Variance & standard deviation

Question Paper 1

Level	A Level
Exam Board	Edexcel
Subject	Mathematics
Module	Mechanics and Statistics
Topic	Location and spread
Sub-Topic	Variance & standard deviation
Booklet	Question paper 1

Time Allowed: **40 minutes**

Score: **/32**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1. *Kaff coffee* is sold in packets. A seller measures the masses of the contents of a random sample of 90 packets of *Kaff coffee* from her stock. The results are shown in the table below.

Mass w (g)	Midpoint y (g)	Frequency (f)
$240 \leq w < 245$	242.5	8
$245 \leq w < 248$	246.5	15
$248 \leq w < 252$	250	35
$252 \leq w < 255$	253.5	23
$255 \leq w < 260$	257.5	9

(You may use $\sum fy^2 = 5\,644\,171.75$)

Estimate the mean and the standard deviation of the mass of the contents of a packet of *Kaff coffee* to 1 decimal place. **(3)**

(Total 3 marks)

2. The following grouped frequency distribution summarises the number of minutes, to the nearest minute, that a random sample of 200 motorists were delayed by roadworks on a stretch of motorway.

Delay (mins)	Number of motorists
4—6	15
7—8	28
9	49
10	53
11—12	30
13—15	15
16—20	10

(a) Use interpolation to estimate the median of this distribution. **(2)**

(b) Calculate an estimate of the mean and an estimate of the standard deviation of these data. **(6)**

(Total 8 marks)

3. Over a period of time, the number of people x leaving a hotel each morning was recorded. These data are summarised in the stem and leaf diagram below.

Number leaving	3	2 means 32	Totals
2	7 9 9		(3)
3	2 2 3 5 6		(5)
4	0 1 4 8 9		(5)
5	2 3 3 6 6 6 8		(7)
6	0 1 4 5		(4)
7	2 3		(2)
8	1		(1)

For these data,

(*a*) write down the mode,

(1)

(*b*) find the values of the three quartiles.

(3)

Given that $\Sigma x = 1335$ and $\Sigma x^2 = 71\,801$, find

(*c*) the mean and the standard deviation of these data.

(4)

(Total 8 marks)

4. Summarised below are the distances, to the nearest mile, travelled to work by a random sample of 120 commuters.

Distance (to the nearest mile)	Number of commuters
0–9	10
10–19	19
20–29	43
30–39	25
40–49	8
50–59	6
60–69	5
70–79	3
80–89	1

For this distribution,

(a) use linear interpolation to estimate its median. **(2)**

The mid-point of each class was represented by x and its corresponding frequency by f giving

$$\Sigma fx = 3550 \quad \text{and} \quad \Sigma fx^2 = 138020$$

(b) Estimate the mean and the standard deviation of this distribution. **(3)**

(Total 5 marks)

5. The birth weights, in kg, of 1500 babies are summarised in the table below.

Weight (kg)	Midpoint, x kg	Frequency, f
0.0 – 1.0	0.50	1
1.0 – 2.0	1.50	6
2.0 – 2.5	2.25	60
2.5 – 3.0		280
3.0 – 3.5	3.25	820
3.5 – 4.0	3.75	320
4.0 – 5.0	4.50	10
5.0 – 6.0		3

[You may use $\sum fx = 4841$ and $\sum fx^2 = 15\,889.5$]

Calculate an estimate of the standard deviation of the birth weight. **(3)**

(Total 3 marks)

6. On a randomly chosen day, each of the 32 students in a class recorded the time, t minutes to the nearest minute, they spent on their homework. The data for the class is summarised in the following table.

Time, t	Number of students
10 – 19	2
20 – 29	4
30 – 39	8
40 – 49	11
50 – 69	5
70 – 79	2

(a) Use interpolation to estimate the value of the median.

(2)

Given that

$$\sum t = 1414 \quad \text{and} \quad \sum t^2 = 69\,378$$

(b) find the mean and the standard deviation of the times spent by the students on their homework.

(3)

(Total 5 marks)