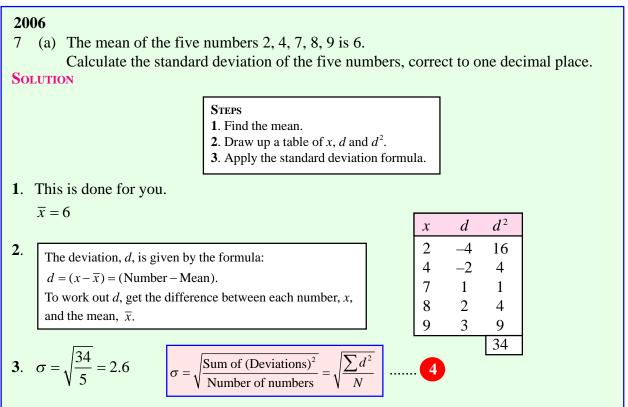
STATISTICS (Q 7, PAPER 2)

LESSON NO. 4: STANDARD DEVIATION



2005

7 (b) There are fourteen questions in an examination.

The table below shows the performance of the candidates.

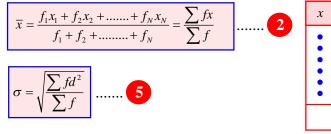
Correct responses	0-2	3 – 5	6-8	9 – 11	12 – 14
Number of candidates	1	2	6	8	3

(i) Using mid-interval values, calculate the mean number of correct responses.

(ii) Calculate the standard deviation, correct to one decimal place.

SOLUTION

If you are asked to find the mean and standard deviation of a frequency distribution, set it out in a table as shown.



x	f	fx	d	d^2	fd²
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
	$\sum f$	$\sum fx$			$\sum fd^2$

Work out the mean first. Then work out *d* using $d = (x - \overline{x})$. Finally, calculate the standard deviation.

x	f	fx	d	d^2	fd^2
1	1	1	-7.5	56.25	56.25
4	2	8	-4.5	20.25	40.5
7	6	42	- 1.5	2.25	13.5
10	8	80	1.5	2.25	18.0
13	3	39	4.5	20.25	60.75
	20	170			189

Draw up a table in the way as shown on the left. The mid-interval values, *x*, are obtained by adding the class interval values together and dividing by two.

(i)
$$\overline{x} = \frac{\sum fx}{\sum f} = \frac{170}{20} = 8.5$$

(ii) $\sigma = \sqrt{\frac{\sum fd^2}{\sum f}} = \sqrt{\frac{189}{20}} = 3.1$

2004

7 (a) The mean of the set of numbers $\{1, 3, 7, 9\}$ is 5. Find the standard deviation, correct to one decimal place.

