Solution 1: **Exercise 19(C)**

Mean of the given data $= \frac{8 + 12 + 16 + 22 + 10 + 4}{6}$

$= \frac{72}{6} = 12$

(i) Multiplied by 3

If $\bar{x}$ is the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$, then mean of $ax_1, ax_2, ax_3, \ldots, ax_n$ is $a\bar{x}$.

Thus, when each of the given data is multiplied by 3, the mean is also multiplied by 3.

Mean of the original data is 12.

Hence, the new mean = 12 x 3 = 36.

(ii) Divided by 2

If $\bar{x}$ is the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$, then mean of $\frac{x_1}{a}, \frac{x_2}{a}, \frac{x_3}{a}, \ldots, \frac{x_n}{a}$ is $\frac{\bar{x}}{a}$.

Thus, when each of the given data is divided by 2, the mean is also divided by 3.

Mean of the original data is 12.

Hence, the new mean $= \frac{12}{2} = 6$.

(iii) multiplied by 3 and then divided by 2

If $\bar{x}$ is the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$,

then mean of $\frac{a}{b}x_1$, $\frac{a}{b}x_2$, $\frac{a}{b}x_3$, ..., $\frac{a}{b}x_n$ is $\frac{a}{b}\bar{x}$.

Thus, when each of the given data is multiplied by $\frac{3}{2}$,

the mean is also multiplied by $\frac{3}{2}$.

Mean of the original data is 12.

Hence, the new mean = $\frac{3}{2} \times 12 = \frac{36}{2} = 18$

(iv) increased by 25%

New mean = Original mean + 25% of original mean

$\Rightarrow$ New mean = 12 + 25% of 12

$\Rightarrow$ New mean = $12 + \frac{25}{100} \times 12$

$\Rightarrow$ New mean = $12 + \frac{1}{4} \times 12$

$\Rightarrow$ New mean = 12 + 3

$\Rightarrow$ New mean = 15

(v) decreased by 40%

New mean = Original mean − 40% of original mean

$\Rightarrow$ New mean = 12 − 40% of 12

$\Rightarrow$ New mean = $12 - \frac{40}{100} \times 12$

$\Rightarrow$ New mean = $12 - \frac{2}{5} \times 12$

$\Rightarrow$ New mean = 12 − 0.4 × 12

$\Rightarrow$ New mean = 12 − 4.8

$\Rightarrow$ New mean = 7.2

Solution 2:

$$\text{Mean of given data} = \frac{18 + 24 + 15 + 2x + 1 + 12}{5}$$

$$\Rightarrow \quad 21 = \frac{70 + 2x}{5}$$

$$\Rightarrow \quad 5 \times 21 = 70 + 2x$$

$$\Rightarrow \quad 105 = 70 + 2x$$

$$\Rightarrow \quad 2x = 105 - 70$$

$$\Rightarrow \quad 2x = 35$$

$$\Rightarrow \quad x = \frac{35}{2}$$

$$\Rightarrow \quad x = 17.5$$

Solution 3:

Let $\bar{x}$ be the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$

$$\text{Mean of given data} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Given that mean of 6 numbers is 42.

That is,

$$\frac{x_1 + x_2 + x_3 + \ldots + x_6}{6} = 42$$

$$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_6 = 6 \times 42$$

$$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 = 252 - x_6 \ldots (1)$$

Also, given that the mean of 5 numbers is 45.

That is,

$$\frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} = 45$$

$$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 = 5 \times 45$$

$$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 = 225 \ldots (2)$$

From equations (1) and (2), we have,

$$x_1 + x_2 + x_3 + x_4 + x_5 = 252 - x_6 = x_1 + x_2 + x_3 + x_4 + x_5 = 225$$

$$252 - x_6 = 225$$

$$\Rightarrow x_6 = 252 - 225 = 27$$

Solution 4:

Let $\bar{x}$ be the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$

Mean of given data $= \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$

Given that mean of 10 numbers is 24.

That is,

$\frac{x_1 + x_2 + x_3 + \ldots + x_{10}}{10} = 24$

$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_{10} = 10 \times 24$

$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_{10} = 240$

$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_{10} + x_{11} = 240 + x_{11} \ldots (1)$

Also, given that mean of 11 numbers is 25.

That is,

$\frac{x_1 + x_2 + x_3 + \ldots + x_{10} + x_{11}}{11} = 25$

$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_{10} + x_{11} = 11 \times 25$

$\Rightarrow x_1 + x_2 + x_3 + \ldots + x_{10} + x_{11} = 275 \ldots (2)$

From equations (1) and (2), we have:

$x_1 + x_2 + x_3 + \ldots + x_{10} + x_{11} = 240 + x_{11} = 275$

$240 + x_{11} = 275$

$\Rightarrow x_{11} = 275 - 240 = 35$

Solution 5:

Consider the given data:

44, 47, 63, 65, x+13, 87, 93, 99, 110

Here the number of observations is 9, which is odd.

Thus, the median of the given data is $\left(\frac{n+1}{2}\right)^{th}$ observation.

From the given data, $\left(\frac{9+1}{2} = 5\right)^{th}$ observation is x + 13

Also, given that the median is 78.

Thus, we have

$x + 13 = 78$

$\Rightarrow x = 78 - 13$

$\Rightarrow x = 65$

Solution 6:

Consider the given data:

24, 27, 43, 48, $x-1$, $x+3$, 68, 73, 80, 90.

