did the same test.

Their scores are shown on the box plot below.



Write two comparisons between the results of the two classes.

_____

_____

_____ [2]

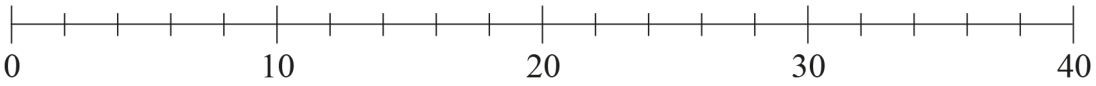
Q6 The following information is available relating to a data set on age.

The median age is 14

The maximum age is 35
The range of ages is 32

The lower quartile is 12
The interquartile range (IQR) is 8

(a) Use all the above information to draw a box plot for the data set.



[4]

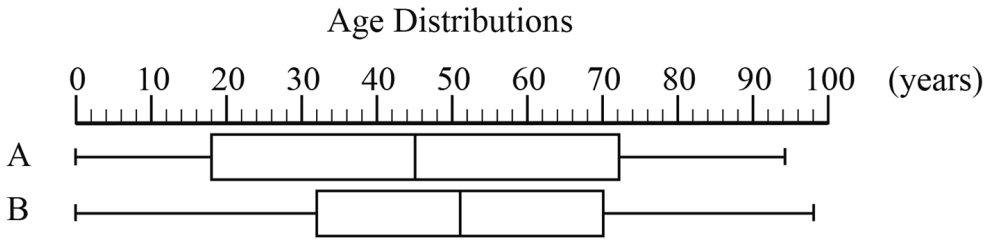
(b) Jane states that the majority of people in this data set are aged below 16
Is she correct?

Give a reason for your answer.

Answer _____ because _____

_____ [1]

Q7 The box plots show the distribution of ages of the people living in two cities, A and B.



(a) In which city is the interquartile range greater? How can you tell this from the diagram?

Answer city _____ because _____

_____ [1]

(b) In which city are people generally older? Explain your answer.

Answer city _____ because _____

_____ [1]

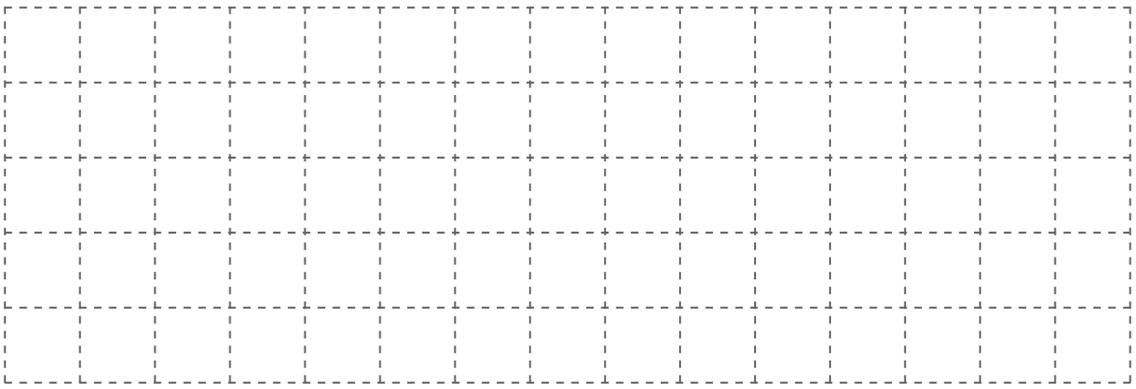
(c) Complete the sentence

75% of the people in city A are aged over _____ [1]

Q8 In a group of 11 pupils, the number of days absent from school was recorded as listed below.

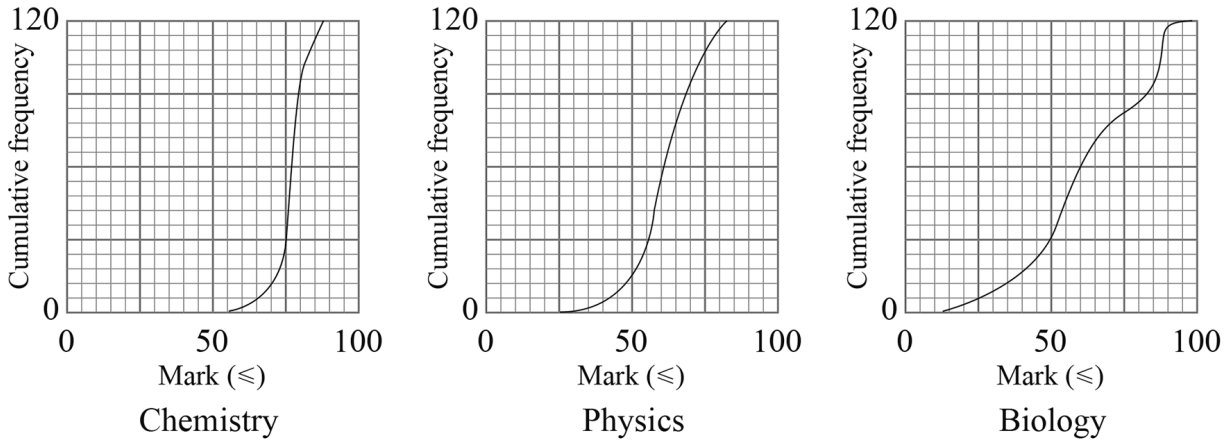
12 6 5 2 8 2 3 11 4 10 7

Draw a box plot for this data on the grid.



