CLASS XI – MATHEMATICS (041)

CHAPTER 13 : STATISTICS

PRACTICE PAPER – STEP-BY-STEP SOLUTIONS & MARKING SCHEME

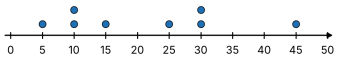
Section A – Answer Key (1 mark each)

Q1	Q2	Q3	Q4	Q5	Q6	Q7
C	D	A	B	C	A	D
Q8	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**
B	A	D	B	C	A	B

SECTION – A (14 × 1 = 14)

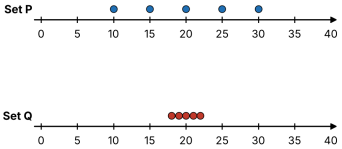
Multiple Choice and Assertion–Reason Questions

Q1. Answer: (C) — 1 mark



Reading the dots: 5, 10, 10, 15, 25, 30, 30, 45. Maximum = 45, minimum = 5.
Range = Maximum – Minimum = 45 – 5 = **40**.

Q2. Answer: (D) — 1 mark



P = {10, 15, 20, 25, 30} and Q = {18, 19, 20, 21, 22}. Both have mean 20.
Range of P = 20 and range of Q = 4. The points of P are more scattered about the mean (variance 50) than those of Q (variance 2).
So P and Q have the same mean but the **standard deviation of P is greater**.

Q3. Answer: (A) — 1 mark

Mean $\bar{x} = 35/5 = 7$. Absolute deviations: 4, 2, 0, 2, 4, with sum 12.
M.D.($\bar{x}$) = 12/5 = **2.4**.

Q4. Answer: (B) — 1 mark

Mean = 30/5 = 6. Deviations: –4, –2, 0, 2, 4, with squares 16, 4, 0, 4, 16 and sum 40.
Variance $\sigma^2 = 40/5 = \mathbf{8}$.

Q5. Answer: (C) — 1 mark

When each observation is multiplied by k, the variance becomes k^2 times the original variance.
New variance = $2^2 \times 6 = \mathbf{24}$.

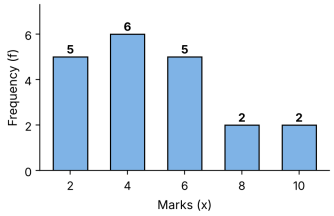
Q6. Answer: (A) — 1 mark

New mean = 2 × 12 + 5 = **29**.
Multiplying by 2 doubles the standard deviation; adding 5 does not change it. New SD = 2 × 3 = **6**.

Q7. Answer: (D) — 1 mark

Variance = $(1/n)\,\Sigma(x_i - \bar{x})^2 = 360/10 = 36$.
Standard deviation = $\sqrt{36} = \mathbf{6}$.

Q8. Answer: (B) **1 mark**



From the bar chart: x = 2, 4, 6, 8, 10 with f = 5, 6, 5, 2, 2. N = 20.
Σfx = 10 + 24 + 30 + 16 + 20 = 100, so mean = 100/20 = **5**.

Q9. Answer: (A) **1 mark**

The data is in order; n = 5, so the median M = 3rd observation = 6.
$|x_i - 6| = 3, 1, 0, 2, 7$, with sum 13. M.D.(M) = 13/5 = **2.6**.

Q10. Answer: (D) **1 mark**

$\sigma^2 = \Sigma x^2/n - (\Sigma x/n)^2 = 700/20 - (100/20)^2 = 35 - 25 =$ **10**.

Q11. Answer: (B) **1 mark**

N = 40, so N/2 = 20. Cumulative frequencies: 5, 14, 30, 40. The median class is 20–30.
l = 20, C = 14, f = 16, h = 10. Median = 20 + [(20 – 14)/16] × 10 = 20 + 3.75 = **23.75**.

Q12. Answer: (C) **1 mark**

If $\sigma^2 = (1/n)\ \Sigma(x_i - \bar{x})^2 = 0$, every squared deviation is zero, so $x_i = \bar{x}$ for all i.
Hence **all the observations are equal**.

Q13. Answer: (A) **1 mark**

Reason: $\Sigma(x_i - \bar{x}) = 0$, so this statement is true.
Assertion: because the deviations add to zero, their mean is always 0 and tells nothing about dispersion; absolute values must be used. **(A) is true** and (R) is its correct explanation.
Correct option: **(A)**.