Here the number of observations is 10, which is even.

Thus, the median of given data is $\frac{1}{2}\left[\left(\frac{n}{2}\right)^{th}\text{ term} + \left(\frac{n}{2}+1\right)^{th}\text{ term}\right]$.

From the given data, $\left(\frac{10}{2}=5\right)^{th}$ observation is $x-1$

and $\left(\frac{10}{2}+1=6\right)^{th}$ observation is $x+3$.

Also, given that the median is 58.

Thus, we have

$\frac{1}{2}[x-1+x+3] = 116$

$\Rightarrow 2x+2 = 116$

$\Rightarrow 2x = 116-2$

$\Rightarrow 2x = 114$

$\Rightarrow x = \frac{114}{2}$

$\Rightarrow x = 57$

Solution 7:

Let $\bar{x}$ be the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Therefore,

$$\text{Mean of given data} = \frac{30 + 32 + 24 + 34 + 26 + 28 + 30 + 35 + 33 + 25}{10}$$

$$= \frac{297}{10}$$

$$= 29.7$$

(i)

Let us tabulate the observations and their deviations from the mean

Observations x_i	Devaiations $x_i - \bar{x}$
30	0.3
32	2.3
24	-5.7
34	4.3
26	-3.7
28	-1.7
30	0.3
35	5.3
33	3.3
25	-4.7
Total	0

From the table, it is clear that the sum of the deviations from

(ii)

Consider the given data:

30, 32, 24, 34, 26, 28, 30, 35, 33, 25

Let us rewrite the above data in ascending order.

24, 25, 26, 28, 30, 30, 32, 33, 34, 35

There are 10 observations, which is even.

$$\text{Therefore, median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th}\text{term} + \left(\frac{n}{2}+1\right)^{th}\text{term}\right]$$

$$= \frac{1}{2}\left[\left(\frac{10}{2}\right)^{th}\text{term} + \left(\frac{10}{2}+1\right)^{th}\text{term}\right]$$

$$= \frac{1}{2}\left[(5)^{th}\text{term} + (5+1)^{th}\text{term}\right]$$

$$= \frac{1}{2}\left[5^{th}\text{term} + 6^{th}\text{term}\right]$$

$$= \frac{1}{2}[30 + 30]$$

$$= \frac{1}{2}[60]$$

$$= 30$$

Solution 8:

Let $\bar{x}$ be the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Therefore,

$$\text{Mean of given data} = \frac{35 + 48 + 92 + 76 + 64 + 52 + 51 + 63 + 71}{9}$$

$$= \frac{552}{9}$$

$$= 61.33$$

Let us rewrite the given data in ascending order:

Thus, we have

35, 48, 51, 52, 63, 64, 71, 76, 92

There are 9 observations, which is odd.

$$\text{Therefore, median} = \left(\frac{n+1}{2}\right)^{th} \text{observation}$$

$$\Rightarrow \text{Median} = \left(\frac{9+1}{2}\right)^{th} \text{observation}$$

$$\Rightarrow \text{Median} = \left(\frac{10}{2}\right)^{th} \text{observation}$$

$$\Rightarrow \text{Median} = 5^{th} \text{observation}$$

$$\Rightarrow \text{Median} = 63$$

If 51 is replaced by 66, the new set of data in ascending order is:

35, 48, 52, 63, 64, 66, 71, 76, 92

Since median = 5^{th}observation,

We have, new median = 64

Solution 9:

Let $\bar{x}$ be the mean of n number of observations $x_1, x_2, x_3, \ldots, x_n$

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

Therefore,

$$\text{Mean of given data} = \frac{x + x + 2 + x + 4 + x + 6 + x + 8}{5}$$

$$= \frac{5x + 20}{5}$$

$$= x + 4$$

Also, it's given that mean of the given data is 11.

$\Rightarrow x + 4 = 11$

$\Rightarrow x = 7$

$$\text{Hence the mean of the first three observations} = \frac{x + x + 2 + x + 4}{3}$$

$$= \frac{3x + 6}{3}$$

$$= x + 2$$

$$= 7 + 2$$

$$= 9$$

Solution 10:

Let us find the factors of 72:

$72 = 1 \times 72$

$= 2 \times 36$

$= 3 \times 24$

$= 4 \times 18$

$= 6 \times 12$

$= 8 \times 9$

$= 9 \times 8$

$= 12 \times 6$

$= 18 \times 4$

$= 24 \times 3$

$= 36 \times 2$

$= 72 \times 1$

Therefore, the data set is:

1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

Mean of the above data set $= \frac{1+2+3+4+6+8+9+12+18+24+36+72}{12}$

$= \frac{195}{12}$

$= 16.25$

Since the number of observations is 12, which is even, median is given by

$$\text{Median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{term} + \left(\frac{n}{2}+1\right)^{th} \text{term}\right]$$

$$= \frac{1}{2}\left[\left(\frac{12}{2}\right)^{th} \text{term} + \left(\frac{12}{2}+1\right)^{th} \text{term}\right]$$

$$= \frac{1}{2}\left[6^{th}\text{term} + 7^{th}\text{term}\right]$$

$$= \frac{1}{2}[8+9]$$

$$= \frac{1}{2} \times 17$$

$$= 8.5$$