[4]

Q9 Examinations in Chemistry, Physics and Biology were taken by 120 students. Each examination was marked out of 100 and the cumulative frequency graphs below illustrate the results.



(a) Which subject has the highest median?

Answer _____ [1]

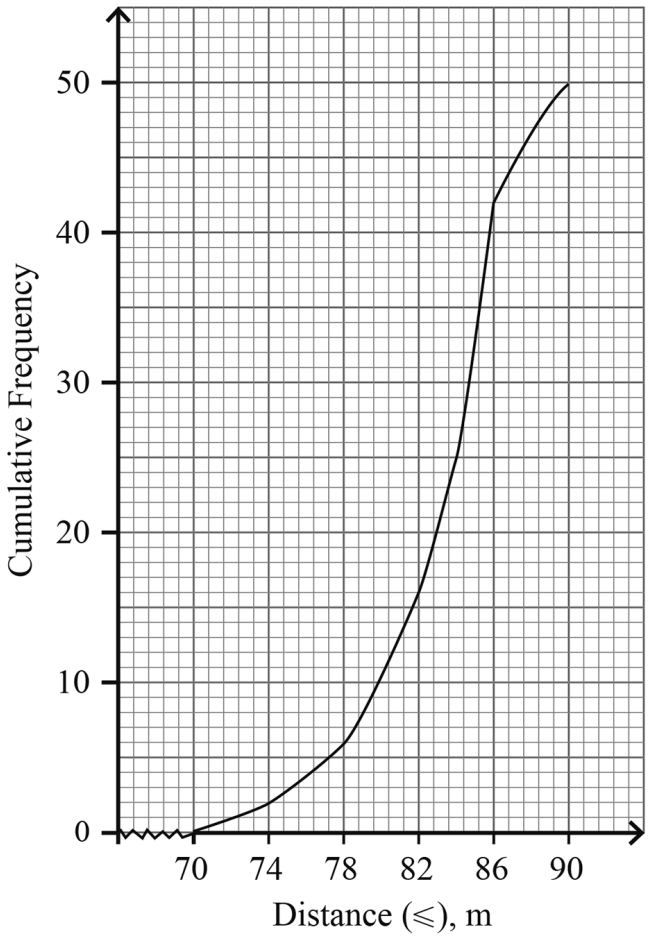
(b) In which subject was the interquartile range the greatest?

Answer _____ [1]

(c) The pass mark was 50. What percentage of the students did not pass Physics?

Answer _____% [1]

Q10 The cumulative frequency graph shows the distances thrown by 50 competitors in a javelin competition.



(a) Use the graph to estimate the median distance thrown.

Answer _____ m [1]

(b) Use the graph to estimate the interquartile range.

Answer _____ m [2]

(c) Use the graph to complete the two tables below.

(i)

Distance (less than or equal to), m	Cumulative Frequency
70	0
74	2
78	6
82	
86	
90	

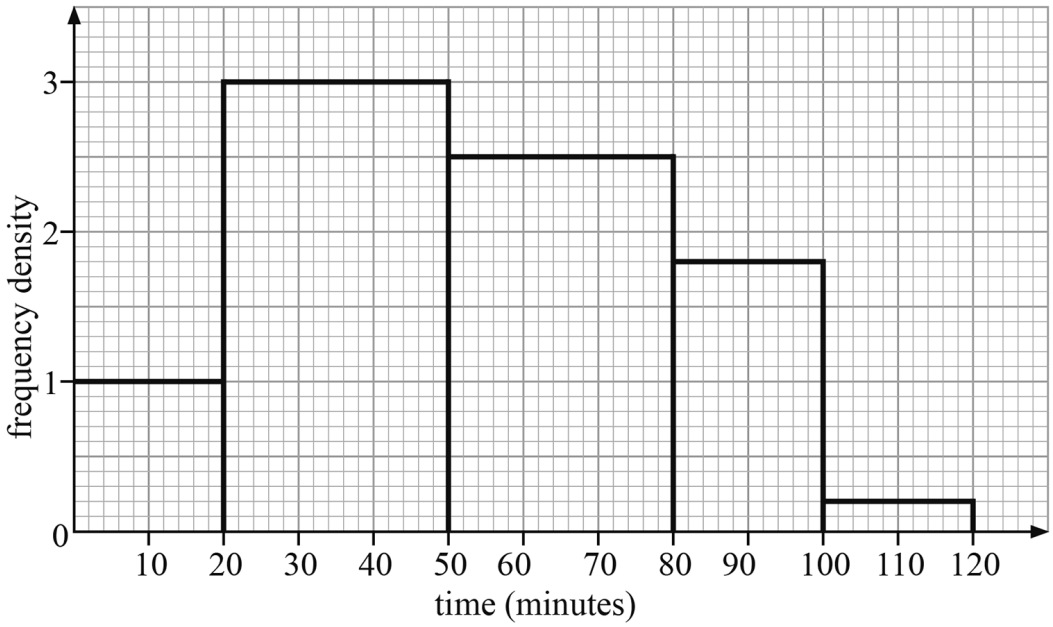
[1]

(ii)

Distance d (m)	Frequency
$66 < d \leqslant 70$	0
$70 < d \leqslant 74$	2
$74 < d \leqslant 78$	4
$78 < d \leqslant 82$	
$82 < d \leqslant 86$	
$86 < d \leqslant 90$	

[2]

Q11 The histogram illustrates how much time drivers took on a particular journey.



