JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- MATHEMATICS
CLASS :- 11th
CHAPTER :- STATISTICES

PAPER CODE :- CWT-12

ANSWER KEY

1.	(D)	**2.**	(A)	**3.**	(A)	**4.**	(C)	**5.**	(C)	**6.**	(A)	**7.**	(A)
8.	(D)	**9.**	(C)	**10.**	(B)	**11.**	(B)	**12.**	(B)	**13.**	(B)	**14.**	(A)
15.	(C)	**16.**	(D)	**17.**	(A)	**18.**	(A)	**19.**	(C)	**20.**	(C)	**21.**	50
22.	21	**23.**	22	**24.**	2	**25.**	31	**26.**	24	**27.**	4	**28.**	1
29.	7	**30.**	12										

SOLUTIONS

1. (D)

Sol. $\frac{w_1 + w_2 + ... + w_9}{9} = x$ ...(1)

$\frac{(w_1 + w_2 + ... + w_9) + w_{10}}{10} = x + \frac{1}{20}x$ ....(2)

From equation (1) &(2)

$w_{10} = \frac{3}{2}x$

Now $\frac{(w_1 + w_2 + ... + w_9) + w_{10} + w_{11}}{11} = x$ ....(3)

From equation (1), (2) and (3)

$w_{11} = \frac{x}{2}$

2. (A)

Sol. Mean = $\frac{\sum_{i=1}^{n} A + iB}{n} = \frac{A.n + B\frac{(n(n+1))}{2}}{n}$

Mean = $A + B\frac{(n+1)}{2}$

3. (A)

Sol. $\alpha - \frac{7}{2}, \alpha - 3, \alpha - \frac{5}{2}, \alpha - 2, \alpha - \frac{1}{2}, \alpha + \frac{1}{2}, \alpha + 4, \alpha + 5\ (\alpha > 0)$

median = $\frac{\alpha - 2 + \alpha - \frac{1}{2}}{2} = \alpha - \frac{5}{4}$

4. (C)

Sol. Geometric mean

$\frac{M(x_1, x_2, x_3.....x_n)}{M(y_1, y_2, y_3.....y_n)} = \frac{(x_1.x_2.x_3......x_n)^{1/n}}{(y_1.y_2.y_3......y_n)^{1/n}}$

$= \left(\frac{x_1}{y_1}.\frac{x_2}{y_2}.....\frac{x_n}{y_n}\right)^{\frac{1}{n}} = M\left(\frac{x_1}{y_1}, \frac{x_2}{y_2}, \frac{x_3}{y_3}, ..., \frac{x_n}{y_n}\right)$

$\Rightarrow$ While in case of 1 & 2 it is not true always

5. (C)

Sol. Mean of variate 1.2.3, 2.3.4, 3.4.5, ..., n.(n + 1).(n + 2)

For sum of series

$T_r = \frac{r(r+1)(r+2)}{4}[(r + 3) - (r - 1)]$

$\Rightarrow S = \sum_{r=1}^{n} T_r = \frac{n(n+1)(n+2)(n+3)}{4}$

Mean = $\frac{s}{n} = \frac{(n+1)(n+2)(n+3)}{4}$

6. (A)

Sol. Coefficient of range

$= \frac{\text{difference of extreme values}}{\text{sum of extreme values}} = \frac{10-2}{10+2} = \frac{2}{3}$

7. (A)

Sol. 34, 38, 42, 44, 46, 48, 54, 55, 63, 70

median = $\frac{46+48}{2} = 47$

$\sum |x_i - M| = 13 + 9 + 5 + 3 + 1 + 1 + 7 + 8 + 16 + 23 = 86$

so mean diviation about median = $\frac{86}{10} = 8.6$

8. (D)

Sol. $\bar{x} = \frac{1}{2n+1}[a + (a + d) + ... + (a + 2nd)]$

$= \frac{1}{2n+1}[(2n + 1)a + d(1 + 2 + ... + 2n)]$

$= a + d\,\frac{2n}{2}\,\frac{(1+2n)}{2n+1} = a + nd$

M.D. from mean = $\frac{1}{2n+1}2|d|(1 + 2 + ... + n)$

$= \frac{n(n+1)|d|}{(2n+1)}$

9. (C)

