1. A group of 100 adults recorded the amount of time, t minutes, they spent exercising each day. Their results are summarised in the table below.

Time (t minutes)	Frequency (f)	Time midpoint (x)
$0 \leqslant t < 15$	25	7.5
$15 \leqslant t < 30$	17	22.5
$30 \leqslant t < 60$	28	45
$60 \leqslant t < 120$	24	90
$120 \leqslant t \leqslant 240$	6	180

[You may use $\sum fx^2 = 455\,512.5$]

A histogram is drawn to represent these data.

The bar representing the time $0 \leqslant t < 15$ has width 0.5 cm and height 6 cm.

(a) Calculate the width and height of the bar representing a time of $60 \leqslant t < 120$

(3)

(b) Use linear interpolation to estimate the median time spent exercising by these adults each day.

(2)

(b) Use linear interpolation to estimate the median time spent exercising by these adults each day.

(2)

(c) Find an estimate of the mean time spent exercising by these adults each day.

(2)

(d) Calculate an estimate for the standard deviation of these times.

(2)

(e) Describe, giving a reason, the skewness of these data.

(1)

Further analysis of the above data revealed that 18 of the 25 adults in the $0 \leqslant t < 15$ group took no exercise each day.

(f) State, giving a reason, what effect, if any, this new information would have on your answers to

(i) the estimate of the median in part (b),

(ii) the estimate of the mean in part (c),

(iii) the estimate of the standard deviation in part (d).

(3)

January2019/Q4

2. Two classes of students, class A and class B, sat a test.

Class A has 10 students. Class B has 15 students.

Each student achieved a score, x, on the test and their scores are summarised in the table below.

	n	$\sum x$	$\sum x^2$
Class A	10	770	59610
Class B	15	t	58035

The mean score for Class A is 77 and the mean score for Class B is 61

(a) Find the value of t

(1)

(b) Calculate the variance of the test scores for each class.

(3)

(b) Calculate the variance of the test scores for each class.

(3)

The highest score on the test was 95 and the lowest score was 45

These were each scored by students from the same class.

(c) State, with a reason, which class you believe they were from.

(1)

The two classes are combined into one group of 25 students.

(d) (i) Find the mean test score for all 25 students.

(ii) Find the variance of the test scores for all 25 students.

(4)

The teacher of class A later realises that he added up the test scores for his class incorrectly. Each student's test score in class A should be increased by 3

(e) Without further calculations, state, with a reason, the effect this will have on

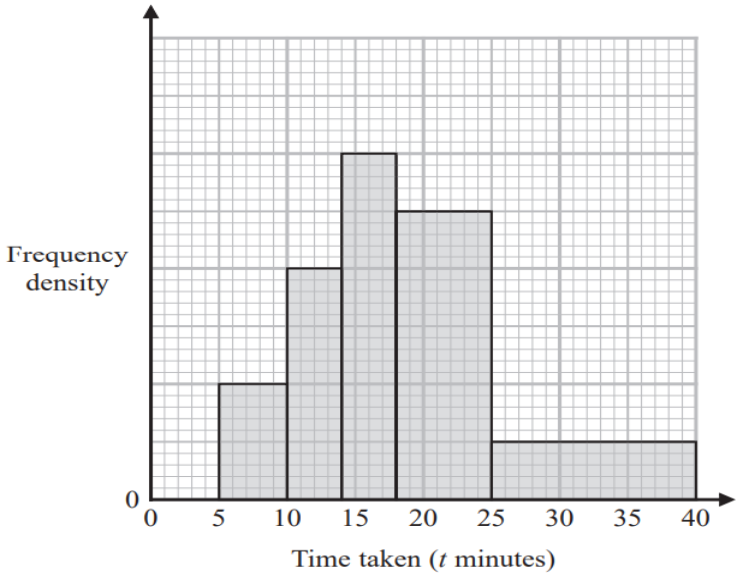
(i) the variance of the test scores for class A

(ii) the mean test score for all 25 students

(iii) the variance of the test scores for all 25 students.