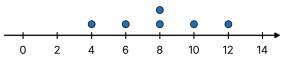
Q14. Answer: (B) **1 mark**

Assertion: adding a constant to each observation shifts the mean by the same amount, so deviations (and hence σ) are unchanged. **(A) is true.**
Reason: multiplying by k multiplies σ by |k|, so **(R) is true**.
But (R) is about multiplication and does not explain why adding a constant leaves σ unchanged. Correct option: **(B)**.

SECTION – B (4 × 2 = 8)

Very Short Answer Questions

Q15. 2 marks



(i) The observations are 4, 6, 8, 8, 10, 12 (n = 6). Mean $\bar{x}$ = 48/6 = **8**. **[1]**

(ii) $|x_i - 8|$ = 4, 2, 0, 0, 2, 4, with sum 12. M.D.($\bar{x}$) = 12/6 = **2**. **[1]**

Q16. 2 marks

Mean $\bar{x}$ = (4 + 7 + 10 + 13 + 16)/5 = 50/5 = **10**. **[½]**

Deviations: –6, –3, 0, 3, 6; squares: 36, 9, 0, 9, 36; sum = 90. **[1]**

Variance = 90/5 = **18**. **[½]**

Q17. 2 marks

(A) In order: 3, 6, 8, 11, 15. Median M = 8. **[½]**

$|x_i - 8|$ = 5, 2, 0, 3, 7, with sum 17. **[1]**

M.D.(M) = 17/5 = **3.4**. **[½]**

OR (B) N = 10, Σfx = 4 + 9 + 10 + 7 = 30, so $\bar{x}$ = 3. $|x - 3|$ = 2, 0, 2, 4, and $\Sigma f|x - \bar{x}|$ = 8 + 0 + 4 + 4 = 16. **[1]**

M.D.($\bar{x}$) = 16/10 = **1.6**. **[1]**

Q18. 2 marks

(A) Mean = 40/8 = 5. Deviations: –3, –1, –1, –1, 0, 0, 2, 4; squares: 9, 1, 1, 1, 0, 0, 4, 16; sum = 32. **[1]**

Variance = 32/8 = **4**; standard deviation = $\sqrt{4}$ = **2**. **[1]**

OR (B) Let the other observations be x and y. Mean 6 ⇒ 3 + 6 + 8 + x + y = 30 ⇒ x + y = 13. **[½]**

Variance 5.2 ⇒ $\Sigma x_i^2 = 5(5.2 + 36) = 206$, so $9 + 36 + 64 + x^2 + y^2 = 206 \Rightarrow x^2 + y^2 = 97$. **[½]**

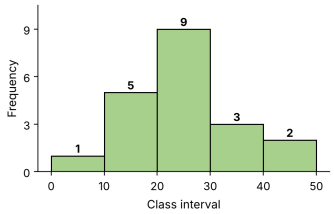
Then $2xy = 13^2 - 97 = 72 \Rightarrow xy = 36$, and $(x - y)^2 = 97 - 72 = 25 \Rightarrow x - y = \pm 5$. **[½]**

Hence the observations are **4 and 9**. **[½]**

SECTION – C (3 × 3 = 9)

Short Answer Questions

Q19. 3 marks



(i) Classes 0–10, …, 40–50 have f = 1, 5, 9, 3, 2 (N = 20), with mid-points 5, 15, 25, 35, 45. **[½]**
Σfx = 5 + 75 + 225 + 105 + 90 = 500, so mean $\bar{x}$ = 500/20 = **25**. **[½]**
(ii) $(x - \bar{x})^2$ = 400, 100, 0, 100, 400, so $f(x - \bar{x})^2$ = 400, 500, 0, 300, 800. Sum = 2000. **[1]**
Variance = 2000/20 = **100**; standard deviation = √100 = **10**. **[1]**

