Total lecture = 4.

Lecture-I

Measure of Central tendency.

Mean ($\bar{x}$ or μ)

1) Mean of ungraped data.

$x_1, x_2, x_3, - - -, x_n$

$$\text{Mean } (\bar{x}) = \frac{\sum x_i}{n} = \frac{x_1 + x_2 + \cdots + x_n}{n}.$$

2) Mean of grouped data.

Class Marks →	x_i	x_1	x_2		x_n
frequencies	f_i	f_1	f_2		f_n

(a) Direct Method → $$\bar{x} = \frac{\sum x_i f_i}{\sum f_i}$$

(b) Shortcut Method → $$\bar{x} = A + \frac{\sum d_i f_i}{\sum f_i}$$

* $d_i = x_i - A$
* A = Assumed Mean.

(c) Step-deviation → $$\bar{x} = A + c\,\frac{\sum u_i f_i}{\sum f_i}$$

$c \rightarrow$ class size. $u_i = \frac{x_i - A}{c}$.

Ex:1) Find the mean of the following frequency distribution.

Class-interval	0-50	50-100	100-150	150-200	200-250	250-300
Frequency	4	8	16	13	6	3

→ Class Marks = Mid-point of class interval.

Class-Interval	f_i	x_i	$x_i f_i$
0-50	4	25	100
50-100	8	75	600
100-150	16	125	2000
150-200	13	175	2275
200-250	6	225	1350
250-300	3	275	825
	50		7150

@ Direct Method $\Rightarrow$ Mean $= \frac{\Sigma x_i f_i}{\Sigma f_i} = \frac{7150}{50} = 143$

Class-Interval	f_i	x_i	$d_i = x_i - A$	$f_i d_i$
0-50	4	25	-100	-400
50-100	8	75	-50	-400
100-150	16	125	0	0
150-200	13	175	50	650
200-250	6	225	100	600
250-300	3	275	150	450
	50			900

Let A be 125

(b) Shortcut Method $\Rightarrow$ Mean $= A + \frac{\Sigma d_i f_i}{\Sigma f_i}$

$$\text{Mean} = 125 + \frac{900}{50} = 125 + 18 = \underline{143} \quad \underline{\text{Ans}}$$

Class-Interval	f_i	x_i	u_i	$f_i u_i$
0-50	4	25	-2	-8
50-100	8	75	-1	-8
100-150	16	125	0	0
150-200	13	175	1	13
200-250	6	225	2	12
250-300	3	275	3	9
	50			18

Let A be 125. & C = 50

© Step-deviation: $\bar{x} = A + C \frac{\sum f_i u_i}{\sum f_i}$

A → Assumed Mean

C → class size.

$u_i = \frac{x_i - A}{C} = \frac{d_i}{C}$

$\bar{x} = 125 + 50 \times \frac{18}{50}$

$= 125 + 18 = 143.$

Lecture-II

2) If the mean of the following distribution is 7.5. find the missing frequency f.

Variable (x_i)	5	6	7	8	9	10	11	12
frequency (f_i)	20	17	f	10	8	6	7	6
$x_i f_i$	100	102	7f	80	72	60	77	72

Sol":

$$\because \bar{x} = \frac{\Sigma x_i f_i}{\Sigma f_i} \quad \therefore 7.5 = \frac{563 + 7f}{74 + f}$$

$$555 + 7.5f = 563 + 7f$$

$$0.5f = 8 \Rightarrow \boxed{f = 16}$$ Ans

3) If the mean of the following distribution is 24, find the value of a.

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	7	a	8	10	5

Marks	f_i	x_i	$f_i x_i$
0-10	7	5	35
10-20	a	15	15a
20-30	8	25	200
30-40	10	35	350
40-50	5	45	225
	$\Sigma f_i = 30 + a$		$\Sigma f_i x_i = 810 + 15a$

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$24 = \frac{810 + 15a}{30 + a}$$

$$720 + 24a = 810 + 15a$$

$$9a = 90 \Rightarrow \boxed{a = 10}$$

Ans

4) The following table gives the life-time (in days) of 100 electric bulbs of a certain make.