(3)

3. The histogram shows the times taken, t minutes, by each of 100 people to swim 500 metres.



(a) Use the histogram to complete the frequency table for the times taken by the 100 people to swim 500 metres.

Time taken (t minutes)	5 – 10	10 – 14	14 – 18	18 – 25	25 – 40
Frequency (f)	10	16	24		

(1)

(b) Estimate the number of people who took less than 16 minutes to swim 500 metres.

(2)

(c) Find an estimate for the mean time taken to swim 500 metres.

(2)

Given that $\sum ft^2 = 41\,033$

(d) find an estimate for the standard deviation of the times taken to swim 500 metres.

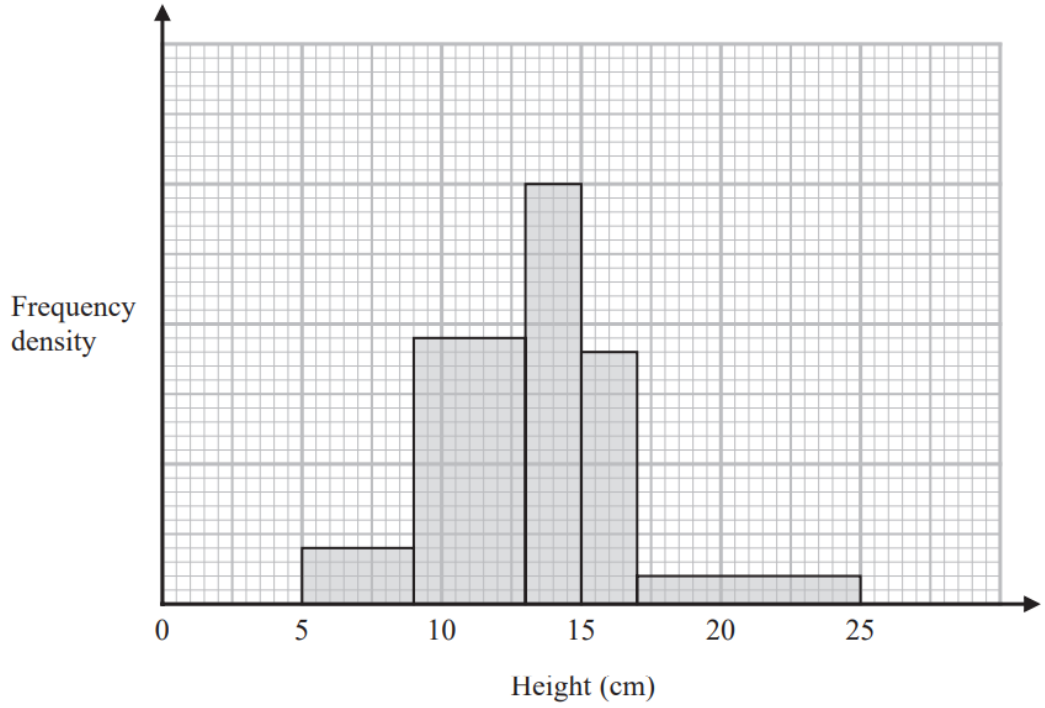
(2)

Given that $Q_3 = 23$

(e) use linear interpolation to estimate the interquartile range of the times taken to swim 500 metres.

(3)

4. The histogram below shows the distribution of the heights, to the nearest cm, of 408 plants.



(a) Use the histogram to complete the following table.

Height (h cm)	$5 \leqslant h < 9$	$9 \leqslant h < 13$	$13 \leqslant h < 15$	$15 \leqslant h < 17$	$17 \leqslant h < 2$
Frequency	32	152	120		

(2)

(b) Use interpolation to estimate the median.

(2)

The mean height of these plants is 13.2 cm correct to one decimal place.

(c) Describe the skew of these data. Give a reason for your answer.

(1)

Two of these plants are chosen at random.

