HISTOGRAMS - GRADE A. (Solutions)

1. A survey was carried out to find the distribution of the lengths of index fingers.
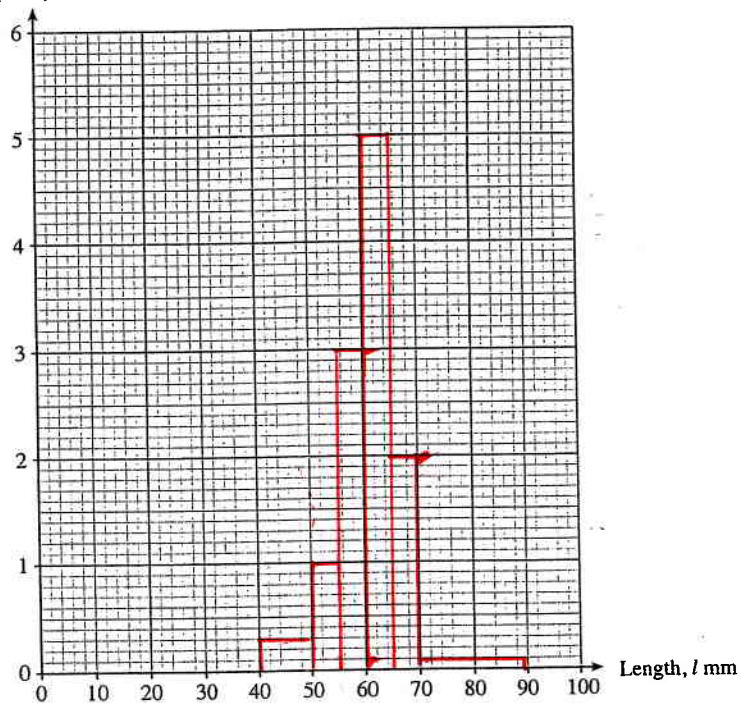The data was recorded in a grouped frequency table.

CLASS Width

Length of index finger, l mm	Frequency	Frequency density
$0 \leqslant l < 40$	0	$0 \div 40 = 0$
$40 \leqslant l < 50$	3	$3 \div 10 = 0.3$
$50 \leqslant l < 55$	5	$5 \div 5 = 1$
$55 \leqslant l < 60$	15	$15 \div 5 = 3$
$60 \leqslant l < 65$	25	$25 \div 5 = 5$
$65 \leqslant l < 70$	10	$10 \div 5 = 2$
$70 \leqslant l < 90$	2	$2 \div 20 = 0.1$

Class width values: 40, 10, 5, 5, 5, 5, 20

Complete the frequency density column in the table above and hence draw the histogram for the data using the axes below. [3]

2. There are 100 pupils in Year 9. The time taken by each pupil to answer a mental mathematics question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	8	17	25	38	12

(a) Find an estimate for the median of this distribution.

100 pupils so Median is 50th pupil.
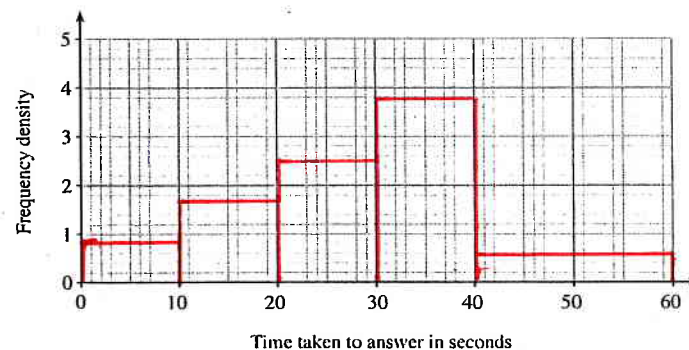1st 8 $\leqslant 10$, 1st 25 $\leqslant 20$, 1st 50 $\leqslant 30$
So estimate 50th pupil taken 30 seconds. [1]

*(b)* Draw a histogram to illustrate the distribution on the graph paper below.

Frequency densities: 0.8 | 1.7 | 2.5 | 3.8 | 0.6

[2]

Time taken to answer in seconds

Turn over.

(185-04)

(184-09)

3 As part of an investigation, the time taken to undo three knots in a piece of string was measured for each pupil in a group of twelve year olds.
The histogram below illustrates the results obtained.

