CHANAKYA 2.0

For CA Foundation

Central Tendency

QUANTITATIVE APTITUDE

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TOPICS TO BE COVERED

01 Mean Median Mode

02 Geometric Mean

03 Harmonic Mean

04 PYQ'S

Central Tendency

⇓

A central value (Number) which represent all the observations of a series (Population or sample)

⇓

central tendency provides accurate description of all data.

- → Mean → G.M.
- → mode → H.M.
- → median

2000 families

4	3	6	6	6
5	6	7	6	5
6	4	6	2	4
7	5	2	3	6
6	4	6	8	

Characteristic Of An Ideal Central Tendency

→ Easy calculation.

→ Easy to understand

→ Should be Based on all observation.

→ It should be properly defined.

→ mathematical properties.

→ Least affected by extreme values.

Arithmetic Mean

Mean (Average)

Denoted by $\bar{X}$ or μ

$\bar{X}$ for sample

μ for Population

$$A.M(\bar{X}) = \frac{\text{Sum of all observation}}{\text{Total no. of observation}}$$

$$\bar{X} = \frac{\sum x_i}{N}$$

Eg marks: 6, 2, 8, 9, 7

mean marks $(\bar{x})$

$$= \frac{6+2+8+9+7}{5}$$

$$= \frac{32}{5} = 6.4$$

Marks (x_i)
$x_1 = 6$
$x_2 = 2$
$x_3 = 8$
$x_4 = 9$
$x_5 = 7$
$\sum x_i = 32$

Data

Ungrouped Data

Individual Series

x_i
✓
✓
✓
✓
✓

Descrete Series

x_i	f_i
—	—
—	—
—	—
—	—

Grouped Data

$\Downarrow$

Continous series.

$\Downarrow$

Class interval	f_i
0 - 2	6
2 - 4	8
4 - 6	10
6 - 8	12

Eg marks: 2, 3, 4, 2, 5, 1, 2, 3, 2, 4
5, 1, 2, 5, 4, 3, 1, 2, 1, 2

x_i
1
1
1
1
2
2
2
2
2
2
2
3
3
3
4
4
4
5
5
5

Individual series
⇓
Proxy observations
name is written

Marks (x_i)	No. of Students (f_i)
1	4
2	7
3	3
4	3
5	3
	$\Sigma f_i = N = 20$

Descrete series.

weight : 62.1, 32.6

Continous series

Weight (C.I.)	No. of Students (f_i)	x_i (midvalue)
30 - 35	5	32.5
35 - 40	7	37.5
40 - 45	8	42.5
45 - 50	2	47.5
50 - 55	3	52.5
	$N = \Sigma f_i = 25$	

$\frac{30+35}{2} = \frac{65}{2} = 32.5$

Arithmetic mean ($\bar{x}$) => methods

Direct method

$$\bar{x} = \frac{\sum f_i x_i}{N}$$

or

$$\bar{x} = \frac{\sum x_i}{N}$$

Shortcut method

Assume mean

$$d_i = x_i - A$$

$$\bar{x} = A + \frac{\sum f_i d_i}{N}$$

Step Deviation

$$u_i = \frac{x_i - A}{h}$$

$$\bar{x} = A + \left[\frac{\sum f_i u_i}{N}\right] \times h$$

The following table gives the monthly income of 10 families in a city:

Income: (x_i)	7800	7600	6900	7500	8400	9200	11000	8100	10500	9500

find mean income

A. 8650

B. 8600

C. 8750

D. 8250

$$\bar{X} = \frac{\Sigma x_i}{N}$$

$$= \frac{8650\cancel{0}}{1\cancel{0}}$$

$$= 8650$$

Individual series

Calculate the arithmetic mean from the following data:

X:	10	15	20	25	30
F:	2	5	4	9	5

Descrete

A. 20

B. 22

C. 25

D. 26

x_i	f_i	$f_i x_i$
10	2	20
15	5	75
20	4	80
25	9	225
30	5	150
	$\boxed{N = 25}$	550

$$\bar{X} = \frac{\Sigma f_i x_i}{N}$$

$$= \frac{550}{25}$$

$$= 22$$

Compute the arithmetic mean from the following data:

Marks:	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students: (f_i)	8	12	10	8	3	2	7

A. 28

B. 25

C. 29

D. 32

CI	f_i	x_i	$f_i x_i$
0-10	8	5	40
10-20	12	15	180
20-30	10	25	250
30-40	8	35	280
40-50	3	45	135
50-60	2	55	110
60-70	7	65	455
	50		1450

Direct method

$$\bar{x} = \frac{\Sigma f_i x_i}{N}$$

$$= \frac{145\cancel{0}}{5\cancel{0}}$$

$$= 29$$

CI	f_i	x_i	$d_i = x_i - A$	$f_i d_i$
0-10	8	5	$5-35=-30$	-240
10-20	12	15	$15-35=-20$	-240
20-30	10	25	-10	-100
30-40	8	35 = A (Assumed mean)	0	00
40-50	3	45	10	30
50-60	2	55	20	40
60-70	7	65	30	210
	50			-300

$$\bar{x} = A + \frac{\Sigma f_i d_i}{N}$$

$$= 35 + \frac{(-300)}{50}$$

$$= 35 - 6$$

$$= 29$$

$u_i = \frac{x_i - A}{h}$

C I	f_i	x_i	u_i	$f_i u_i$
0-10	8	5	-3	-24
10-20	12	15	-2	-24
20-30	10	25	-1	-10
30-40	8	35=A	0	0
40-50	3	45	1	3
50-60	2	55	2	4
60-70	7	65	3	21
	50			-30

$$\bar{x} = A + \frac{\Sigma f_i u_i}{N} \times h$$

$$= 35 + \frac{(-30)}{5\cancel{0}} \times 1\cancel{0}$$

$$= 35 - 6$$

$$= 29$$

Q

C I	f_i	x_i	$f_i x_i$
1 – 4	6	2.5	15
4 – 7	8	5.5	44
7 – 10	2	8.5	17
10 – 13	9	11.5	103.5
13 – 16	5	14.5	72.5
	30		252