Sol. Coefficient of variation = 0.58 = $\frac{\sigma}{\bar{x}}$

σ(S.D.) = .58 × 4 = 2.32

10. (B)

Sol. $\sum_{i=1}^{10}(x_i - 50)^2 = 250$

$\sigma = \sqrt{\frac{\sum_{i=1}^{10}(x_i-50)^2}{10}} = 5$

coeff. of variation = $\frac{\sigma}{\bar{x}} \times 100 = 10\%$

11. (B)

Sol. 28, 29, 30, 31, 32

Mean = 30

$\Rightarrow$ variance = σ^2

$= \frac{(30-28)^2 + (30-29)^2 + (30-30)^2 + (30-31)^2 + (30-32)^2}{5}$

$\sigma^2 = 2 \quad \Rightarrow \quad$ S.D. = $+\sqrt{\sigma^2} = \sqrt{2}$

12. (B)

Sol. $\frac{{}^{2n+1}C_0 + \ldots\ldots {}^{2n+1}C_n}{n+1} = \frac{2^{2n}}{n+1}$

13. (B)

Sol. $\bar{x} = \frac{0.{}^nC_0 + 1.{}^nC_1 + 2{}^nC_2 + \ldots\ldots + n{}^nC_n}{{}^nC_0 + {}^nC_1 + {}^nC_2 + \ldots\ldots + {}^nC_n}$

$= \frac{n.2^{n-1}}{2^n} = \frac{n}{2}$

14. (A)

Sol.

x_i	f_i	$f_i x_i$	$f_i x_i^2$
0	1	0	0
1	9	9	9
2	7	14	28
3	5	15	45
4	3	12	48
	$\sum f_i = 25$	$\sum f_i x_i = 50$	$\sum f_i x_i^2 = 130$

$\sigma^2 = \left[\frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i}\right)^2\right]$

$= \left[\frac{130}{25} - \left(\frac{50}{25}\right)^2\right] = 1.2$

so variance of A = 1.2 < 1.25 = variance of B

so more consistent team = A

15. (C)

Sol. $\frac{\Sigma x_i}{200} = 25, \quad \frac{\Sigma y_i}{300} = 10$

$\Rightarrow \quad \Sigma x_i = 5000, \quad \Sigma y_i = 3000$

$\sigma_x = 3$ and $\sigma_y = 4$

$\Rightarrow \quad \frac{\Sigma x_i^2}{200} - (25)^2 = 9$ and $\frac{\Sigma y_i^2}{300} - (10)^2 = 16$

$\Rightarrow \quad \Sigma x_i^2 = 126800$ and $\Sigma y_i^2 = 34800$

$\therefore \quad \sigma = \frac{\Sigma z_i^2}{n} - \left(\frac{\Sigma z_i}{n}\right)^2$

$= \frac{\Sigma(x_i^2 + y_i^2)}{500} - \left(\frac{\Sigma x_i + \Sigma y_i}{500}\right)^2$

$= \frac{161600}{500} - \left(\frac{8000}{500}\right)^2 = 67.2$

16. (D)

Sol. $(\bar{x}) = 60, \quad (\bar{y}) = 40$

$(\sigma_x^2) = 16, \quad (\sigma_y^2) = 36$

$\sigma_x^2 = \frac{\Sigma x_1^2}{10} - (\bar{x})^2, \quad \sigma_y^2 = \frac{\Sigma y^2}{10} - (\bar{y})^2$

$\Sigma x_1^2 = 160 + (60)^2 - 10 \quad \Sigma y_1^2 = 360 + (40)^2.10$

$\sigma^2(\text{overall}) = \frac{\Sigma x_1^2 + \Sigma y_1^2}{20} - \left(\frac{10\bar{x} + 10\bar{y}}{20}\right)^2$

