

**STATISTICS (Q 7, PAPER 2)**

**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.
- (b) The following table shows the time in minutes spent by customers in a cafeteria.

Time in minutes	0 – 10	10 – 20	20 – 40	40 – 70
Number of customers	80	100	160	60

[Note that 10 – 20 means at least 10 but less than 20 minutes etc.]

- (i) Find the total number of customers.
- (ii) Draw a histogram to represent the data.
- (iii) By taking the data at the mid-interval values, calculate the mean number of minutes per customer.
- (iv) What is the greatest number of customers who could have spent more than 30 minutes in the cafeteria?
- (v) What is the least number of customers who could have spent more than 30 minutes in the cafeteria?

**SOLUTION**

**7 (a)**

<b>STEPS</b> 1. Find the mean. 2. Draw up a table of $x$ , $d$ and $d^2$ . 3. Apply the standard deviation formula.
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1. This is done for you.

$$\bar{x} = 5$$

2.

The deviation, $d$ , is given by the formula: $d = (x - \bar{x}) = (\text{Number} - \text{Mean})$ . To work out $d$ , get the difference between each number, $x$ , and the mean, $\bar{x}$ .
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$x$	$d$	$d^2$
1	-4	16
3	-2	4
7	2	4
9	4	16
		40

3.  $\sigma = \sqrt{\frac{40}{4}} = \sqrt{10} = 3.2$

$\sigma = \sqrt{\frac{\text{Sum of (Deviations)}^2}{\text{Number of numbers}}} = \sqrt{\frac{\sum d^2}{N}} \dots\dots \mathbf{4}$
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**7 (b) (i)**

Total number of customers =  $80 + 100 + 160 + 60 = 400$

**7 (b) (ii)**

Time in minutes	0 – 10	10 – 20	20 – 40	40 – 70
Number of customers	80	100	160	60

Each column in the table is represented by a rectangular box. The area of the box corresponds to the frequency (no. of customers).

$$\text{Area (No. of students)} = \text{Base} \times \text{Height} = \text{Frequency}$$

Look at the times. Pick out the smallest interval (0 – 10) and make this base one unit. Therefore the interval 20 – 40 has a base of 2 units and the interval 40 – 70 has a base of 3 units. Divide the base into the area (frequency) to get the height of a box.

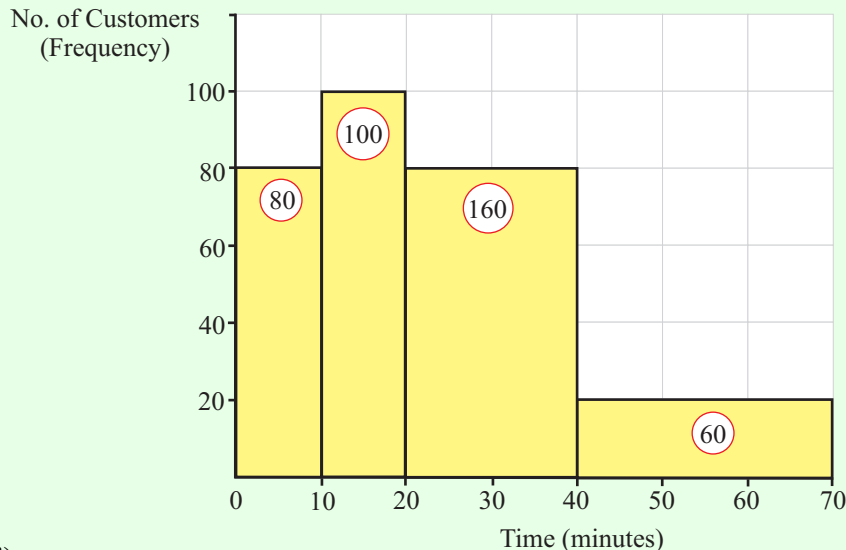
Draw a new table:

Interval (Time)	0 – 10	10 – 20	20 – 40	40 – 70
Frequency (No. of customers)	80	100	160	60
Base	1	1	2	3
Height	80	100	80	20

Drawing the histogram:

**Horizontal** (*x*-axis) axis (Time): Look at the intervals. The times go from 0 to 70. The smallest interval (Base 1) is 10 so go up in 10's.

**Vertical** (*y*-axis) axis (No. of customers): Always start at zero. The biggest number is the maximum height (i.e. 100).



**7 (b) (iii)**

Draw up a frequency table using the mid-interval values. To get a mid-interval value add the two numbers together and divide by 2.

**Ex.** Class interval: 10 – 20

$$\text{Mid-interval value: } \frac{10 + 20}{2} = 15$$

<i>x</i>	<i>f</i>	<i>fx</i>
5	80	400
15	100	1500
30	160	4800
55	60	3300
	400	10000

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + \dots + f_Nx_N}{f_1 + f_2 + \dots + f_N} = \frac{\sum fx}{\sum f} \dots \textcircled{2}$$

Mean time:  $\bar{x} = \frac{\sum fx}{\sum f} = \frac{10000}{400} = 25$

**7 (b) (iv)**

160 customers were present in the time interval 20 – 30 minutes. All 160 customers could have been present for a time greater than 30 minutes.

Therefore, the greatest number of customers who could have been present for more than 30 minutes = 160 + 60 = 220.

**7 (b) (v)**

160 customers were present in the time interval 20 – 30 minutes. All 160 customers could have been present for a time less than 30 minutes.

Therefore, the least number of customers who could have been present for more than 30 minutes = 60.