Direct method

$$\bar{x} = \frac{\Sigma f_i x_i}{N} = \frac{252}{30} = 8.4$$

x_i	f_i	u_i	$f_i u_i$
2.5	6	-2	-12
5.5	8	-1	-8
8.5 = A	2	0	0
11.5	9	1	9
14.5	5	2	10
	$\boxed{N = 30}$		-1

$$\bar{x} = A + \frac{\Sigma f_i u_i}{N} \times h$$

$$= 8.5 + \frac{(-1)}{30} \times 3$$

$$= 8.5 - \frac{1}{10}$$

$$= 8.5 - 0.1 = 8.4$$

For the data given below, find the missing frequency if the arithmetic mean is 28.

Marks:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students:	12	18	27	f=?	17	6

A. 15

B. 20

C. 22

D. 26

x_i	f_i	$f_i x_i$
5	12	60
15	18	270
25	27	675
35	f	35f
45	17	765
55	6	330
	N = 80 + f	2100 + 35f

$$\bar{x} = \frac{\Sigma f_i x_i}{N}$$

$$28 = \frac{2100 + 35f}{80 + f}$$

$$\Rightarrow 2240 + 28f = 2100 + 35f$$

$$\Rightarrow 2240 - 2100 = 35f - 28f$$

$$\Rightarrow 140 = 7f$$

$$\Rightarrow \boxed{f = 20}$$

The average marks of 80 students were found to be 40. Later on it was discovered that a score of $\boxed{54}$ was misread as $\boxed{84}$. Find the correct mean of 80 students.

(A.) 28

(B.) 39.625 ✓

(C.) 38

(D.) None

✓ $N = 80$

$\bar{x} = 40$

$\bar{x} = \frac{\Sigma x_i}{n}$

$40 = \frac{\Sigma x_i}{80}$

wrong $\Sigma x_i = 3200$

correct $\Sigma x_i = 3200 - 84 + 54 = 3170$

x_i

54

$\cancel{84}$

$3\cancel{2}00$

correct mean $= \frac{3170}{80}$

$= 39.625$

$40 - \frac{30}{80}$

$= 40 - 0.375$

$= 39.625$

The arithmetic mean of the marks obtained by 50 students was calculated 44. It was later discovered that a score of 36 was misread as56. Find the correct value of the arithmetic mean of the marks obtained by the students.

A. 43.6

B. 44.4

C. 43.4

D. None

$N = 50$

$\bar{x} = 44$

x_i

36

$\cancel{56}$

$\frac{\sum x_i}{N} = 44$

$\frac{\sum x_i}{50} = 44$

wrong $\sum x_i = 2200$

correct $\sum x_i = 2200 - 56 + 36 = 2180$

correct mean

$= \frac{2180}{50}$

$= 43.6$

$44 - \frac{2\cancel{0}}{5\cancel{0}}$

$44 - 0.4$

43.6

Property of combined mean

Group-A	Group-B
N_1	N_2
$\bar{X}_1$	$\bar{X}_2$

Combined mean $(\bar{X}_{12}) = \dfrac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1+N_2}$

eg

Boys	Girls
$N_1 = 6$	$N_2 = 4$
$\bar{X}_1 = 70$	$\bar{X}_2 = 90$

find mean of 10 students

$\frac{6}{4} = \frac{3}{2}$

Sol: $\bar{X}_{12} = \dfrac{6(70)+4(90)}{6+4}$

$= \dfrac{420+360}{10}$

$= \dfrac{78\cancel{0}}{1\cancel{0}}$

$\boxed{\bar{X}_{12} = 78}$

$\bar{X}_1 = 70$ $\quad$ $\bar{X}_2 = 90$

$\bar{X}_{12} = 78$

12 : 8

$N_1 : N_2 =$

$12 : 8$

$= 3 : 2$

Class 12th has three sections A,B and C with 50, 60, 50 students respectively. The mean marks for the three sections were determined as 73,60 and 55 respectively. Find the mean marks of all three sections put together.

