PRACTICE PAPER

ICSE CLASS 10 – MATHEMATICS

Chapter 24 : Measures of Central Tendency

STEP-BY-STEP SOLUTIONS & MARKING SCHEME · Maximum Marks: 40

Results used

Mean = $\Sigma fx/\Sigma f$. Short-cut: Mean = $A + \Sigma fd/\Sigma f$. Step-deviation: Mean = $A + (\Sigma ft/\Sigma f) \times i$, where $t = (x - A)/i$.

Median = (n/2)th term (n even: mean of (n/2)th and (n/2 + 1)th terms); (n + 1)/2 th term for odd n. Q_1 = (n/4)th term, Q_3 = (3n/4)th term (n even); (n + 1)/4 th and 3(n + 1)/4 th terms (n odd). IQR = $Q_3 - Q_1$.

Mode = value with the maximum frequency; for grouped data it is read from the histogram by the diagonal method. From an ogive, the value at cumulative frequency c is read along the curve (straight between plotted points).

SECTION A (20 Marks)

Question 1 [8 × 1 = 8]

Part	Ans.	Working
(i)	**(b)**	New mean = 2 × 15 − 3 = 27.
(ii)	**(c)**	Ascending: 3, 4, 7, 9, 10, 12; median = (7 + 9)/2 = 8.
(iii)	**(a)**	14 occurs 3 times, the maximum.
(iv)	**(d)**	Mean = 50 + (−40/80) = 50 − 0.5 = 49.5.
(v)	**(b)**	n = 11 is odd, so Q_1 = ((11 + 1)/4)th = 3rd term.
(vi)	**(c)**	IQR = 26 − 14 = 12.
(vii)	**(c)**	Both true: n = 9 gives ((9 + 1)/2)th = 5th term, so (R) explains (A).
(viii)	**(b)**	(A) is false: the diagonal method gives a mode that need not be the mid-value. (R) is true.

Question 2 [4 + 4 + 4 = 12]

(i)

(a) Sum = 3 + x + 9 + x + 4 + 2x + 1 = 4x + 17 [1]

(4x + 17)/5 = 13 ⇒ 4x + 17 = 65 ⇒ **x = 12** [1]

(b) Mean after adding 5 = 13 + 5 = 18 [1]

Mean after doubling = 2 × 18 = **36** [1]

(ii)

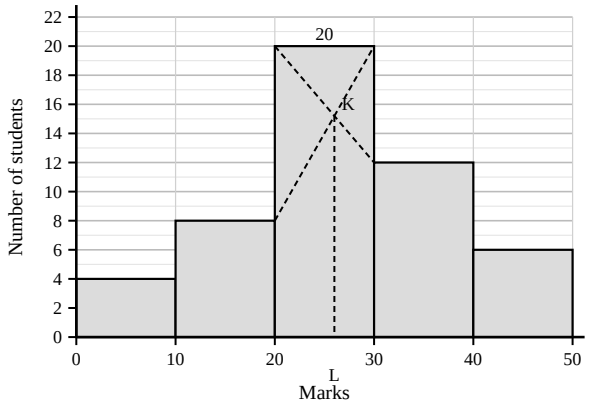
Class marks x: 25, 35, 45, 55, 65. Take A = 45, d = x − 45 [1]

x	**25**	**35**	**45**	**55**	**65**
f	6	10	14	12	8
d	-20	-10	0	10	20
fd	-120	-100	0	120	160

$\Sigma f = 50$, $\Sigma fd = -120 - 100 + 0 + 120 + 160 = 60$ [2]

Mean = $A + \Sigma fd/\Sigma f = 45 + 60/50 =$ **46.2** [1]

(iii)



(a) Highest frequency is 20, so modal class = **20 – 30** [1]

(b) Join the top-right corner of the previous rectangle (20, 8) to that of the modal rectangle (30, 20) [1]

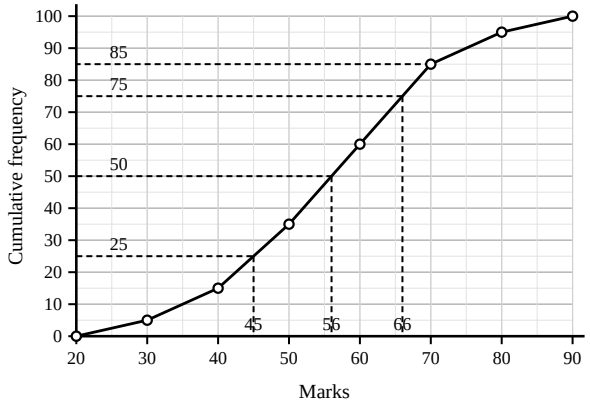
Join the top-left corner of the modal rectangle (20, 20) to that of the next rectangle (30, 12) [1]

The diagonals meet at K; KL ⊥ x-axis meets it at L = 20 + 6 = **26** [1]

(Check: $8 + 1.2t = 20 - 0.8t$ gives $t = 6$, so mode = 26.)