Q20. 3 marks

(A) N = 20, N/2 = 10. Cumulative frequencies: 4, 10, 18, 20. Median class: 10–20 (c.f. = 10 ≥ 10). **[1]**
Median = 10 + [(10 – 4)/6] × 10 = 20. Mid-points 5, 15, 25, 35 give |x – 20| = 15, 5, 5, 15 and f|x – 20| = 60, 30, 40, 30, with sum 160. **[1]**
M.D.(M) = 160/20 = **8**. **[1]**
OR (B) Mid-points 10, 30, 50, 70; N = 20; Σfx = 20 + 150 + 450 + 280 = 900, so $\bar{x}$ = 45. **[1]**
|x – 45| = 35, 15, 5, 25 and f|x – 45| = 70, 75, 45, 100, with sum 290. **[1]**
M.D.($\bar{x}$) = 290/20 = **14.5**. **[1]**

Q21. 3 marks

(A) Incorrect Σx = 20 × 10 = 200, so correct Σx = 200 – 5 + 25 = 220. Correct mean = 220/20 = **11**. **[1]**
Incorrect $\Sigma x^2 = 20(4^2 + 10^2) = 20 \times 116 = 2320$, so correct $\Sigma x^2 = 2320 - 25 + 625 = 2920$. **[1]**
Correct variance = $2920/20 - 11^2 = 146 - 121 = 25$, so the correct standard deviation = **5**. **[1]**
OR (B) Let $y_i = x_i/2 - 3$. Dividing by 2 multiplies the variance by $(1/2)^2$ and subtracting 3 does not change it. **[1]**
New variance = 16/4 = **4**. **[1]**
$\Sigma(y_i - \bar{y})^2 = n \times \text{variance} = 12 \times 4 =$ **48**. **[1]**

SECTION – D **(1 × 5 = 5)**

Long Answer Question

Q22. **5 marks**

Class	f	x	y = (x – 55)/10	fy	y^2	fy^2
20–30	2	25	–3	–6	9	18
30–40	4	35	–2	–8	4	16
40–50	9	45	–1	–9	1	9
50–60	13	55	0	0	0	0
60–70	12	65	1	12	1	12
70–80	9	75	2	18	4	36
80–90	1	85	3	3	9	9
Total	**50**			**10**		**100**

(A) Take A = 55, h = 10 and y = (x – 55)/10. N = 50, $\Sigma fy = 10$, $\Sigma fy^2 = 100$. **[1]**

Mean $\bar{x} = A + (\Sigma fy/N) \times h = 55 + (10/50) \times 10 = 55 + 2 =$ **57**. **[1]**

Variance $\sigma^2 = (h^2/N^2)[N\Sigma fy^2 – (\Sigma fy)^2] = (100/2500)[50 \times 100 – 100] = (1/25) \times 4900 =$ **196**. **[2]**

Standard deviation $\sigma = \sqrt{196} =$ **14**. **[1]**

OR (B) N = 40. Cumulative frequencies: 2, 4, 12, 19, 29, 40. N/2 = 20, so the 20th and 21st observations both lie in the 25 row; median M = 25. **[2]**

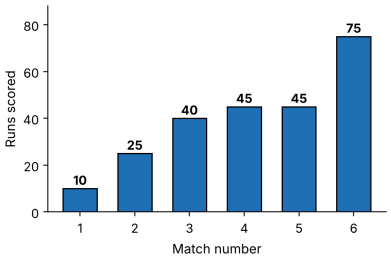
$|x – 25| = 20, 15, 10, 5, 0, 5$ and $f|x – 25| = 40, 30, 80, 35, 0, 55$, with sum 240. **[2]**

M.D.(M) = 240/40 = **6**. **[1]**

SECTION – E (1 × 4 = 4)

Case Study Based Question

Q23. **4 marks**



(i) Runs: 10, 25, 40, 45, 45, 75. Range = 75 – 10 = **65**. **[1]**

(ii) Mean = (10 + 25 + 40 + 45 + 45 + 75)/6 = 240/6 = **40**. **[1]**

(iii)(a) Deviations from the mean 40: –30, –15, 0, 5, 5, 35. Squares: 900, 225, 0, 25, 25, 1225, with sum 2400. **[1]**

Variance = 2400/6 = **400**; standard deviation = √400 = **20**. **[1]**

OR (b) Absolute deviations from the mean: 30, 15, 0, 5, 5, 35, with sum 90. **[1]**

M.D.($\bar{x}$) = 90/6 = **15**. **[1]**

— End of Solutions —