(d) Estimate the probability that both of their heights are between 8 cm and 14 cm

(3)

5. The weights, in grams, of a random sample of 48 broad beans are summarised in the table.

Weight in grams (x)	Frequency (f)	Class midpoint (y)
$0.9 < x \leqslant 1.1$	9	1.0
$1.1 < x \leqslant 1.3$	12	1.2
$1.3 < x \leqslant 1.5$	11	1.4
$1.5 < x \leqslant 1.7$	8	1.6
$1.7 < x \leqslant 1.9$	3	1.8
$1.9 < x \leqslant 2.1$	3	2.0
$2.1 < x \leqslant 2.7$	2	2.4

(You may assume $\sum fy^2 = 101.56$)

A histogram was drawn to represent these data. The $2.1 < x \leqslant 2.7$ class was represented by a bar of width 1.5 cm and height 1 cm.

(a) Find the width and height of the $0.9 < x \leqslant 1.1$ class.

(3)

(b) Give a reason to justify the use of a histogram to represent these data.

(1)

(c) Estimate the mean and the standard deviation of the weights of these broad beans.

(4)

(d) Use linear interpolation to estimate the median of the weights of these broad beans.

(2)

One of these broad beans is selected at random.

(e) Estimate the probability that its weight lies between 1.1 grams and 1.6 grams.

(1)

One of these broad beans having a recorded weight of 0.95 grams was incorrectly weighed. The correct weight is 1.4 grams.

(f) State, giving a reason, the effect this would have on your answers to part (c). Do not carry out any further calculations.

(2)

June2018/Q5

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6. The heights, x metres, of 40 children were recorded by a teacher. The results are summarised as follows

$$\sum x = 58 \qquad \sum x^2 = 84.829$$

(a) Find the mean and the variance of the heights of these 40 children.

(3)

The teacher decided that these statistics would be more useful in centimetres.

(b) Find

(i) the mean of these heights in centimetres,

(ii) the standard deviation of these heights in centimetres.

(2)

Two more children join the group. Their heights are 130 cm and 160 cm.

(c) (i) State, giving a reason, the mean height of the 42 children.

(ii) Without recalculating the standard deviation, state, giving a reason, whether the standard deviation of the heights of the 42 children will be greater than, less than or the same as the standard deviation of the heights of the group of 40 children.

(4)

June2019/Q1

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7. A random sample of 100 carrots is taken from a farm and their lengths, L cm, recorded. The data are summarised in the following table.

Length, L cm	Frequency, f	Class mid point, x cm
$5 \leqslant L < 8$	5	6.5
$8 \leqslant L < 10$	13	9
$10 \leqslant L < 12$	16	11
$12 \leqslant L < 15$	25	13.5
$15 \leqslant L < 20$	30	17.5
$20 \leqslant L < 28$	11	24

A histogram is drawn to represent these data.
The bar representing the class $5 \leqslant L < 8$ is 1.5 cm wide and 1 cm high.

(a) Find the width and height of the bar representing the class $15 \leqslant L < 20$

(3)

(b) Use linear interpolation to estimate the median length of these carrots.

(2)

(c) Estimate

(i) the mean length of these carrots,

(2)

(ii) the standard deviation of the lengths of these carrots.

(3)

A supermarket will only buy carrots with length between 9 cm and 22 cm.

(d) Estimate the proportion of carrots from the farm that the supermarket will buy.

(2)

Any carrots that the supermarket does not buy are sold as animal feed.

The farm makes a profit of 2.2 pence on each carrot sold to the supermarket, a profit of 0.8 pence on each carrot longer than 22 cm and a loss of 1.2 pence on each carrot shorter than 9 cm.

(e) Find an estimate of the mean profit per carrot made by the farm.

(2)

June2021/Q3

8. Gill buys a bag of logs to use in her stove. The lengths, l cm, of the 88 logs in the bag are summarised in the table below.

Length (l)	Frequency (f)
$15 < l \leqslant 20$	19
$20 < l \leqslant 25$	35
$25 < l \leqslant 27$	16
$27 < l \leqslant 30$	15
$30 < l \leqslant 40$	3

A histogram is drawn to represent these data.
The bar representing logs with length $27 < l \leqslant 30$ has a width of 1.5 cm and a height of 4 cm.