A. 62

B. 62.5

C. 63

D. None

A B C

$N_1 = 50$ $N_2 = 60$ $N_3 = 50$

$\bar{X}_1 = 73$, $\bar{X}_2 = 60$ $\bar{X}_3 = 55$

$$\bar{X}_{123} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2 + N_3\bar{X}_3}{N_1 + N_2 + N_3}$$

$$= \frac{50(73) + (60)(60) + 50(55)}{50+60+50}$$

$$= \frac{10{,}000}{160} = 62.5$$

The mean age of a combined group of men and women is 30 years. If the mean age of the group of men is 32 and that of the group women is 27, find the percentage of men

A. 60 %

B. 40

C. 35

D. None

men

$N_1 = ?$

$\bar{X}_1 = 32$

women

$N_2 = ?$

$\bar{X}_2 = 27$

$\bar{X}_{12} = 30$

3 : 2

$N_1 : N_2 = 3 : 2$

men = 3

women = 2

5

% men = $\frac{3}{5} \times 100$

= 60%

Weighted Arithmetic Mean

Salary (x_i)	weight (w_i)	$w_i x_i$
8000	70	560000
10000	20	200000
40000	10	400000
	100	1,16,0000

weighted mean

$$= \frac{\Sigma w_i x_i}{\Sigma w_i}$$

$$= \frac{1,16,00\cancel{00}}{1\cancel{00}}$$

$$= 11600$$

Calculate weighted mean from the following data:

Value:	10	12	15	18	20
Weight:	2	5	12	4	7

A. 15.7

B. 16.2

C. 14.87

D. 18.22

x_i	w_i	$w_i x_i$
10	2	20
12	5	60
15	12	180
18	4	72
20	7	140
	30	472

Weighted mean

$$= \frac{\Sigma w_i x_i}{\Sigma w_i}$$

$$= \frac{472}{30} = 15.73$$

Change of origin

⇓

when a fix number k is added or subtracted from each observation.

Eg

x_i
2
5
8

$$\bar{x} = \frac{15}{3} = 5$$

$$y_i = x_i + 10$$

y_i
12
15
18

$$\bar{y} = \frac{45}{3} = 15$$

If $\bar{x}$ is the mean of some observations & k is added to each observation then new mean will b $\bar{x} + k$

Q $\bar{x} = 15$

If $y_i = x_i + 25$

find $\bar{y}$

Sol: $\bar{y} = \bar{x} + 25$

$= 15 + 25$

$= 40$

Q $\bar{x} = 30$

If 5 is subtracted from each item. find New mean.

Sol: $\bar{x} = 30$

$y_i = x_i - 5$

$\bar{y} = ?$

$\bar{y} = 30 - 5$

$= 25$

$\boxed{\text{Change of scale}}$

$\Downarrow$

when each item is multiplied
or Divided by some scalar 'k'

Eg

x_i
1
4
7

$\bar{x} = \frac{12}{3} = 4$

$y_i = 2x_i$

y_i
2
8
14

$\bar{y} = \frac{24}{3} = 8$

If mean of some observation is $\bar{x}$ & each element is multiplied by K
then new mean $= K\bar{x}$

Eg $\bar{x} = 10$

$y_i = 6x_i$

find $\bar{y} = ?$

Sol:

$$\bar{y} = 6\bar{x}$$

$$= 6 \times 10$$

$$= 60$$

Eg If $\bar{x} = 25$

& $y_i = 3x_i + 10$

find $\bar{y} = ?$

Sol:

$$\bar{y} = 3\bar{x} + 10$$

$$= 3 \times 25 + 10$$

$$= 75 + 10$$

$$= 85$$

Properties of A.M.

#1] If each element is constant 'K' then AM = K

eg

x_i
2
2
2
2
2

$$\bar{X} = \frac{10}{5} = 2$$

#2] Combined mean

$$= \bar{X}_{12}$$

$$= \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$$

#3] $\Sigma(x_i - \bar{x}) = 0$

or

$\Sigma(\bar{X} - x_i) = 0$

Sum of deviations from arithmetic mean is always zero.

or

$$\Sigma (x_i - \bar{x}) = 0$$

Eg

x_i	$d_i = x_i - \bar{x} = x_i - 8$
1	$1-8 = -7$
2	$2-8 = -6$
5	$5-8 = -3$
24	$24-8 = 16$
$\bar{x} = \frac{32}{4} = 8$	0

Sum of the Square of Deviation is minimum only when Deviations are taken from Arithmetic mean.

i.e. $\Sigma (x_i - A)^2$ is minimum

when A = Arithmetic mean (7)

Q

x_i	x_i-5	x_i-4	x_i-6	x_i-7	$(x_i-5)^2$	$(x_i-4)^2$	$(x_i-6)^2$	$(x_i-7)^2$
1	-4	-3	-5	-6	16	9	25	36
5	0	1	-1	-2	0	1	1	4
12	7	8	6	5	49	64	36	25
$\bar{X} = \frac{18}{3} = 6$					65	74	62	65

minimum

Sum of the square of deviation is minimum when taken from ______

(A.) MEAN

(B.) MEDIAN

(C) MODE

(D.) None

If relationship between x and y is y=2x+10 & mean of x is 25 ,then mean of y will be = ?

A. 50

B. 35

C. 60

D. None

$y = 2x + 10$

$\bar{x} = 25$

$\bar{y} = 2\bar{x} + 10$

$= 2 \times 25 + 10$

$= 60$

Which of the following statements is true?

(a) Usually mean is the best measure of central tendency

(b) Usually median is the best measure of central tendency

(c) Usually mode is the best measure of central tendency

(d) Normally GM is the best measure of central tendency

Which of the following statements is wrong?