(a) Calculate an estimate for the mean time.

Answer _____ minutes [4]

(b) Two-thirds of the drivers took more than M minutes.

Calculate an estimate for the value of M.

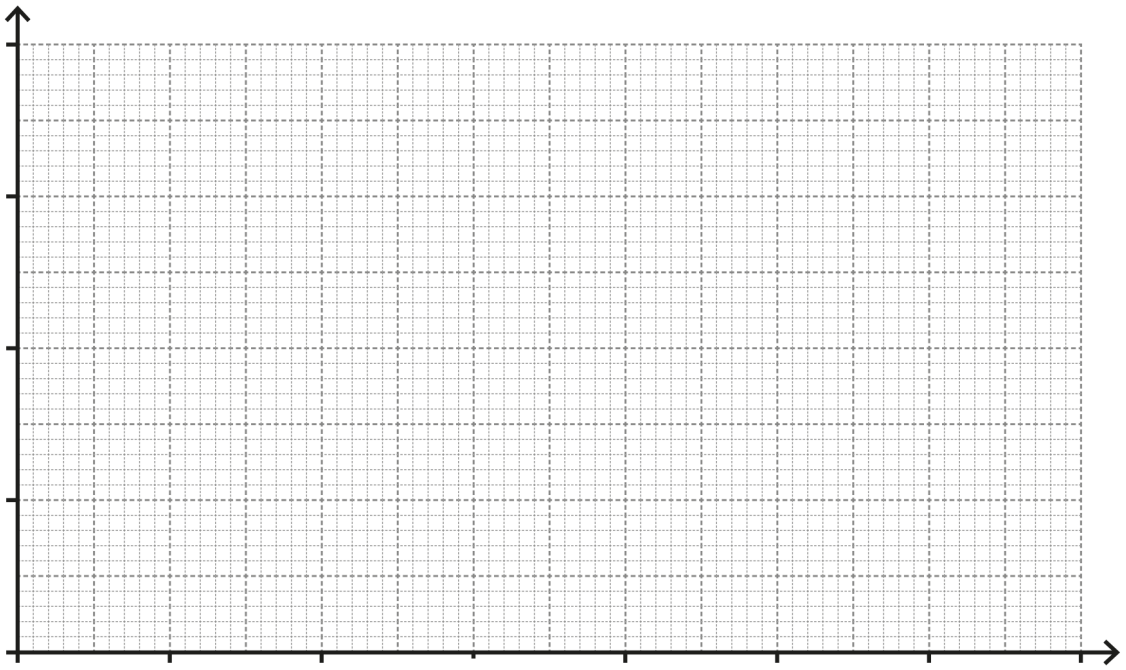
Answer _____ minutes [3]

Q12

The weights, in grams, of a collection of waste bags from a hospital are shown.

Weight, w (g)	Frequency
$0 < w \leqslant 20$	5
$20 < w \leqslant 30$	8
$30 < w \leqslant 45$	24
$45 < w \leqslant 55$	38
$55 < w \leqslant 95$	64
$95 < w \leqslant 115$	36
$115 < w \leqslant 140$	45

(a) Draw a histogram on the axes provided to illustrate this data.



[3]

(b) Estimate the number of bags which weighed more than 60 g.

Answer _____ [2]

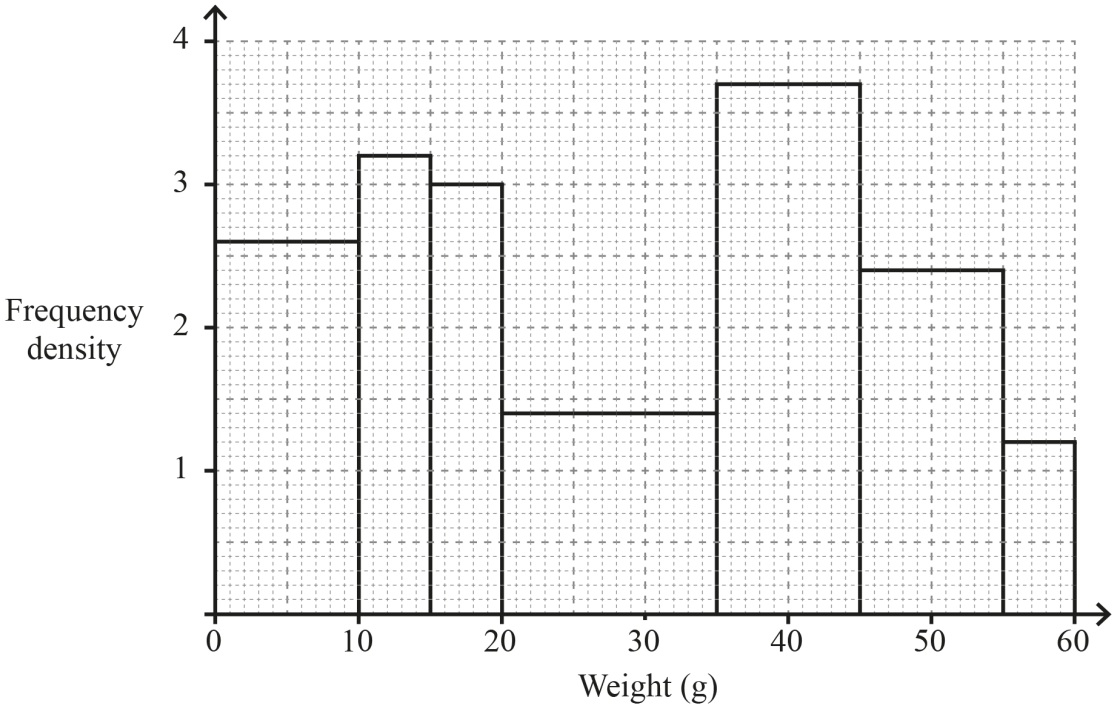
A stratified sample of 70 bags was selected from those with weights less than or equal to 95 g.