SECTION B (20 Marks) — any two questions

Question 3 [3 + 3 + 4 = 10]



(i)

n = 100, so median = (n/2)th = 50th term [1]

Horizontal line at 50 meets the ogive between (50, 35) and (60, 60); vertical line down [1]

Median = **56 marks** [1]

(ii)

Q_1 = (n/4)th = 25th term: between (40, 15) and (50, 35), reads **45** [1]

Q_3 = (3n/4)th = 75th term: between (60, 60) and (70, 85), reads **66** [1]

IQR = 66 − 45 = **21** [1]

(iii)

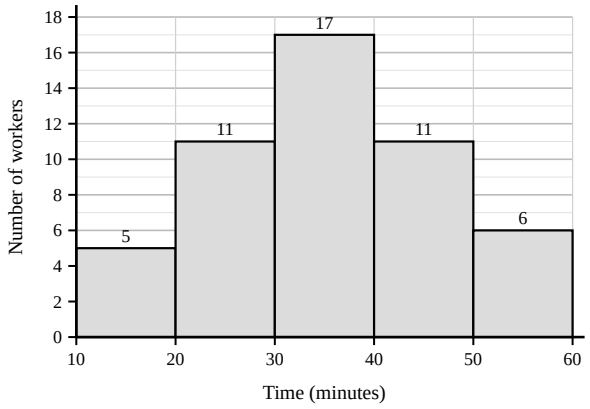
(a) Number scoring below 45 (the pass mark) = c.f. at 45 = 25 [1]

= **25 students failed** [1]

(b) c.f. at 70 = 85, so more than 70 = 100 − 85 = 15 [1]

Percentage = 15/100 × 100 = **15%** [1]

Question 4 [3 + 3 + 4 = 10]



(i)

Heights of the rectangles give the frequencies; class mark = ½(lower + upper): [2]

Class	**10–20**	**20–30**	**30–40**	**40–50**	**50–60**
Class mark	15	25	35	45	55
Frequency	5	11	17	11	6

Total = 5 + 11 + 17 + 11 + 6 = 50 ✓ [1]

(ii)

Class	**10–20**	**20–30**	**30–40**	**40–50**	**50–60**
Cumulative frequency	5	16	33	44	50

Cumulative frequencies: 5, 16, 33, 44, 50 [2]

N/2 = 25 lies in c.f. 33, so median class = **30 – 40** [1]

(iii)

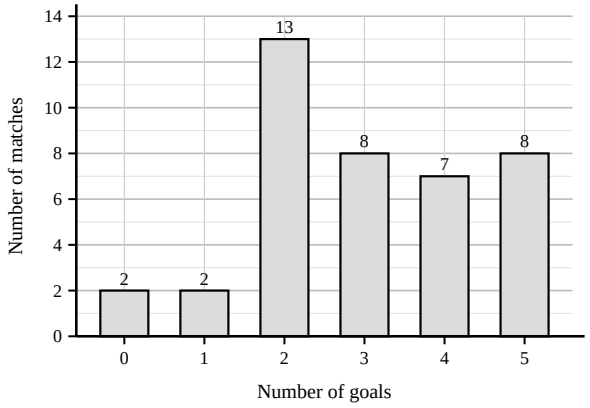
Take A = 35, i = 10, t = (x − 35)/10 [1]

x	**15**	**25**	**35**	**45**	**55**
f	5	11	17	11	6
t	-2	-1	0	1	2
ft	-10	-11	0	11	12

Σf = 50, Σft = −10 − 11 + 0 + 11 + 12 = 2 [2]

Mean = 35 + (2/50) × 10 = **35.4 minutes** [1]

Question 5 [3 + 3 + 4 = 10]



(i)

Heights of the bars give the frequencies: [2]

Goals (x)	**0**	**1**	**2**	**3**	**4**	**5**
Matches (f)	2	2	13	8	7	8

Total = 2 + 2 + 13 + 8 + 7 + 8 = 40 ✓ [1]

(ii)

x	**0**	**1**	**2**	**3**	**4**	**5**
f	2	2	13	8	7	8
fx	0	2	26	24	28	40

$\Sigma fx = 0 + 2 + 26 + 24 + 28 + 40 = 120$ [2]

Mean = 120/40 = **3 goals** [1]

(iii)

(a) Maximum frequency 13 is at x = 2, so mode = **2** [1]

x	**0**	**1**	**2**	**3**	**4**	**5**
c.f.	2	4	17	25	32	40

(b) n = 40: median = ½(20th + 21st term) = ½(3 + 3) = **3** [1]

(c) Q_1 = 10th term = 2; Q_3 = 30th term = 4 [1]

IQR = 4 − 2 = **2** [1]

Question 6 [3 + 3 + 4 = 10]

(i)

$\Sigma f = 3 + 5 + f + 7 + 5 = 20 + f$ [1]

$\Sigma fx = 30 + 100 + 30f + 280 + 250 = 660 + 30f$ [1]

$(660 + 30f)/(20 + f) = 32 \Rightarrow 660 + 30f = 640 + 32f \Rightarrow$ **f = 10** [1]

(ii)

Ascending: 18, 20, 22, 24, 25, 27, 29, 30, 33, 35, 36, 38, 40, 41, 45 (n = 15) [1]

Median = 8th term = **30**; Q_1 = (16/4)th = 4th term = **24** [1]

Q_3 = 3(16)/4 = 12th term = **38**; IQR = 38 − 24 = **14** [1]

(iii)

(a) n = 8, so median = ½(4th + 5th term) = ½(x − 2 + x + 4) [1]

$(2x + 2)/2 = 30 \Rightarrow x + 1 = 30 \Rightarrow$ **x = 29** [1]

Data: 12, 15, 19, 27, 33, 40, 48, 55 [1]

(b) Q_1 = (8/4)th = 2nd term = 15; Q_3 = (3 × 8/4)th = 6th term = 40; IQR = **25** [1]

— End of Solutions —