Life-time (in days)	less than 50	less than 100	less than 150	less than 200	less than 250	< 300
No. of bulbs	7	21	52	79	91	100

Find the mean life-time of these bulbs.

C.I	f_i	x_i	u_i	$f_i u_i$
0-50	7	25	-3	-21
50-100	14	75	-2	-28
100-150	31	125	-1	-31
150-200	27	175	0	0
200-250	12	225	1	12
250-300	9	275	2	18
$\Sigma f_i =$	100			$\Sigma f_i u_i = -50$

$A = 175$

$C = 50$

$u_i = \frac{x_i - A}{C}$

$\bar{x} = 175 + (\cancel{50}) \left(\frac{-50}{\cancel{100}\ 2}\right)$

$= 175 - 25 = 150$

Mean life-time of these bulbs = 150 days.

75-79 ⟹ 74.5-79.5

80-84 ⟹ 79.5-84.5

85-89

90-94

95-99

{ C-0.5 in lower limit

+0.5 in upper limit

Weights of 60 eggs were recorded as given below :

Weights (in gms)	75 – 79	80 – 84	85 – 89	90 – 94	95 – 99	100 – 104	105 – 109
Number of eggs	4	9	13	17	12	3	2

Calculate their mean weight to the nearest gm.

C.I	x_i	f_i	u_i	f_iu_i
74.5 – 79.5	77	4	-3	-12
79.5 – 84.5	82	9	-2	-18
84.5 – 89.5	87	13	-1	-13
89.5 – 94.5	92	17	0	0
94.5 – 99.5	97	12	1	12
99.5 – 104.5	102	3	2	6
104.5 – 109.5	107	2	3	6
		$\Sigma f_i = 60$		$\Sigma f_iu_i = -19$

$C = 5$, $A = 92$) $\bar{x} = 92 + 5 \times \frac{(-19)}{60_{12}}$

$\bar{x} = 92 - 1.59 = 90.41$ gms $\simeq$ 90 gms.

$\bar{x} = \frac{1104 - 19}{12} = \frac{1085}{12} \simeq 90.41$ gms.

H.W) 18, 20, 21, 23, 26 → Mean

Lecture-III

Median, Quartiles & Mode.

+ Graphical Representation of data.

Median → The value of the middle-most observation obtained after arranging the data in ascending order. (or descending order).

Median of ungrouped data.

* Arrange the given data in ascending order.

If n is odd → Median = $\left(\frac{n+1}{2}\right)^{th}$ observation.

eg:- 1, 2, 3 → (2) → Median.

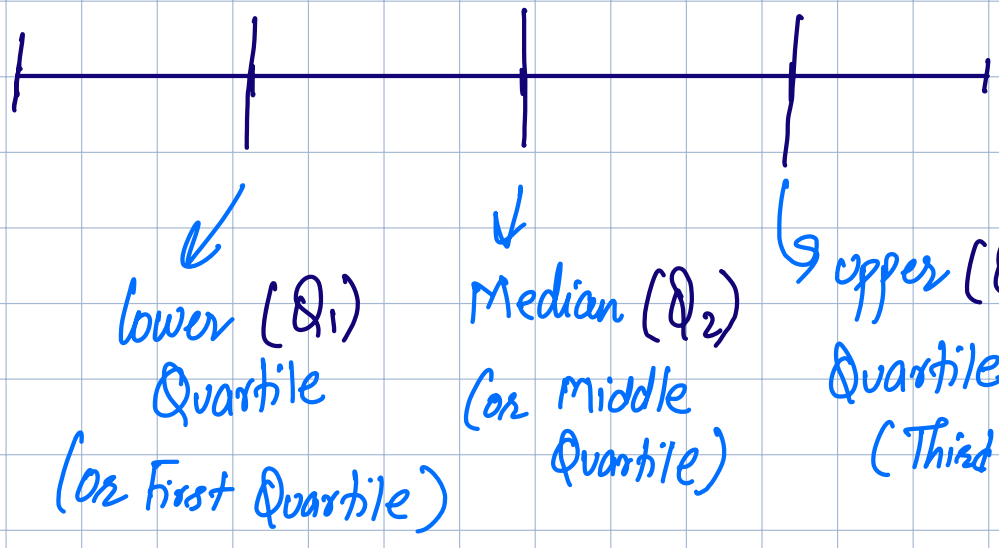
If n is even → Median = $\frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}}{2}$