(c) Estimate how many of this sample weighed less than 40 g.

Answer _____ [3]

Q13

The weights of a second collection of bags are shown in the histogram below.



(d) Estimate the mean weight for this collection.

Answer _____ g [4]

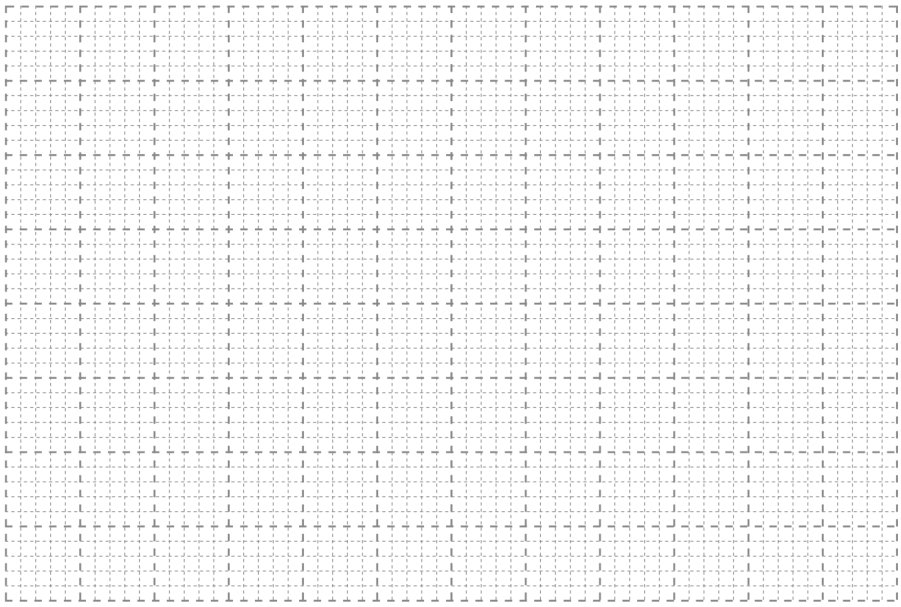
(e) Estimate the median weight for this collection.

Answer _____ g [3]

Q14 The table gives information about the weights of 75 children.

Weight, w kg	Number of Children
$20 \leqslant w < 30$	18
$30 \leqslant w < 36$	15
$36 \leqslant w < 40$	14
$40 \leqslant w < 50$	22
$50 \leqslant w < 65$	6

(a) Illustrate the data by drawing a histogram on the graph paper below.



[3]

(b) A stratified sample of 30 children was taken from those whose weight was less than 40 kg.

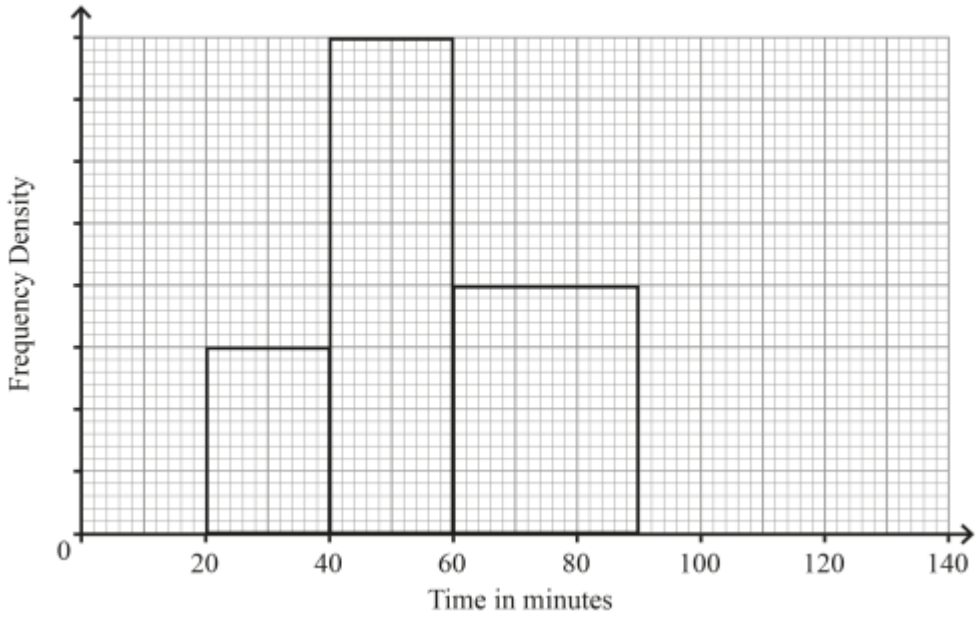
Estimate how many of the sample were taken from the interval 30–36

Answer _____ [2]

Q15 The table and histogram show information about the length of time 230 pupils spent on social media on a week night.