Times for the 12 year olds

10×3 (30)   10×4 (40)   10×5 (50)   10×4 (40)   20×1 (20)
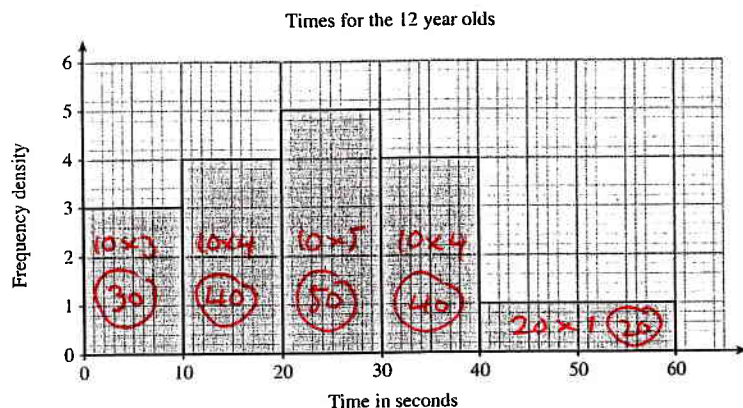
(a) Use the histogram to calculate the number of twelve year olds in this group.

$$30 + 40 + 50 + 40 + 20 = 180$$

[3]

(b) The time taken to undo three knots in a piece of string was measured for each pupil in a group of 200 sixteen year olds.
The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of people	45	55	60	30	10

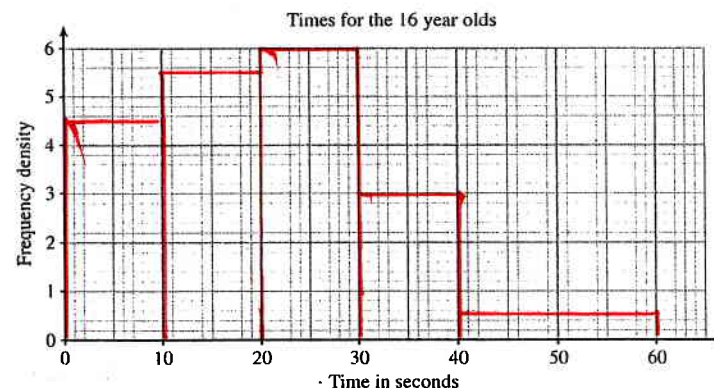(i) Find an estimate for the median of this distribution.

200 pupils so median is 100th pupil
1st 45 pupils ≤10, 1st 100 pupils ≤20
So estimate median pupil takes 20 seconds   [1]

(ii) Draw a histogram to illustrate the distribution on the graph paper below.

Frequency densities:

| 4.5	5.5	6	3	0.5

[2]

Times for the 16 year olds

(c) State, with a reason, which of the two groups is the better, on average, at undoing knots.

The 16 year olds are better – only 10/200 = 5% take longer than 40 secs compared to 20/180 = 11% of the 12 yr olds.   [1]

4 A survey was carried out to measure the lengths of the gardens of a number of houses. The histogram shows the results of the survey.

Length of garden (metres)
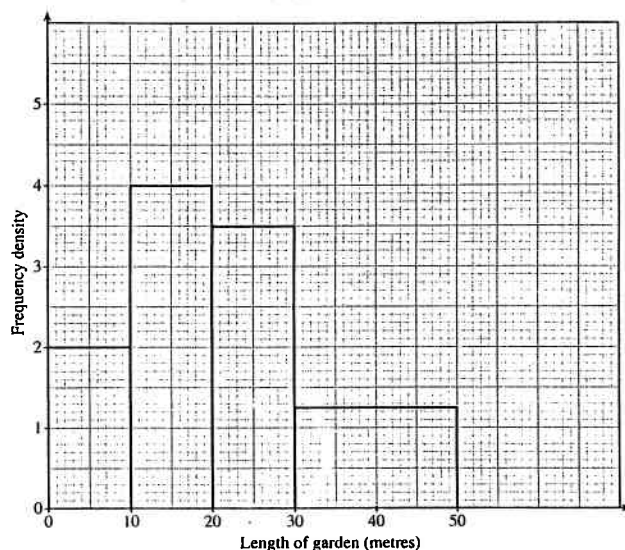
(a) Use the histogram to calculate the number of gardens measured.

$(10×2) + (10×4) + (10×3.5) + (20×1.25)$
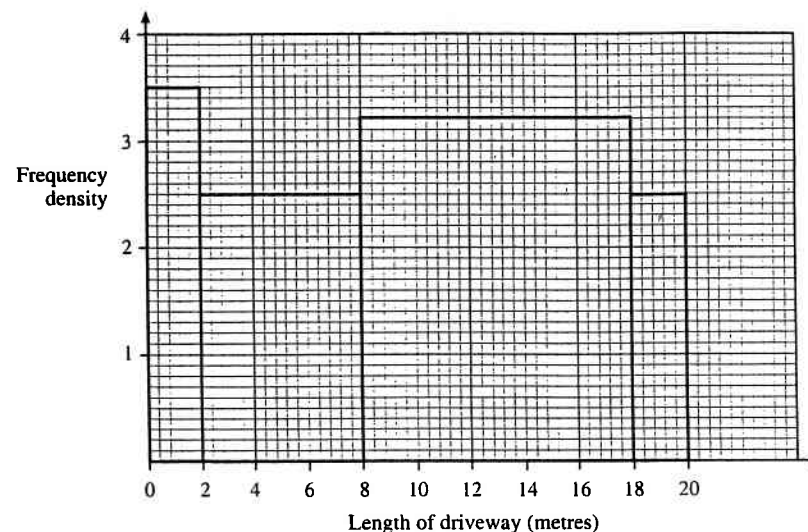
$20 + 40 + 35 + 25$

$= 120$ gardens.