$= \frac{520 + 52000}{20} - (50)^2$

$\sigma^2 = 2626 - 2500 = 126$

S.D. = $+\sqrt{\sigma^2} = 11.2$

17. (A)

Sol. Let x_n misread value $(x_n) = 10$ $(x_n)_{actual} = 12$

$\sigma^2 = 3.3 \quad \bar{x} = 11.3$

$\Rightarrow \sum_{i=1}^{n-1} x_i = 113 - 10 = 103 = 10.(\bar{x}) - 10$

$\sigma^2 = \frac{\sum_{i=1}^{n-1} x_i^2 + x_n^2}{10} - (\bar{x})^2$

$\sum_{i=1}^{n-1} x_i^2 = -67 + 10(\bar{x})^2 \quad \ldots(1)$

$\Rightarrow (\sigma^2)_{actual} = \frac{\sum_{i=1}^{n} x_1^2 + (x_n)^2_{actual}}{10} - (\bar{x})_{actual}$

$= \frac{-67 + 10(\bar{x})^2 + 144}{10} - \left(\frac{10(\bar{x}) - 10 + 12}{10}\right)$

$= (\sigma^2_{actual}) = 3.14$

18. (A)

Sol. $x_1, x_2, x_3, \ldots\ldots x_{2n}, x_{2n+1} \ldots\ldots x_{4n}$

mean $\bar{x} = \dfrac{x_1 + x_2 + \ldots\ldots + x_{4n}}{4n}$

median = $\dfrac{x_{2n} + x_{2n+1}}{2}$, which lies between x_{2n} and x_{2n+1}

$\Rightarrow$ observations below median are $x_1, x_2, \ldots\ldots x_{2n}$

observations above median are $x_{2n+1}, \ldots\ldots x_{4n}$

New mean

= $\dfrac{(x_1+12)+(x_2+12)+\ldots+(x_{2n}+12)+(x_{2n+1}-4)+\ldots+(x_{4n}-4)}{4n}$

= $\dfrac{x_1 + x_2 + \ldots\ldots + x_{4n} + 16n}{4n}$ = $\bar{x}$ + 4.]

19. (C)

Sol. Let they number are a and b, then

$\dfrac{1+2+6+a+b}{5} = 4$

9 + a + b = 20

$\Rightarrow$ a + b = 11 ......(i)

variance, $\sigma^2 = \dfrac{\sum X^2}{N} - \bar{X}^2$

$(5.2) = \dfrac{1+4+36+a^2+b^2}{5} - 16$

$= \dfrac{41+a^2+b^2-80}{5}$

$a^2 + b^2 - 39 = 26$

$a^2 + b^2 = 65$ ......(ii)

Equation (i) and (ii),

a = 4, b = 7 **Ans.**]

20. (C)

Sol. Let the numbers x and y

$\dfrac{1+2+6+x+y}{5} = 4 \Rightarrow x + y = 11$ .... (1)

Variance = 5.2

$\dfrac{1^2+2^2+6^2+x^2+y^2}{5} - (\text{mean})^2 = 5.2$

$41 + x^2 + y^2 - 80 = 26$

$x^2 + y^2 = 65$ .... (2)

Solve (1) and (2) negative

x = 4, 7

y = 7, 4

21. **50**

Sol. Mean of 21 observation $\bar{x}$ = 40, so

Sum of numbers = 21 × 40 = 840

$\Rightarrow$ As numbers greater then median increased by 21, so 10 observations will increase by 21.