No pupil spent more than 120 minutes on social media on a week night.

Length of time in minutes, *m*	**Frequency**
$0 < m \leq 10$	10
$10 < m \leq 20$	25
$20 < m \leq 40$	
$40 < m \leq 60$	80
$60 < m \leq 90$	60
$90 < m \leq 100$	
$100 < m \leq 120$	10



(a) Complete the table and the histogram. [6]

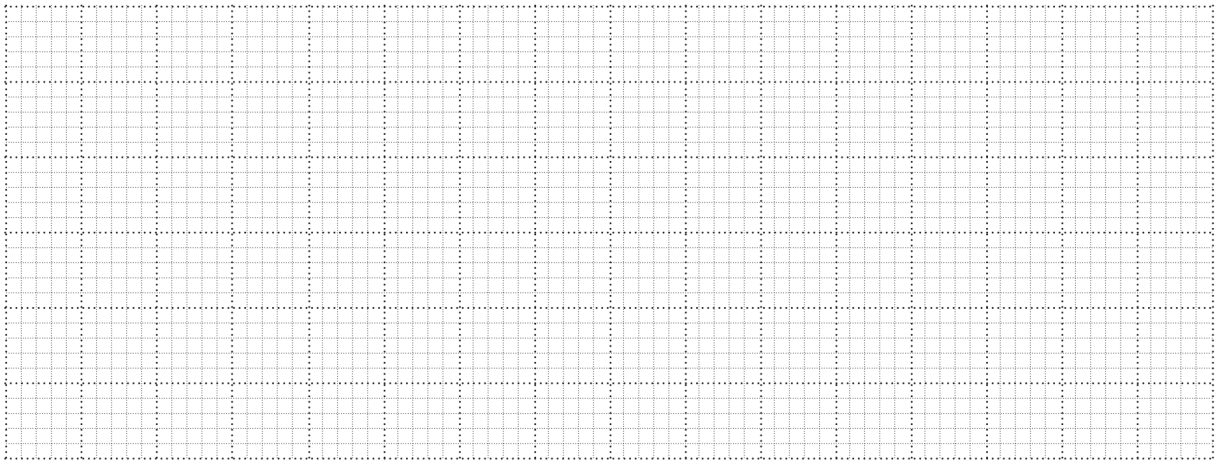
(b) Use the histogram to estimate the median time spent on social media.

Answer _____ minutes [2]

Q16 A speed camera in a 30 mph speed zone records the following results over a two-hour period:

Speed(s) in mph	Number of cars
$0 < s \leq 30$	66
$30 < s \leq 33$	18
$33 < s \leq 40$	21
$40 < s \leq 60$	8
$60 < s \leq 75$	3

(a) Illustrate this data by drawing a histogram on the grid below.



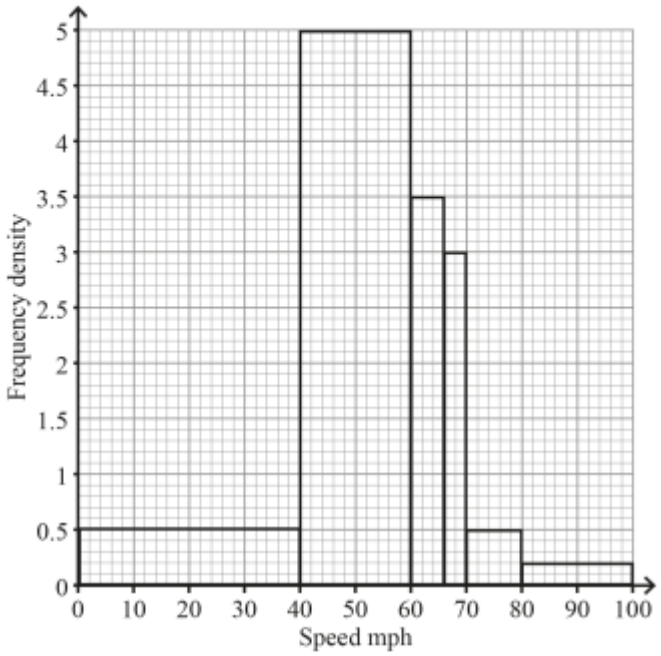
[4]

(b) A stratified sample of 50 cars was taken from the data on the previous page.

Estimate how many cars sampled had a speed between 33 and 40 mph.

Answer _____ [2]

(c) A speed camera in a 60 mph speed zone records the speeds of cars and the results are shown in the histogram below.



Calculate an estimate for the mean speed over the two-hour period for this data.