(a) Calculate the width and height of the bar representing log lengths of $20 < l \leqslant 25$

(3)

(b) Use linear interpolation to estimate the median of l

(2)

The maximum length of log Gill can use in her stove is 26 cm.
Gill estimates, using linear interpolation, that x logs from the bag will fit into her stove.

(c) Show that $x = 62$

(1)

Gill randomly selects 4 logs from the bag.

(d) Using $x = 62$, find the probability that all 4 logs will fit into her stove.

(2)

The weights, W grams, of the logs in the bag are coded using $y = 0.5w - 255$ and summarised by

$$n = 88 \qquad \sum y = 924 \qquad \sum y^2 = 12\,862$$

(e) Calculate

(i) the mean of W

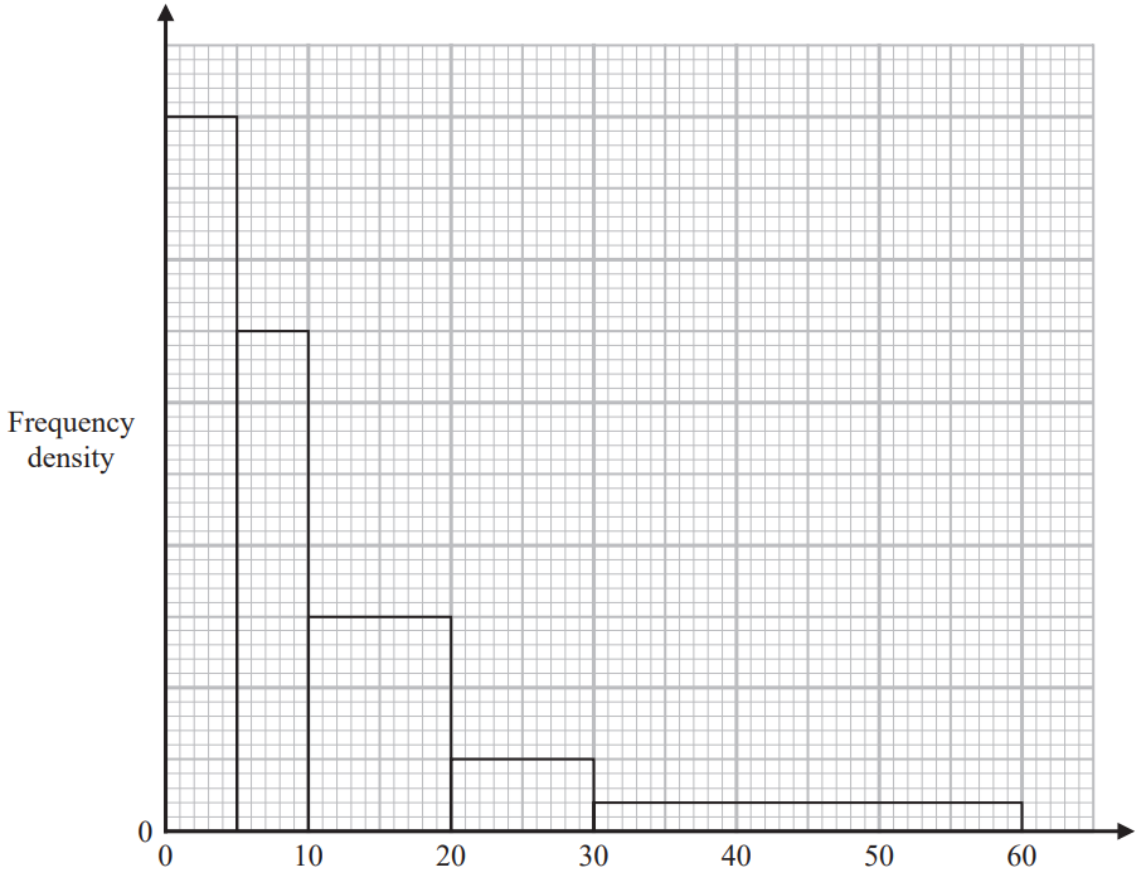
(3)

(ii) the variance of W

(3)

June2022/Q3

9. The histogram shows the distances, in km, that 274 people travel to work.



Given that 60 of these people travel between 10 km and 20 km to work, estimate

(a) the number of people who travel between 22 km and 45 km to work,

(3)

(b) the median distance travelled to work by these 274 people,

(2)

(c) the mean distance travelled to work by these 274 people.