e.g:- 1, 2, 3, 4 → Median = $\frac{2+3}{2} = 2.5$.

Q.1) The median of the following observations 11, 12, 14, $(x-2)$, $(x+4)$, $(x+9)$, 32, 38, 47 arranged in ascending order is 24. Find the value of x.

Sol^n:-

$x+4 = 24 \Rightarrow \boxed{x=20}$



$$Q_1 = \begin{cases} \left(\frac{n}{4}\right)^{th} \text{observation}; & n \text{ is even.} \\ \left(\frac{n+1}{4}\right)^{th} \text{observation}; & n \text{ is odd.} \end{cases}$$

n is no. of observation.

$$Q_3 = \begin{cases} \left(\frac{3n}{4}\right)^{th} \text{obs.}; & n \text{ is even.} \\ \left(\frac{3(n+1)}{4}\right)^{th} \text{obs.}; & n \text{ is odd.} \end{cases}$$

IQR (Interquartile Range) $= (Q_3 - Q_1)$

Semi-Interquartile Range $= \frac{Q_3 - Q_1}{2}$.

Range = (biggest − lowest) observation.

Estimating Median & Quartiles from Ogive.

Marks	No. of students (f_i)	CF
0-10	5	5
10-20	9	14
20-30	16	30
30-40	22	52
40-50	26	78
50-60	18	96
60-70	11	107
70-80	6	113
80-90	4	117
90-100	3	120 = N.