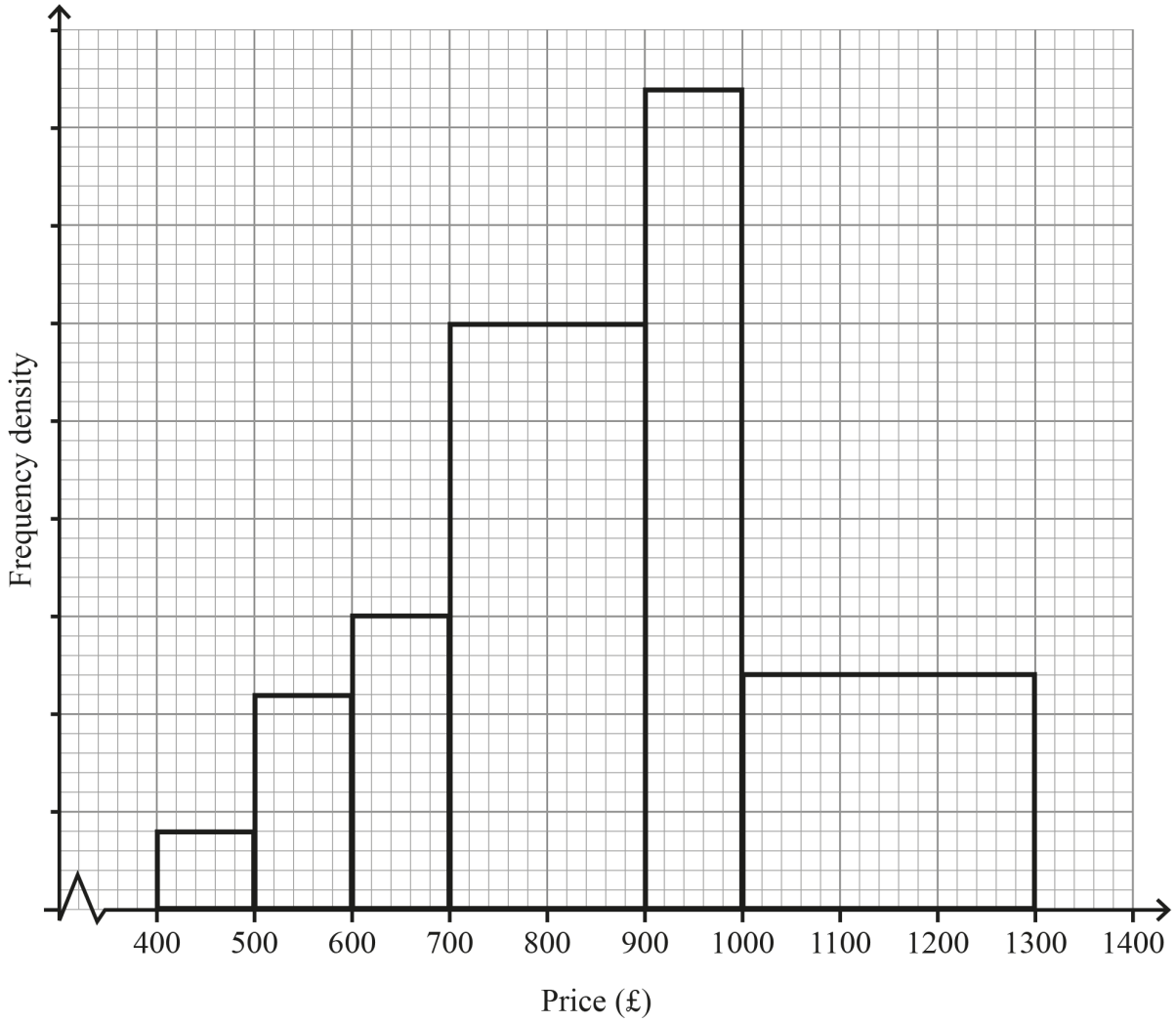
Answer _____ mph [4]

(d) Anyone driving at a speed that is greater than 10% above the speed limit is given a fine.

Compare the percentage of fines given in the two speed zones.

[2]

Q17 The histogram below shows the prices of televisions sold online one month.



150 televisions cost less than £600

(a) Calculate the number of televisions costing between £900 and £1200

Answer _____ [4]

(b) A stratified sample is taken.

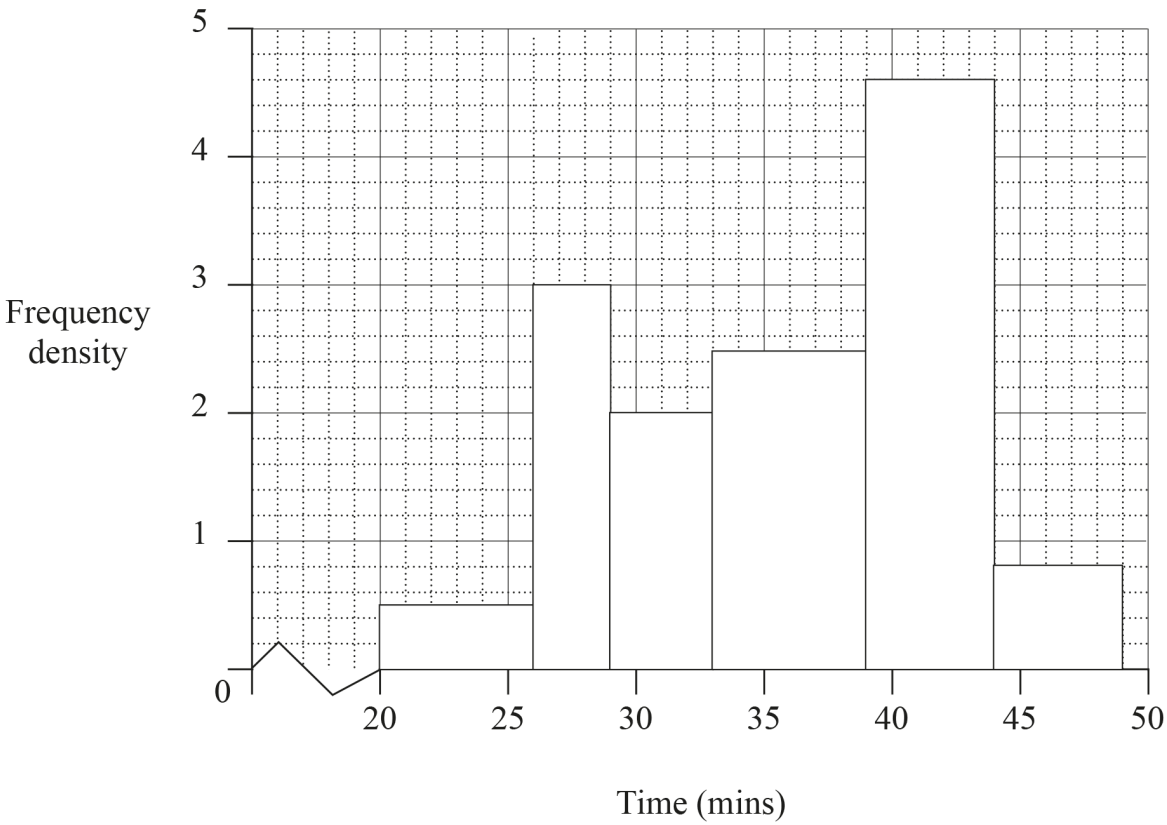
Given that 11 televisions are sampled from the £500–£600 group, find the number of televisions in the sample.