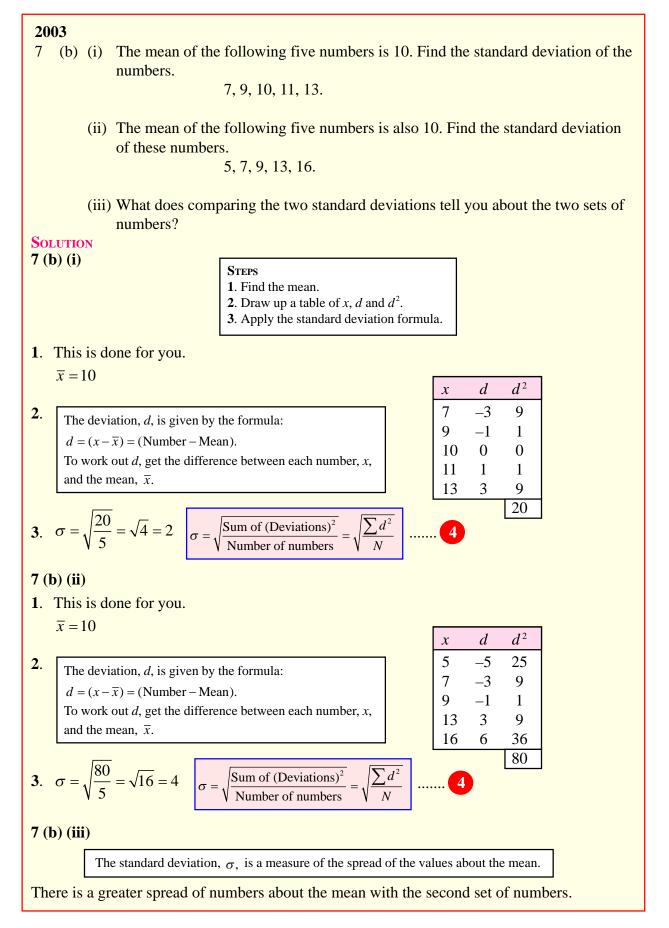
SOLUTION

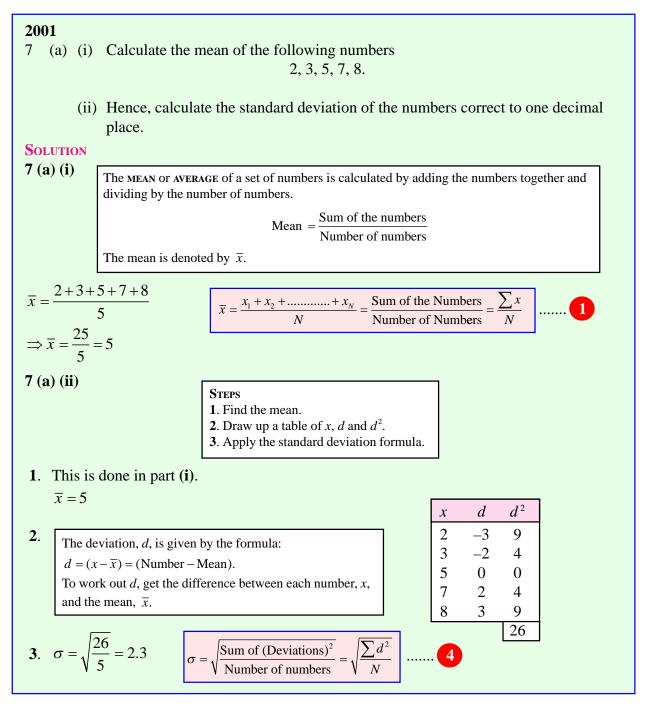
- STEPS **1**. Find the mean.
- **2**. Draw up a table of x, d and d^2 .
- **3**. Apply the standard deviation formula.

1. This is done for you.

 $\overline{x} = 5$

	x = 5		x	d	d^2
2.	The deviation, <i>d</i> , is given by the formula: $d = (x - \overline{x}) = ($ Number – Mean $).$ To work out <i>d</i> , get the difference between each number, <i>x</i> ,		1 3 7	-4 -2 2	16 4 4
	and the mean, \overline{x} .	l	9	4	16 40
3.	$\sigma = \sqrt{\frac{40}{4}} = \sqrt{10} = 3.2$ $\sigma = \sqrt{\frac{\text{Sum of (Deviations)}^2}{\text{Number of numbers}}} = \sqrt{\frac{\sum d}{N}}$. 4	





1999

7 (c) The number of minutes taken by 20 pupils to answer a short question is shown in the following distribution table:

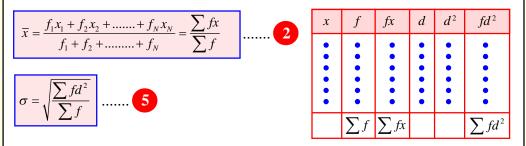
Minutes	2 - 4	4 - 6	6-8	8 - 10
Number of pupils	6	9	4	1

By taking the data at mid-interval values, calculate

- (i) the mean number of minutes taken per pupil
- (ii) the standard deviation, correct to one place of decimals.

SOLUTION

If you are asked to find the mean and standard deviation of a frequency distribution, set it out in a table as shown.



Work out the mean first. Then work out *d* using $d = (x - \overline{x})$. Finally, calculate the standard deviation.

x	f	fx	d	d^2	$\int d^2$
3	6	18	- 2	4	24
5	9	45	0	0	0
7	4	28	2	4	16
9	1	9	4	16	16
	20	100			56

Draw up a table in the way as shown on the left. The mid-interval values, x, are obtained by adding the class interval values together and dividing by two.

(i)
$$\overline{x} = \frac{\sum fx}{\sum f} = \frac{100}{20} = 5$$

(ii) $\sigma = \sqrt{\frac{\sum fd^2}{\sum f}} = \sqrt{\frac{56}{20}} = 1.7$

1998

7 (c) The following table shows the sizes, in hectares, of 20 farms in a particular area:

No. of hectares	15 – 45	45 – 75	75 – 105	105 – 195
Number of farms	1	4	8	7

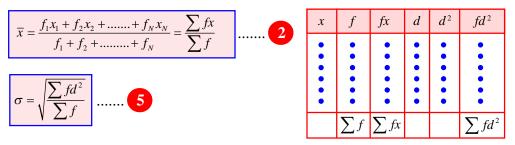
By taking the data at mid-interval values, calculate

(i) the mean number of hectares per farm

(ii) the standard deviation, correct to the nearest hectare.

SOLUTION

If you are asked to find the mean and standard deviation of a frequency distribution, set it out in a table as shown.



Work out the mean first. Then work out *d* using $d = (x - \overline{x})$. Finally, calculate the standard deviation.

x	f	fx	d	d^2	$\int d^2$
30	1	30	- 72	5184	5184
60	4	240	- 42	1764	7056
90	8	720	- 12	144	1152
150	7	1050	48	2304	16128
	20	2040			29520

Draw up a table in the way as shown on the left. The mid-interval values, x, are obtained by adding the class interval values together and dividing by two.

(i)
$$\overline{x} = \frac{\sum fx}{\sum f} = \frac{2040}{20} = 102$$

(ii)
$$\sigma = \sqrt{\frac{\sum fd^2}{\sum f}} = \sqrt{\frac{29520}{20}} = 38$$