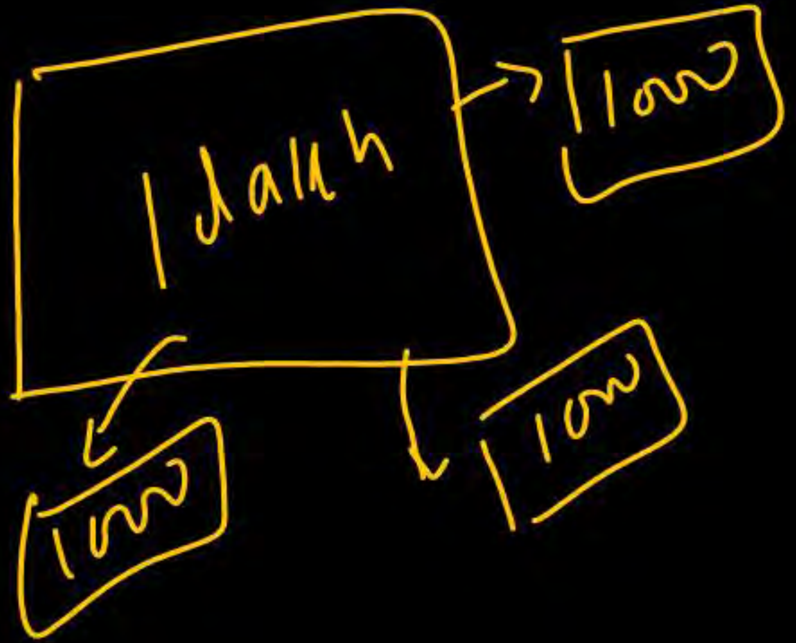
(a) Mean is rigidly defined (correct)

(b) Mean is not affected due to sampling fluctuations

(c) Mean has some mathematical properties (correct)

(d) All these

mean is affected due to sampling fluctuation



Find the missing frequency from the following distribution , given that the median is 24.

Class interval :	0-10	10-20	20-30	30-40	40-50
Frequency:	5	25	-	18	7

(A.) 20

(B.) 25

(C.) 28

(D.) None

For open-end classification, which of the following is the best measure of central tendency?

(a) AM (b) GM (c) Median (d) Mode

Median

⇓

→ A positional average (middle most value)

→ It represents 50%

→ A number which divides entire series in two equal parts

median

Individual series / Descrete series

Total no. of observation (n)

n

odd

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

even

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

marks: $\underbrace{12}$, $\underbrace{18}$, $\underbrace{5}$, $\underbrace{2}$, $\underbrace{9}$, $\underbrace{18}$, $\underbrace{17}$

find median marks.

Sol:

x_i
✓ 2
✓ 5
✓ 9
✓ 12 → median
17
18
18

$N = 7$ (odd)

median $= \left(\dfrac{7+1}{2}\right)^{th}$ term

$= 4^{th}$ term

$= 12$

Eg marks: 2, 3, 8, 12, 14, 16, 18, 18, 19, 20

find median marks

Sol:

$$N = 10 \text{ (even)}$$

$$\text{median} = \frac{\left(\frac{N}{2}\right)^{th} + \left(\frac{N}{2}+1\right)^{th}}{2}$$

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

$$= \frac{5^{th} + 6^{th}}{2} = \frac{14+16}{2} = 15$$

or

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

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

$$= (5.5)^{th}$$

$$= 5^{th} + 0.5(6^{th} - 5^{th})$$

$$= 14 + 0.5(16-14)$$

$$= 14 + 0.5(2)$$

$$= 14 + 1 = 15$$

Q

x_i
10
18
22
35
46
50

find median?

sol: $N = 6$

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

$$= \left(\frac{6+1}{2}\right)^{th}$$

$$= (3.5)^{th} \text{ term}$$

$$= 3^{rd} + 0.5(4^{th} - 3^{rd})$$

$$= 22 + 0.5(35 - 22)$$

$$= 22 + 0.5(13)$$

$$= 22 + 6.5 = 28.5$$

Descrete series

Salary (x_i)	No of employees (f_i)	C.f. (cumulative frequency)
10,000	3	3 (1,2,3)
15000	2	5 (4,5)
$\boxed{20{,}000}$	4	9 (6,7,8,9)
25000	2	11 (10,11)
	N = 11	

find median salary

10,000, 10000, 10000, 15000, 15000, $\boxed{20000}$, 20000, 20000, 20000, 25000, 25000

$N = 11$

$$\text{median} = \left(\frac{11+1}{2}\right)^{th} \text{term}$$

$$= 6^{th} \text{ term}$$

$$= 20{,}000$$

Eg

Marks (x_i)	No. of students (f_i)	(C.f.)
1	4	4 (1-4)
2	6	10 (5-10)
3	5	15 (11-15)
4	7	22 (16-22)
5	2	24 (23-24)
	N = 24	

find median marks

median

$$= \left(\frac{n+1}{2}\right)^{th}$$

$$= \left(\frac{24+1}{2}\right)^{th}$$

$$= (12.5)^{th}$$

$$= 12^{th} + 0.5(13^{th} - 12^{th})$$

$$= 3 + 0.5(3-3)$$

$$= 3$$

Sol: 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 5, 5

Find the value of median from the following data:

88	72	33	29	70	86	54	91	61	57

A. 61

B. 70

C. 65.5

D. None

Find the value of median from the following data:

8 3 11 7 12 6 9

A. 8

B. 7

C. 9

D. None

Calculate median from the following data:

X:	10	15	20	25	30
F:	2	5	4	9	11

A. 20

B. 25

C. 18

D. 26

x_i	f_i	cf
10	2	2 (1-2)
15	5	7 (3-7)
20	4	11 (8-11)
25	9	20 (12-20)
30	11	31 (21-31)
	N=31	

$$\text{median} = \left(\frac{31+1}{2}\right)^{th}$$

$$= 16^{th}$$

$$= 25$$

Median in continous series

→ find $\frac{N}{2}$

→ locate $\frac{N}{2}$ in cf

→ select median class

$$M_e = l + \left\{ \frac{\frac{N}{2} - cf}{f} \right\} \times h$$

l = lower limit of median class

cf = cumulative frequency preceding to median class

f ⇒ frequency median class

h ⇒ class length

CI	fi	cf
0-4	1	1
4-8	2	3
8-12	1	4
12-16	8	12
16-20	4	16
	16	

median class

find median

sol: $N = 16$

$\frac{N}{2} = 8$

median class $= 12-16$

$l = 12$

$$\text{median} = l + \left\{ \frac{\frac{N}{2} - cf}{f} \right\} \times h$$

$$= 12 + \left\{ \frac{8-4}{8} \right\} \times 4$$

$$= 12 + \frac{4 \times 4}{8}$$

$$= 12 + 2 = 14$$

Marks:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students :	12	16	18	25	20	9

Calculate the median marks

A. 31

B. 31.4

C. 31.6

D. 32

CI	fi	cf
0-10	12	12
10-20	16	28
20-30	18	46
30-40	25	71
40-50	20	91
50-60	9	100
	N = 100	

median class

$\frac{N}{2} = \frac{100}{2} = 50$

$M_e = l + \left\{ \frac{\frac{N}{2} - cf}{f} \right\} \times h$

$= 30 + \left\{ \frac{50 - 46}{25} \right\} \times 10$

$= 30 + \frac{4}{25} \times 10$

$= 31.6$

CI	f_i
5-10	4
11-16	3
17-22	6
23-28	2

find median

Inclusive class interval

CI	f_i	cf
4.5 - 10.5	4	4
10.5 - 16.5	3	7
16.5 - 22.5	6	13
22.5 - 28.5	2	15
	$\boxed{N=15}$	

$$\frac{N}{2} = \frac{15}{2} = 7.5$$

$$M_e = l + \left\{\frac{\frac{N}{2} - cf}{f}\right\} \times h$$

$$= 16.5 + \left\{\frac{7.5 - 7}{\cancel{6}}\right\} \times \cancel{6} = 16.5 + 0.5$$

$$= 17$$

Find the missing frequency from the following distribution , given that the median is 24.

Class interval :	0-10	10-20	20-30	30-40	40-50
Frequency:	5	25	f = ?	18	7

A. 20 ✗

B. 25

C. 28

D. None

CI	f_i	cf
0-10	5	5
10-20	25	30
20-30	f	30+f
30-40	18	48+f
40-50	7	55+f

$N = 55+f$

$N = 55+f$

med class = 20-30

median = 24

$M_e = l + \left\{\dfrac{\frac{N}{2} - cf}{f}\right\} \times h$

$24 = 20 + \left\{\dfrac{\frac{55+f}{2} - 30}{f}\right\} \times 10$

$4 = \left(\dfrac{55+f-60}{2f}\right) \times 10$

$8f = (f-5)10$

$8f = 10f - 50$

$-2f = -50$

$\boxed{f = 25}$

$$\boxed{\Sigma(x_i - \bar{x}) = 0}$$

$\Sigma(x_i - A)^2$ is minimum when $A = \bar{x}$

Sum of $\boxed{\text{absolute deviation}}$ is minimum when deviations are taken from median.

$\Sigma|x_i - m|$ is minimum

or

$\Sigma|x_i - A|$ is minimum when A = median

eg

x_i	$x_i-\bar{x}$	x_i-m	$\lvert x_i-\bar{x}\rvert$	$\lvert x_i-m\rvert$
1	-2	-1	2	1
2	-1	0	1	0
6	3	4	3	4
			6	5

$\bar{x} = \frac{9}{3} = 3$

$M_e = 2$

minimum

	Mean	Median	Mode
Change of origin	✓	✓	✓
Change of scale	✓	✓	✓

$$y = a + bx$$

$$\text{mean of } \bar{y} = a + b(\bar{x})$$

$$\text{median of } y = a + b(\text{median of } y)$$

If relationship between x and y is y=3x-2 & median of x is 10, then median of y will be = ?

A. 30

B. 8

C. 28

D. None

$$y = 3x - 2$$

Median of $y = 3(10) - 2$

$= 28$

Sum of the absolute deviation is minimum when taken from ______

A. MEAN

B. MEDIAN

C. MODE

D. None

$\Sigma |x_i - m|$

minimum

For open-end classification, which of the following is the best measure of central tendency?

(a) AM (b) GM (c) Median (d) Mode

CI

xi

30-35
20-35
15-35

less than 35

30-35

35-40

40-45

45-50

50-55

more than 55

The presence of extreme observations does not affect

(a) AM (b) Median (c) Mode (d) Any of these.

Q

Marks	No of Students (CF)
less than 4	2
less than 8	5
less than 12	12
" 16	14
20	15

find median marks.