Answer _____ [4]

Q18

62 pupils completed a couch to 5km programme, which ended with everyone completing a 5 km run.

Their times were recorded and the histogram below illustrates the data collected.



(a) Complete the table below.

Time (t minutes)	Frequency
$20 \leqslant t < 26$	3
$26 \leqslant t < 29$	
$29 \leqslant t < 33$	

[4]

(b) Find an estimate for the mean time taken by the 62 pupils to complete the 5 km.

Answer _____ minutes [4]

1.

(a)	4, 10, 26, 50, 80, 96, 108, 112	A1
(b)	Cumulative frequency graph	M1 A1
(c)	**(i)** From their graph	A1
	(ii) Readings at 28 and 84	A1
	Correct subtraction	A1
(d)	112 – their reading	MA1
	Expressed as % of 112	MA1

2.

(a)	6 correct	A2 (4 correct A1)
	lines/curve	A1
(b)	reading at 40 to give 47	MA1
	$\frac{3}{50} = 6\%$	MA1

3.

(a)	Cumulative frequency graph and scale	M1 A2
(b)	160 – (reading from 55 on their graph) (correct reading approx. 160 – 72 = 88) Allow A1 for reading at 55	A2

4.

(a) 6, 16, 41, 78, 110, 139, 166, 180 — A1

(b) Plot all points correctly (30, 6) (60, 16) (90, 41) etc. — MA2
Line/curve through points — MA1

(c) **(i)** Reading from graph (approx. = 132) — MA1

(ii) Readings from graph subtracted (approx. 176 – 93 = 83) — MA2

(d) On average pupils spend more time on their phones than staff
Pupils' results/data are more spread out
Max time spent by pupils a lot more than staff (240 mins compared to 160 mins)
(or any other valid comparisons) — A1 A1 A1

5.

(a) IQR = 13 — MA1
Max drawn at 48 (13 + 25 = 38 + 10) — MA1

(b) Range may have been affected by an extreme high/low value — A1

(c) 75% — A1

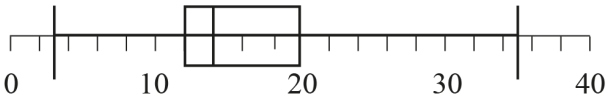
(d) On average Mrs. Clarke's class got higher scores and their scores were less spread out/more consistent. — A2

6.

(a) UQ = 20 MA1

Min = 3 MA1

Box plot drawn A2



(b) Yes because 50% are below 14 so more than 50% are below 16 – majority A1

7.

(a) City A because the 'box' is greater A1

(b) City B as it has higher median A1

(c) 18 A1

8.

Arranged in order MA1

Median = 6 A1

Minimum/Maximum = 2, 12 A1

Quartiles = 3, 10 A1

9.

(a) Chemistry A1

(b) Biology A1

(c) $12\frac{1}{2}\%$ A1

10.

(a) 84 m A1

(b) Follow their readings A2

(c) **(i)**

Distance (less than)	cumulative frequency
70	**0**
74	**2**
78	**6**
82	16
86	42
90	50

A1

(ii)

Distance (m)	frequency
$66 < d \leqslant 70$	**0**
$70 < d \leqslant 74$	**2**
$74 < d \leqslant 78$	**4**
$78 < d \leqslant 82$	10
$82 < d \leqslant 86$	26
$86 < d \leqslant 90$	8

M1 A1

11.

(a)

0–20	20	
20–50	90	
50–80	75	
80–100	36	
100–120	4	MA2

$\frac{20\times10+90\times35+75\times65+36\times90+4\times110}{225}$ MA1

$=\frac{11905}{225}=52.9$ A1

(b) 75 less M (or 150 more than M) so 55 in second group (so 35 in second group) MA1

$\frac{55}{90}$ of 30 is 18.3 A1

M = 38.3 minutes A1

12.