[3]

(b) Find the length exceeded by 50% of the gardens measured.

50% of gardens $= 60$ gardens.

1st 60 gardens measure less than 20 metres

∴ 50% of gardens exceed 20 metres

[1]

Turn over.

(0184/7)

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5 A survey was carried out to measure the lengths of the driveways to a number of houses. The histogram shows the results of the survey.

Length of driveway (metres)

(a) Use the histogram to calculate the number of driveways measured.

$(2×3.5) + (6×2.5) + (10×3.2) + (2×2.5)$

$7 + 15 + 32 + 5$

$= 59$ driveways measured

[3]

(b) Find the length exceeded by 75% of the driveways measured. Give your answer to 2 decimal places.

Need to find length of driveway for 1st 25%

$0.25 × 59 = 14.75$ driveways.

1st 7 driveways in 0→2m bar.

So next $(14.75 - 7 = 7.75$ drives in 2→8 bar)

Area $= 2.5 × x$

$7.75 = 2.5 × x$

$x = \dfrac{7.75}{2.5} = 3.1$

∴ 75% of driveway exceed $(2+3.1=)5.1$ metres in length.

2.5

2   8

[3]

6. The histogram below represents the results of gathering and measuring the lengths of twigs.

Frequency
density
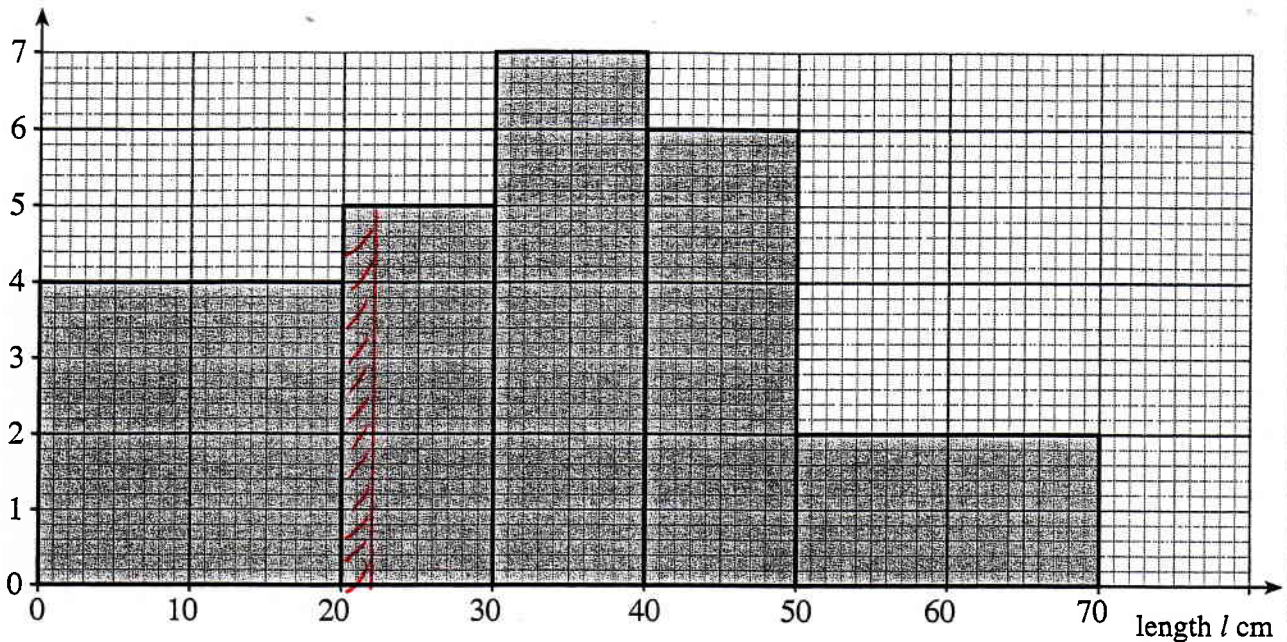
length *l* cm

(a) Use the histogram to complete the grouped frequency table below.

Length, *l* cm	$0 \leqslant l < 20$	$20 \leqslant l < 30$	$30 \leqslant l < 40$	$40 \leqslant l < 50$	$50 \leqslant l < 70$
Number of twigs	20×4 = 80	10×5 = 50	10×7 = 70	10×6 = 60	20×2 = 40

[2]

(b) Find the fraction of twigs that are 40 cm or longer, expressing your fraction in its lowest terms.

$$\frac{N^o \text{ of twigs} \geqslant 40}{\text{Total twigs}} = \frac{100}{300} = \frac{1}{3}$$

[1]

(c) Calculate an estimate of the number of twigs with length less than 22 cm.

$$(20 \times 4) + (2 \times 5)$$
$$80 + 10$$
$$= 90 \text{ twigs measure less than 22cm}$$

[3]

Turn over.