ANSWER KEYS

1. (2)	**2.** (4)	**3.** (9)	**4.** (1)	**5.** (1)	**6.** (3)	**7.** (4)	**8.** (4)
9. (1)	**10.** (1)						

1. (2)

Mean is the ratio of sum of all the observations to total number of observations.

Here, mean, $\bar{x}=\frac{6+8+12+15+10+9}{6}=10$

The arithmetic average of the deviations (all taking positive) from the mean, median or mode is known as mean deviation.

$\therefore$ Mean deviation from mean $=\frac{\Sigma\left|x_i-\bar{x}\right|}{n}$

$=\frac{[|6-10|+|8-10|+|12-10|+|15-10|+|10-10|+|9-10|]}{6}$

$=\frac{4+2+2+5+0+1}{6}=\frac{14}{6}=2.33$

2. (4) We have, $\sum_{i=1}^{n}\left(x_i+1\right)^2=11n\ldots\ldots$(i)

and $\sum_{i=1}^{n}\left(x_i-1\right)^2=7n\ldots$(ii)

Adding (i) and (ii) , we get

$2\sum_{i=1}^{n}\left(x_i^2+1\right)=18n$

$\Rightarrow \sum_{i=1}^{n}\left(x_i^2+1\right)=9n$

$\Rightarrow \sum_{i=1}^{n}x_i^2+n=9n$

$\Rightarrow \sum_{i=1}^{n}x_i^2=8n$

$\Rightarrow \frac{\sum_{i=1}^{n}x_i^2}{n}=8$

Subtracting (i) and (ii), we get

$4\sum_{i=1}^{n}x_i=4n \Rightarrow \sum_{i=1}^{n}x_i=n$

$\Rightarrow \frac{\sum_{i=1}^{n}x_i}{n}=1$

Now, variance $=\frac{1}{n}\left[\sum_{i=1}^{n}x_i^2\right]-\left[\frac{\sum_{i=1}^{n}x_i}{n}\right]^2=8-1=7$

3. (9)

We have,

$n_1=20,\ \bar{x}_1=50,\ \sigma_1^2=1$

$n_1=40,\ \bar{x}_1=50,\ \sigma_2^2=4$

Then,

$\bar{x}=\frac{n_1\bar{x}_1+n_2\bar{x}_2}{n_1+n_2}$

$\Rightarrow \bar{x}=\frac{20\times50+40\times50}{20+40}=50$

Then,

$d_1=\bar{x}-\bar{x}_1=0$

$d_1=\bar{x}-\bar{x}_2=0$

Then,

$\sigma^2=\frac{n_1\left(\sigma_1^2+d_1^2\right)+n_2\left(\sigma_2^2+d_2^2\right)}{n_1+n_2}$

$\Rightarrow \sigma^2=\frac{20\times1+40\times2^2}{60}=3$

4. (1)

Given, $\sigma=9$

Let a student obtains x out of 75.

Then his marks out of 100 are $\frac{4x}{3}$.

$\Rightarrow$ Each observation is multiplied by $\frac{4}{3}$

$\Rightarrow$ New $\sigma=\frac{4}{3}\times9=12$,

$\Rightarrow$ New Variance $=\sigma^2=144$

5. (1)

Series $A=101,\ 102,\ 103,\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots,\ 200$

Series $B=151,\ 152,\ 153,\ \ldots\ldots\ldots\ldots,\ 250$

Series B is obtained by adding a fixed quantity to each item of series A, we know that variance is independent of change of origin both series have the same variance so ratio of their variances is 1.

6. **(3)**

Observations are 2021, so median is $\left(\frac{2021+1}{2}\right)^{th}$ observation, i.e. $(1011)^{th}$.

Now increasing the value of largest 40 observations won't affect the median.
Hence, the median of the data would remain same as 20. 19

7. **(4)** We have $n=20$, $\bar{x}_{old}=10$, $Var_{old}=4$

$\Rightarrow \bar{x}=\frac{\Sigma x_i}{20} \Rightarrow \Sigma x_i=200$

$\Rightarrow (\Sigma x_i)_{new}=192, \bar{X}_{new}=\frac{192}{9}$

$Var_{(old)}=\frac{\Sigma x_i^2}{20}-(\bar{x}_{old})^2$

$4=\frac{\Sigma x_i^2}{20}-100$

$\Sigma x_{i\,(old)}^2=2080$

$\Sigma x_{i\,new}^2=2080-64=2016$

$Var_{(new)}=\frac{2016}{19}-\left(\frac{192}{19}\right)^2=\frac{1440}{361}$

8. **(4)**

For a, b, c

mean $=\frac{a+b+c}{3}(=\bar{x})$

$b=a+c$

$\Rightarrow \bar{x}=\frac{2b}{3} \quad \ldots(1)$

$\mathrm{S.D.}(a+2, b+2, c+2)=\mathrm{S.D.}(a, b, c)=d$

$\Rightarrow d^2=\frac{a^2+b^2+c^2}{3}-(\bar{x})^2$

$\Rightarrow d^2=\frac{a^2+b^2+c^2}{3}-\frac{4b^2}{9}$

$\Rightarrow 9d^2=3(a^2+b^2+c^2)-4b^2$

$\Rightarrow b^2=3(a^2+c^2)-9d^2$

9. **(1)**

Let observations are denoted by xi for $1 \leq i<2n$

$\bar{x}=\frac{\sum x_i}{2n}=\frac{(a+a+\ldots+a)-(a+a+\ldots+a)}{2n}$

$\Rightarrow \bar{x}=0$

and $\sigma_x^2=\frac{\sum x_i^2}{2n}-(\bar{x})^2=\frac{a^2+a^2+\ldots+a^2}{2n}-0=a^2$

$\Rightarrow \sigma_{\mathrm{x}}=\mathrm{a}$

Now, adding a constant b then $\bar{y}=\bar{x}+b=5$

$\Rightarrow b=5$

and $\sigma_y=\sigma_x$ (No change in S.D.) $\Rightarrow a=20$

$\Rightarrow a^2+b^2=425$

10. **(1)** $\bar{x}=A+\frac{\sum fd}{n}=4-\frac{11}{100}=3.87$

And $\sigma=\sqrt{\frac{\sum d^2}{n}-\left(\frac{\sum d}{n}\right)^2}=\sqrt{\frac{257}{100}-\left(-\frac{11}{100}\right)^2}=1.6$

Coefficient of variation

$=\frac{\sigma}{\bar{x}} \times 100=\frac{1.6}{3.89} \times 100=41.13\%$