(3)

June2023/Q1

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11. The lengths, x mm, of 50 pebbles are summarised in the table below.

Length	Frequency
$20 \leqslant x < 30$	2
$30 \leqslant x < 32$	16
$32 \leqslant x < 36$	20
$36 \leqslant x < 40$	8
$40 \leqslant x < 45$	3
$45 \leqslant x < 50$	1

A histogram is drawn to represent these data.

The bar representing the class $32 \leqslant x < 36$ is 2.5 cm wide and 7.5 cm tall.

(a) Calculate the width and the height of the bar representing the class $30 \leqslant x < 32$

(3)

(b) Using linear interpolation, estimate the median of x

(2)

(b) Using linear interpolation, estimate the median of x

(2)

The weight, w grams, of each of the 50 pebbles is coded using $10y = w - 20$
These coded data are summarised by

$$\sum y = 104 \qquad \sum y^2 = 233.54$$

(c) Show that the mean of w is 40.8

(2)

(d) Calculate the standard deviation of w

(4)

The weight of a pebble recorded as 40.8 grams is added to the sample.

(e) Without carrying out any further calculations, state, giving a reason, what effect this would have on the value of

(i) the mean of w

(ii) the standard deviation of w

(3)

June2024/Q3

12. The parking times, t hours, for cars in a car park are summarised below.

Time (t hours)	Frequency (f)	Time midpoint (m)
$0 \leqslant t < 1$	10	0.5
$1 \leqslant t < 2$	18	1.5
$2 \leqslant t < 4$	15	3
$4 \leqslant t < 6$	12	5
$6 \leqslant t < 12$	5	9

(You may use $\sum fm = 182$ and $\sum fm^2 = 883$)

A histogram is drawn to represent these data.

The bar representing the time $1 \leqslant t < 2$ has a width of 1.5 cm and a height of 6 cm.

(a) Calculate the width and the height of the bar representing the time $4 \leqslant t < 6$

(3)

(b) Use linear interpolation to estimate the median parking time for the cars in the car park.

(2)

(b) Use linear interpolation to estimate the median parking time for the cars in the car park.

(2)

(c) Estimate the mean and the standard deviation of the parking time for the cars in the car park.

(3)

(d) Describe, giving a reason, the skewness of the data.

(2)

One of these cars is selected at random.

(e) Estimate the probability that this car is parked for more than 75 minutes.

(3)

October 2018/Q3

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13. The stem lengths of a sample of 120 tulips are recorded in the grouped frequency table below.

Stem length (cm)	Frequency
$40 \leqslant x < 42$	12
$42 \leqslant x < 45$	18
$45 \leqslant x < 50$	23
$50 \leqslant x < 55$	35
$55 \leqslant x < 58$	24
$58 \leqslant x < 60$	8

A histogram is drawn to represent these data.

The area of the bar representing the $40 \leqslant x < 42$ class is $16.5\,\text{cm}^2$

(a) Calculate the exact area of the bar representing the $42 \leqslant x < 45$ class.

(2)

The height of the tallest bar in the histogram is 10 cm.

(b) Find the exact height of the second tallest bar.

The height of the tallest bar in the histogram is 10 cm.

(b) Find the exact height of the second tallest bar.

(3)

Q_1 for these data is 45 cm.

(c) Use linear interpolation to find an estimate for

(i) Q_2

(ii) the interquartile range.

(4)

One measure of skewness is given by

$$\frac{Q_3 - 2Q_2 + Q_1}{Q_3 - Q_1}$$

(d) By calculating this measure, describe the skewness of these data.

(2)

October2022/Q1