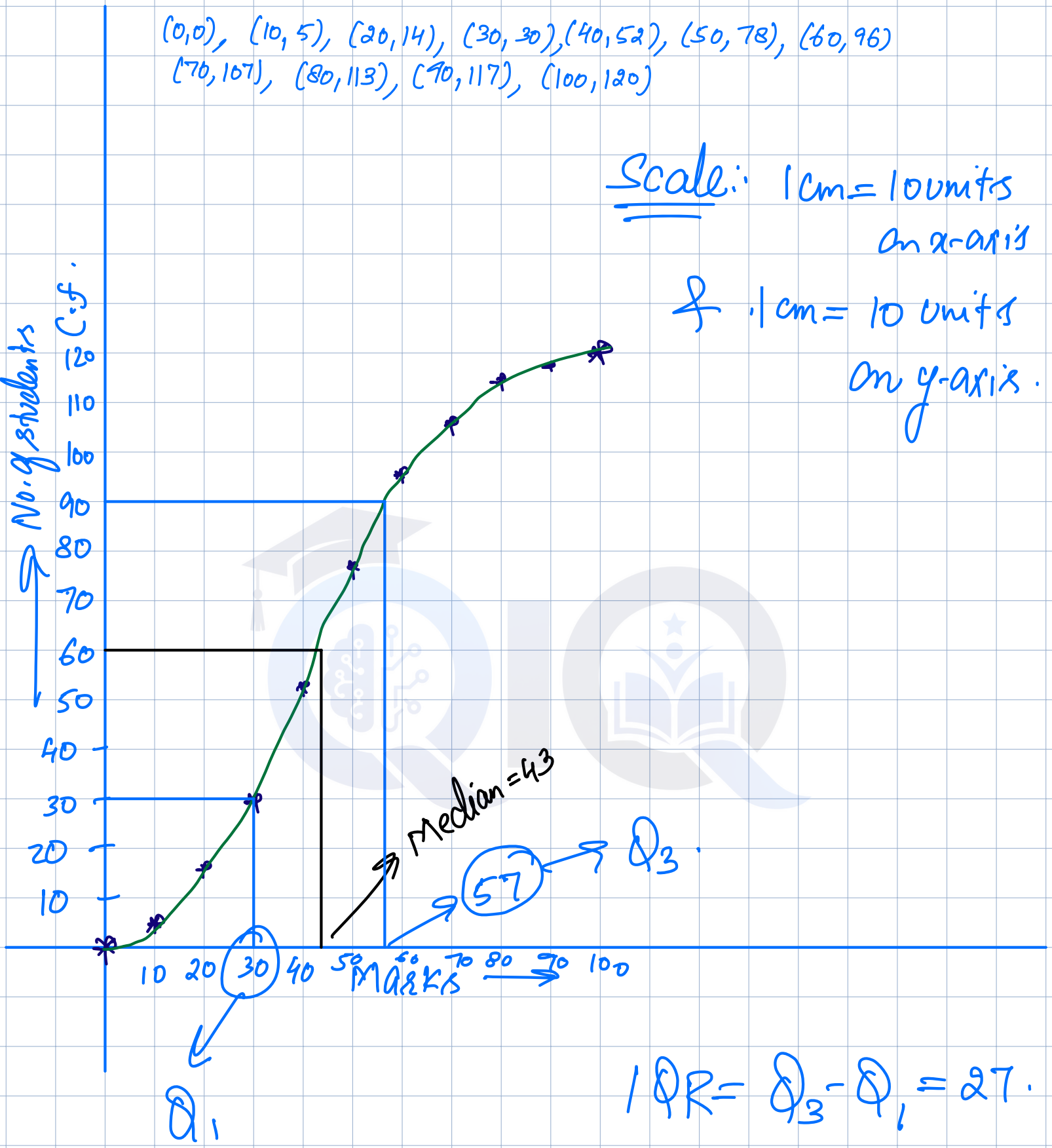
$\frac{N}{2} = 60$ (for median)

$\frac{N}{4} = 30$ (Q_1)

$\frac{3N}{4} = 90$ (Q_3)

(0,0), (10, 5), (20, 14), (30, 30), (40, 52), (50, 78), (60, 96)
(70, 107), (80, 113), (90, 117), (100, 120)

Scale: 1 cm = 10 units on x-axis
& 1 cm = 10 units on y-axis.



$IQR = Q_3 - Q_1 = 27.$

c.f.: 4 12 32 46 53 59 60

. A survey regarding height (in cm) of 60 boys belonging to class 10 of a school was conducted. The following data was recorded: (2018)

Height (in cm)	135-140	140-145	145-150	150-155	155-160	160-165	165-170
Number of boys	4	8	20	14	7	6	1

Taking 2 cm = height of 10 cm along one axis and 2 cm = 10 boys along the other axis, draw an ogive of the above distribution. Use the graph to estimate the following :