(a) FDs 0.25 0.8 1.6 3.8 1.6 1.8 1.8 MA1

Labels and scales A1

7 bars correct MA1

(b) $\frac{35}{40}\times64=56$ MA1

$56+36+45=137$ MA1

(c) Weights less than 95 g = 64 + 38 + 24 + 8 + 5 = 139 MA1

Number less than 40 g = $\frac{2}{3}\times24+8+5=29$ MA1

Number in sample = $\frac{70}{139}\times29=14.6$ (accept 14 or 15) MA1

13.

weights	frequency	wf
5	26	130
12.5	16	200
17.5	15	262.5
27.5	21	577.5
40	37	1480
50	24	1200
57.5	6	345

Correct mid points and frequencies MA1 MA1
Correct wf column MA1

Mean = $4195 \div 145 = 28.93$ g MA1

median at $\frac{145}{2} = 72.5$th
72.5th is in the group 20–35

or

median at $\frac{146}{2} = 73$rd
73rd is in the group 20–35 MA1

Median = $20 + \left(\frac{15.5}{21}\right)15 = 31.1$

median = $20 + \left(\frac{16}{21}\right)15 = 31.4$ MA2

14.

(a) Fd 1.8 2.5 3.5 2.2 0.4 MA1

Labels on both axes A1

Correct blocks A1

(b) Sampling Fraction $= \frac{30}{47}$ A1

Sample $= \frac{30}{47} \times 15 = 9.57$. Accept 9 or 10 MA1

15.

(a) 30, 15 — A1 A1

0–10 bar, freq. density of 1.0 — MA1
10–20 bar, freq. density of 2.5 — MA1
90–100 bar, freq. density of 1.5 — MA1
100–120 bar, freq. density of 0.5 — MA1

(b) Median $= 40 + \frac{50}{80} \times 20$ — MA1

$= 52.5$ minutes — A1

(a) 30, 15 — A1 A1

0–10 bar, freq. density of 1.0 — MA1
10–20 bar, freq. density of 2.5 — MA1
90–100 bar, freq. density of 1.5 — MA1
100–120 bar, freq. density of 0.5 — MA1

(b) Median $= 40 + \frac{50}{80} \times 20$ — MA1

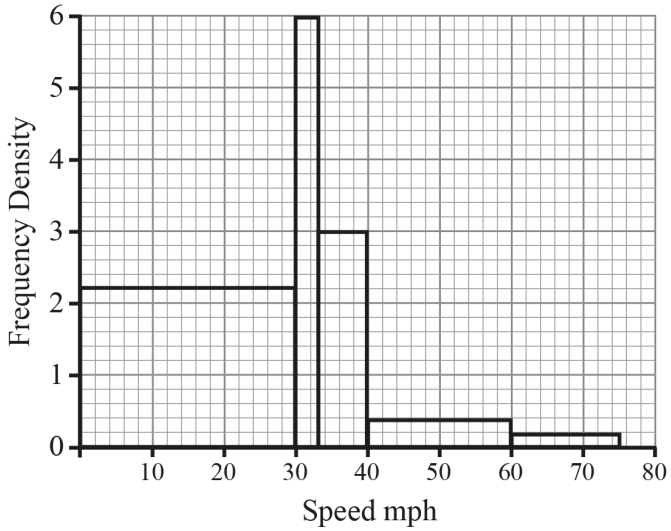
$= 52.5$ minutes — A1

16.

(a) F.D. = 2.2, 6, 3, 0.4, 0.2 (all freq densities correct) MA1

Correct labels and scales A2

5 correct bars (see below) A1



(follow through numerical error, e.g. one FD calculation error could lead to 3 marks)

(b) $\frac{21}{116} \times 50$ MA1

$= 9$ A1

(c)

Speed(s)	Frequency	Mid-point	Mid-point × frequency
$0 < s \leq 40$	20	20	400
$40 < s \leq 60$	100	50	5000
$60 < s \leq 66$	21	63	1323
$66 < s \leq 70$	12	68	816
$70 < s \leq 80$	5	75	375
$80 < s \leq 100$	4	90	360
Total	**162**		**8274**

MA3

(follow through for numerical errors if method correct, deduct 1 mark per error)

$$\text{Mean} = \frac{8274}{162}$$

$= 51.1$ mph MA1

(d) 30 mph zone: $\frac{32}{116} \times 100 = 27.6\%$

60 mph zone: $\frac{21}{162} \times 100 = 13.0\%$ MA1

So over twice the percentage were speeding in the 30 mph zone (or similar conclusion) MA1

17. **(a)** $100 \times 4 + 100 \times 11 = 1500$

Area of 1500 = frequency of 150 MA1

Area of 1 unit = frequency of 0.1 **or**

1 large square = FD of 0.5 MA1

$100 \times 4.2 + 200 \times 1.2 = 660$ MA2

(b) Total = $150 + (100 \times 1.5) + (200 \times 3) + (100 \times 4.2)$

$+ (300 \times 1.2)$ MA1

$= 1680$ A1

$\frac{110}{1680} \times n = 11$ MA1

$n = 168$ A1

18.

(a)

Time (minutes)	Frequency
$20 \leqslant t < 26$	3
$26 \leqslant t < 29$	9
$29 \leqslant t < 33$	8
$33 \leqslant t < 39$	15
$39 \leqslant t < 44$	23
$44 \leqslant t < 49$	4

Allow MA1 for 1 correct, MA2 for 3 correct, MA3 for 4 correct MA4

(b)

Mid interval	Mid interval × Frequency
23	69
27.5	247.5
31	248
36	540
41.5	954.5
46.5	186

M1 A1

Mean $= \frac{2245}{62}$ MA1

36.21 minutes A1

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