Now sum of all observations = 840 + 10×(21) = 1050

$\Rightarrow$ So now new mean is = $\dfrac{1050}{21}$ = 50

22. **21**

Sol. Mean – Mode = 63

As mode = 3 median – 2 mean

$\Rightarrow$ mean – 63 = 3 median – 2 mean

$\Rightarrow$ mean – median = 21

23. **22**

Sol. n = 88

Median = $\dfrac{44^{th}\text{value} + 45^{th}\text{value}}{2} = \dfrac{56+57}{2}$ = 56.5

M.D.(median)

$= \dfrac{\sum_{i=1}^{88} |x_i - 56.5|}{88} = \dfrac{43.5+42.5+\ldots+0.5+0.5+\ldots+43.5}{88}$

$= \dfrac{1+3+5+\ldots+85+87}{88} = 22$

24. **2**

Sol. Mean = $\dfrac{-1+0+4}{3} = 1$

Hence M.D. (about mean)

$\dfrac{|-1-1|+|0-1|+|4-1|}{3} = 2$

25. **31**

Sol. $\sum_{i=1}^{20}(x_i - 30) = 20 \Rightarrow \sum_{i=1}^{20} x_i - 20 \times 30 = 20$

$\sum_{i=1}^{20} x_i = 600 + 20 = 620$

Mean = $\dfrac{620}{20} = 31$ Ans.

26. **24**

Sol. Let two observations are x and y

then $\frac{x+y+2+4+10+12+14}{7} = 8$

$x + y + 42 = 56 \Rightarrow x + y = 14$ ...(A)

and $\frac{x^2+y^2+4+16+100+144+196}{7}$

$- \frac{(x+y+42)^2}{49} = 16$

$\Rightarrow \frac{x^2+y^2+460}{7} = 16 + 64 = 80$

$\Rightarrow x^2 + y^2 = 560 - 460 = 100$ ...(B)

$\therefore$ on solving (A) & (B) we get x = 6, y = 8

27. **4**

Sol. $\sigma_x = 3 \Rightarrow \frac{\sum x_i^2}{100} - (\bar{x})^2 = 9$

$\Rightarrow \sum x_i^2 = 23400$

$\sum z_i = 250 \times 15.6 = 3900$

$\therefore \Sigma y_i = \Sigma z_i - \Sigma x_i = 3900 - 1500 = 2400$

$\sigma_z^2 = 13.44 \Rightarrow \frac{\sum x_i^2 + \sum y_i^2}{250}$

$-(15.6)^2 = 13.44 \Rightarrow \sum y_i^2$

$= 40800 \Rightarrow \sigma_y$

$= \sqrt{\frac{\sum y_i^2}{150} - \left(\frac{\sum y_i}{150}\right)^2} = \sqrt{\frac{40800}{150} - \left(\frac{2400}{150}\right)^2}$

$= 4$

28. **1**

Sol. Mean $(\bar{x}) = 4$, variance = 5.2

$a_1, a_2, a_3 = 1, 2, 3.$

Let x_1, x_2 are remaining values

Mean $\bar{x} = \frac{a_1+a_2+a_3+x_1+x_2}{5}$

$\Rightarrow x_1 + x_2 = 11$ ....(1)

variance $\sigma^2 = 5.2 = \frac{a_1^2+a_2^2+a_3^2+x_1^2+x_2^2}{5}$

$-(\bar{x})^2 \Rightarrow x_1^2 + x_2^2 = 65$ ....(2)

$\Rightarrow |x_1 - x_2| = 3$

$\Rightarrow$ So $\lambda = 11$ $\Rightarrow 10 - x^2 - 2x = \lambda$

$\Rightarrow (x + 1)^2 = 0$ one solution

29. **7**

Sol. $\sum x_i = 14$

$\sum x_i^2 = \left(\sum x_i\right)^2 - 2\sum x_1 x_2$

$= 196 - 2 \cdot 70 = 56$

$\sigma^2 = \frac{1}{n}\left(\sum_{i=1}^{n} x_i^2\right) - \frac{1}{n^2}\left(\sum_{i=1}^{n} x_i\right)^2$

$\Rightarrow 4n^2 - 56n + (14)^2 = 0$

$\Rightarrow 4(n - 7)^2 = 0$

$\Rightarrow n = 7$ **Ans.**]

30. **12**

Sol. $\sigma^2 = \frac{\Sigma x^2}{n} - (\bar{x})^2$

$\sigma^2 = \frac{1560}{10} - (\sqrt{12})^2 = 144 \Rightarrow$ S.D.$= \sqrt{\sigma^2}$

$= 12$