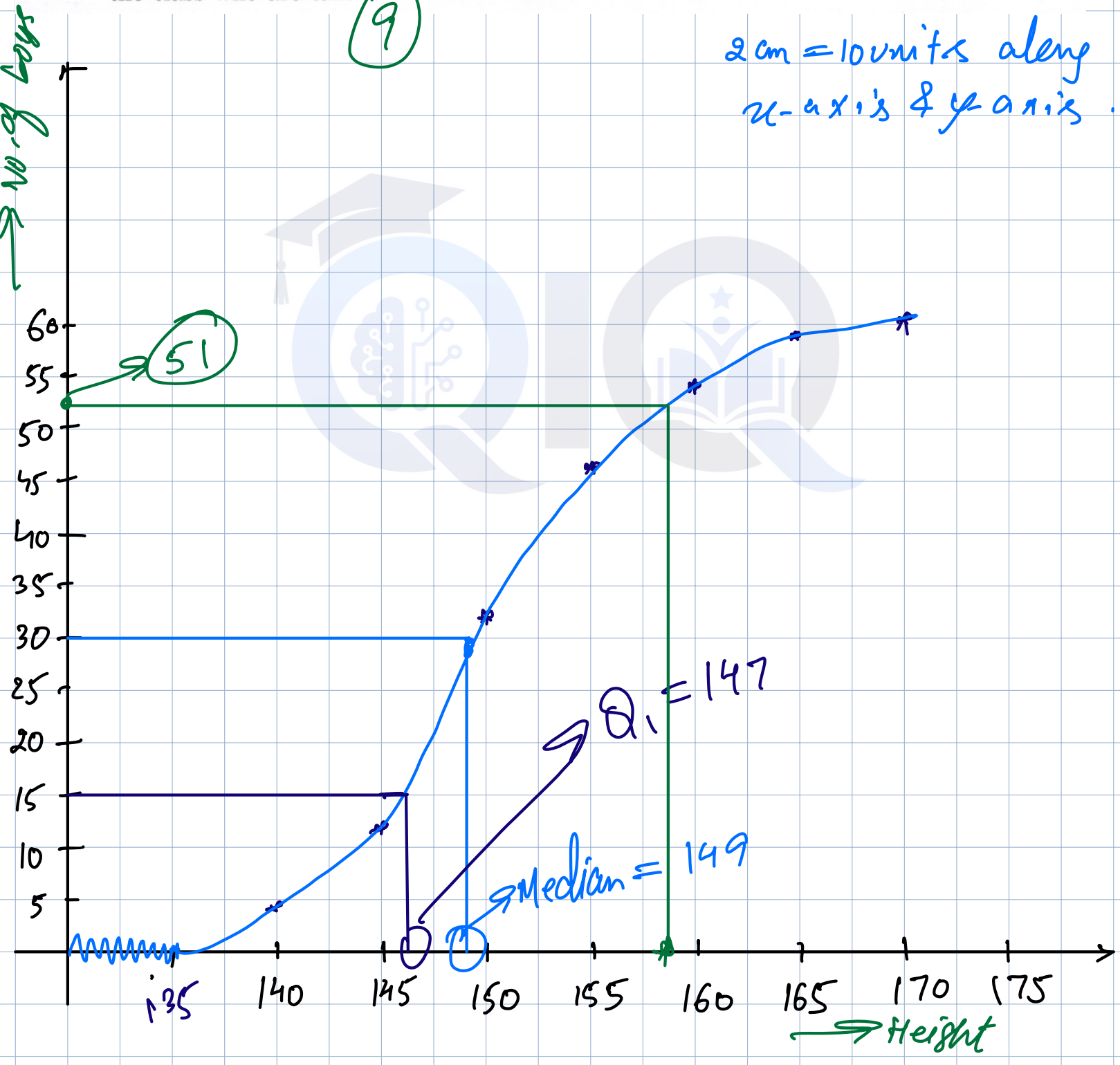
(i) the median

(ii) the lower quartile

(iii) if above 158 cm is considered as the tall boys of the class, find the number of boys in the class who are tall.

9

2 cm = 10 units along x-axis & y-axis.