Sol:

CI	f_i
0-4	2
4-8	3
8-12	7
12-16	2
16-20	1

Sol:

2, 3, , 6, 7, 7, 9, 9, 10, 11, 11, 11, 11, 13, 15, 18

Eg

Marks	cf No of Students
Less than 2	6
4	10
6	12
8	18
10	20
12	21
14	25

CI	fi
0 - 2	6
2 - 4	4
4 - 6	2
6 - 8	6
8 - 10	2
10 - 12	1
12 - 14	4

eg

marks	No of students (cf)
more than 0	23
more than 5	20
more than 10	14
" 15	12
" 20	5
" 25	2

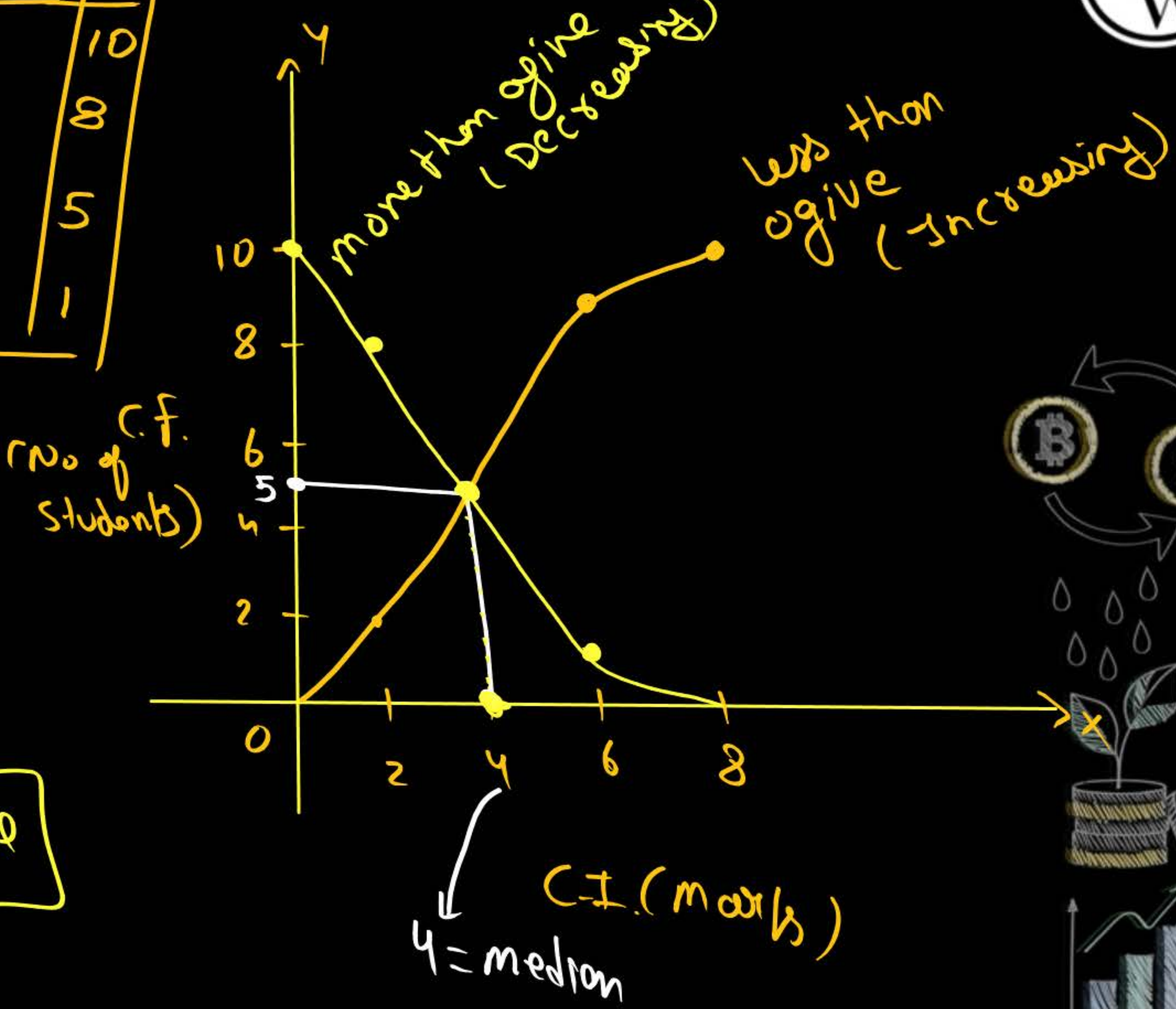
CI	f_i
0-5	3
5-10	6
10-15	2
15-20	7
20-25	3
25-30	2

marks CI	f_i	x_i less than	y_i cf	More than	cf
0-2	2	2	2	0	10
2-4	3	4	5	2	8
4-6	4	6	9	4	5
6-8	1	8	10	6	1
	10				

$N = 10$

$\frac{N}{2} = 5$

median
⇓
Graphically ⇒ $\boxed{\text{ogive}}$



median

⇓

⇓

50%

⇓

single value

Quartiles

$\Downarrow$

Q_1 Q_2 & Q_3 are three Quartile which represent 25%, 50% & 75% of series

$\Downarrow$

Divide entire series in 4 parts

25%	50%	75%
$\Downarrow$	$\Downarrow$	$\Downarrow$
Q_1	median	Q_3
	$\Downarrow$	
	Q_2	