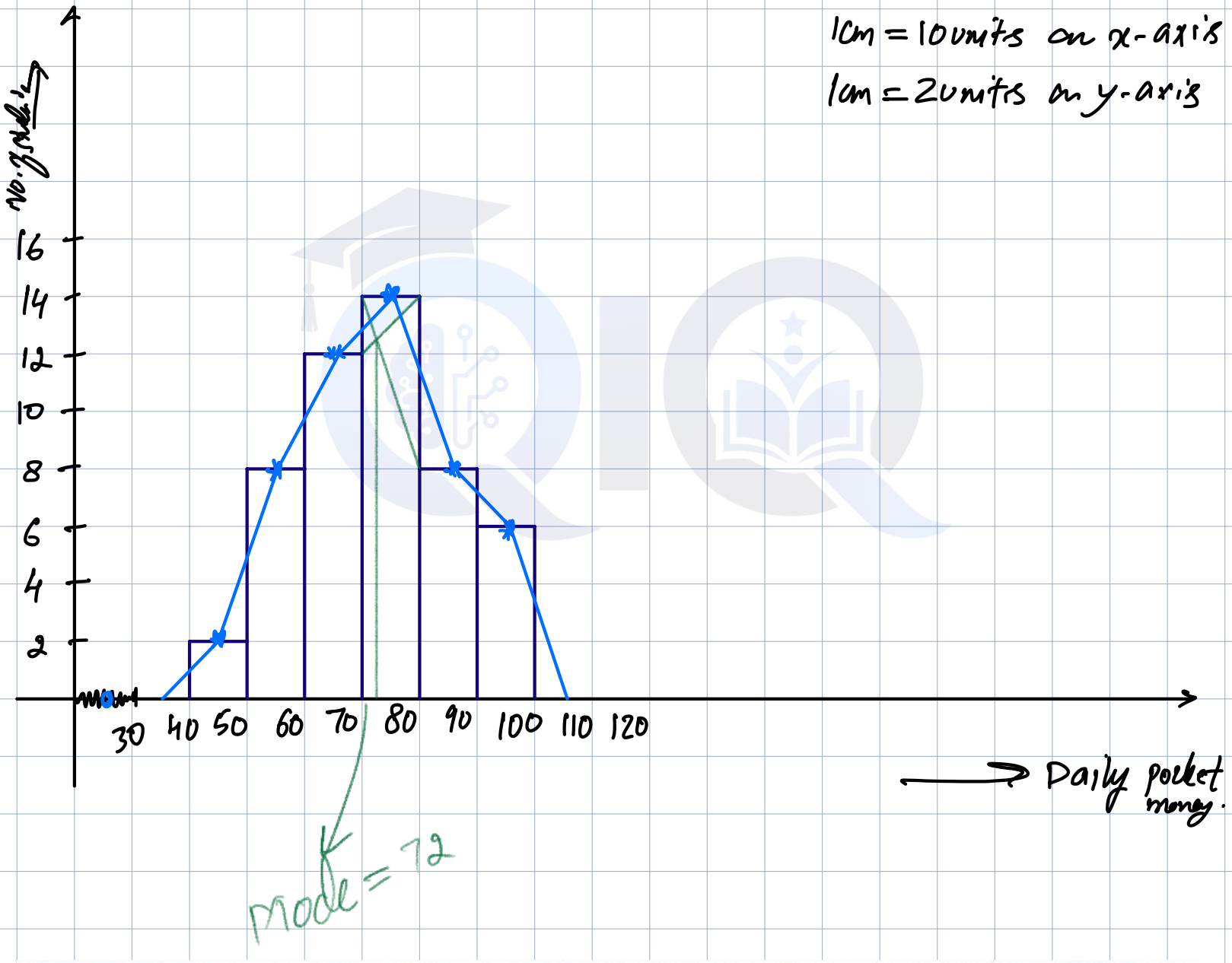


Mode & Histogram. Lecture-IV

In a school, the daily pocket money of 50 students is as follows :

Daily pocket money (in ₹)	40-50	50-60	60-70	70-80	80-90	90-100
Number of students	2	8	12	14	8	6

Draw a histogram and a frequency polygon on the same graph. Find the mode from the graph. **(2009)**



Using a graph paper, draw a histogram for the given distribution showing the number of runs scored by 50 batsmen. From the histogram, estimate the mode of the data : **(2018)**

Runs scored	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000-9000	9000-10000
No. of batsmen	4	18	9	6	7	2	4