Individual series / Descrete series

$$Q_1 = \left(\frac{N+1}{4}\right)^{th} \text{ term}$$

$$Q_3 = \left[3\left(\frac{N+1}{4}\right)\right]^{th} \text{ term}$$

Continous series

→ locate $\frac{N}{4}$ & $\frac{3N}{4}$ in cf

& select Q_1 class & Q_3 class

→ $Q_1 = l + \left\{\frac{\frac{N}{4} - cf}{f}\right\} \times h$ & $Q_3 = l + \left\{\frac{\frac{3N}{4} - cf}{f}\right\} \times h$

eg

x_i	
10	
12	
$\boxed{15}$	$\rightarrow Q_1$
20	
35	
$\boxed{45}$	$\rightarrow Q_2$
65	
75	
$\boxed{80}$	$\rightarrow Q_3$
90	
98	

$N = 11$

$$Q_1 = \left(\frac{N+1}{4}\right)^{th} = \left(\frac{11+1}{4}\right)^{th} = 3^{rd} \text{ term}$$

$$Q_1 = 15$$

$$Q_3 = \left[3\left(\frac{N+1}{4}\right)\right]^{th} = \left[3\left(\frac{11+1}{4}\right)\right]^{th} = 9^{th}$$

$$Q_3 = 80$$

$$Q_2 = \text{median} = \left(\frac{n+1}{2}\right)^{th} = 6^{th} = 45$$

eg

x_i	f_i	cf
1	3	3 (1-3)
2	2	5 (4-5)
3	5	10 (6-10)
4	6	16 (11-16)
5	8	24 (17-24)
6	2	26
7	4	30
	$N=30$	

find Q_1 & Q_3

1, 1, 1, 2, 2, 3, 3, 3, 3, 3, 4, 4

4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5

ans

$$Q_1 = \left(\frac{30+1}{4}\right)^{th}$$

$$= (7.75)^{th}$$

$$= 7^{th} + 0.75\left(8^{th} - 7^{th}\right)$$

$$= 3 + 0.75(3-3)$$

$$= 3$$

now

$$Q_3 = \left[3\left(\frac{30+1}{4}\right)\right]^{th}$$

$$= (23.25)^{th}$$

$$= 23^{rd} + 0.25\left(24^{th} - 23^{rd}\right)$$

$$= 5 + 0.25(5-5) = 5$$

eg

CI	fi	cf
0-8	2	2
8-16	6	8
16-24	8	16
24-32	4	20
32-40	2	22
	N = 22	

Q_1 class: 8-16

Q_3 class: 24-32

$N = 22$

$\frac{N}{4} = \frac{22}{4} = 5.5$

$\frac{3N}{4} = \frac{3 \times 22}{4} = 16.5$

Now

$$Q_1 = l + \left\{ \frac{\frac{N}{4} - cf}{f} \right\} \times h$$

$$= 8 + \left\{ \frac{5.5 - 2}{6} \right\} \times 8$$

$$= 12.67$$

Now

$$Q_3 = l + \left\{ \frac{\frac{3N}{4} - cf}{f} \right\} \times h$$

$$= 24 + \left\{ \frac{16.5 - 16}{4} \right\} \times 8$$

$$= 25$$

Decile

$\Downarrow$

Divide entire series in 10 parts.

$\Downarrow$

Total Deciles = 9 ($D_1, D_2, \ldots D_9$)

D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9
$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$
10%	20%	30%	40%	50%	60%	70%	80%	90%

$\Downarrow$

5^{th} Decile

D_5 = median

Individual series / Descrete

$$D_1 = \left(\frac{N+1}{10}\right)^{th}, \quad D_3 = \left[3\left(\frac{N+1}{10}\right)\right]^{th}, \quad D_8 = \left[8\left(\frac{N+1}{10}\right)\right]^{th}$$

Continous series

For D_1

→ locate $\frac{N}{10}$ in cf & select D_1 class

→ $D_1 = l + \left\{\dfrac{\frac{N}{10} - cf}{f}\right\} \times h$

for D_6

→ locate $6\frac{N}{10}$ in cf

→ select D_6 class

→ $D_6 = l + \left\{\dfrac{\frac{6N}{10} - cf}{f}\right\} \times h$

Percentile

$\Downarrow$

Divides entire series in 100 parts

$\Downarrow$

total 99 percentile $(P_1, P_2, P_3, \ldots, P_{99})$

P_1	P_2	P_3	...	P_{50}	P_{51}	...	P_{99}
1%	2%	3%		50%	51%		99%

P_{50} $\Downarrow$ median

$= Q_2 = D_5 = P_{50}$

Mode

⇓

observation with Highest frequency

eg marks : 2, 9, 8, 7, 6, 6, 5, 7, 8
7, 9, 7, 3, 4, 7, 5, 6, 7

mode = 7

eg

Marks (x_i)	No of students (f_i)
1	5
2	3
3	4
4	12
5	7

→ Highest frequency

mode = 4

marks	f_i
0 - 4	6
4 - 8	3
8 - 12	9 $\rightarrow f_0$
$\boxed{12 - 16}$	$\boxed{12}$ $\rightarrow f_1$
16 - 20	10 $\rightarrow f_2$
20 - 24	4

modal class

find mode

$$\text{mode} = l + \left\{\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right\} \times h$$

$$= 12 + \left\{\frac{12 - 9}{2(12) - 9 - 10}\right\} \times 4$$

$$= 12 + \frac{(3) \times 4}{5}$$

$$= 12 + 2.4$$

$$= 14.4$$

Q

CI	f_i
0 - 2	4
2 - 6	6
6 - 8	8
8 - 12	2

find mode

sol:

CI	f_i	
0 - 2	4	
2 - 4	3	
4 - 6	3	$\to f_0$
$\boxed{6 - 8}$	$\boxed{8}$	$\to f_1$
8 - 10	1	$\to f_2$
10 - 12	1	

modal class

$$\text{mode} = l + \left\{ \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right\} \times h$$

$$= 6 + \left\{ \frac{8 - 3}{16 - 3 - 1} \right\} \times 2$$

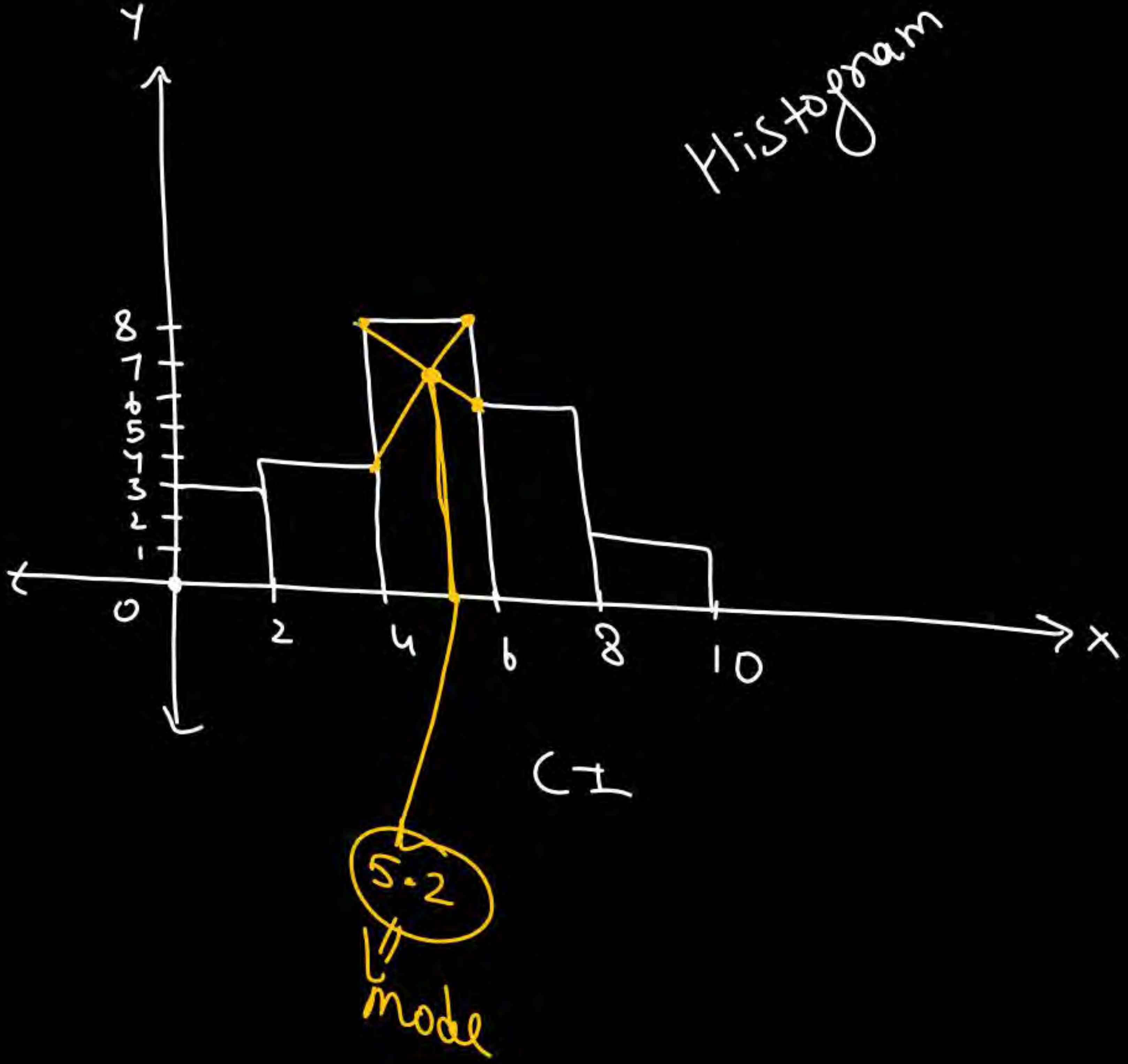
$$= 6 + \frac{5}{12} \times 2$$

$$= 6.83$$

Eg

CI	f_i
0-2	3
2-4	4
4-6	8
6-8	6
8-10	2

Histogram



If x and y are related by x – y - 10 = 0 and mode of X is known to be 23, then the mode of y is

A. 10

B. 12

C. 13

D. None

$x - y - 10 = 0$ & mode of $x = 23$

$x - 10 = y$

$y = x - 10$

mode of $y = 23 - 10$

$= 13$

Relation b/w mean, median & mode

$\boxed{3\,\text{median} = \text{mode} + 2\,\text{mean}}$

Eg. mean = 20
mode = 15
median = ?

Sol: $3\,\text{Median} = 15 + 2(20)$

$3\,\text{median} = 55$

$\text{median} = \frac{55}{3} = 18.33$

Diff b/w mode & mean = 3 [Diff b/w median & mean]

$\boxed{\text{mode} - \text{mean} = 3(\text{median} - \text{mean})}$

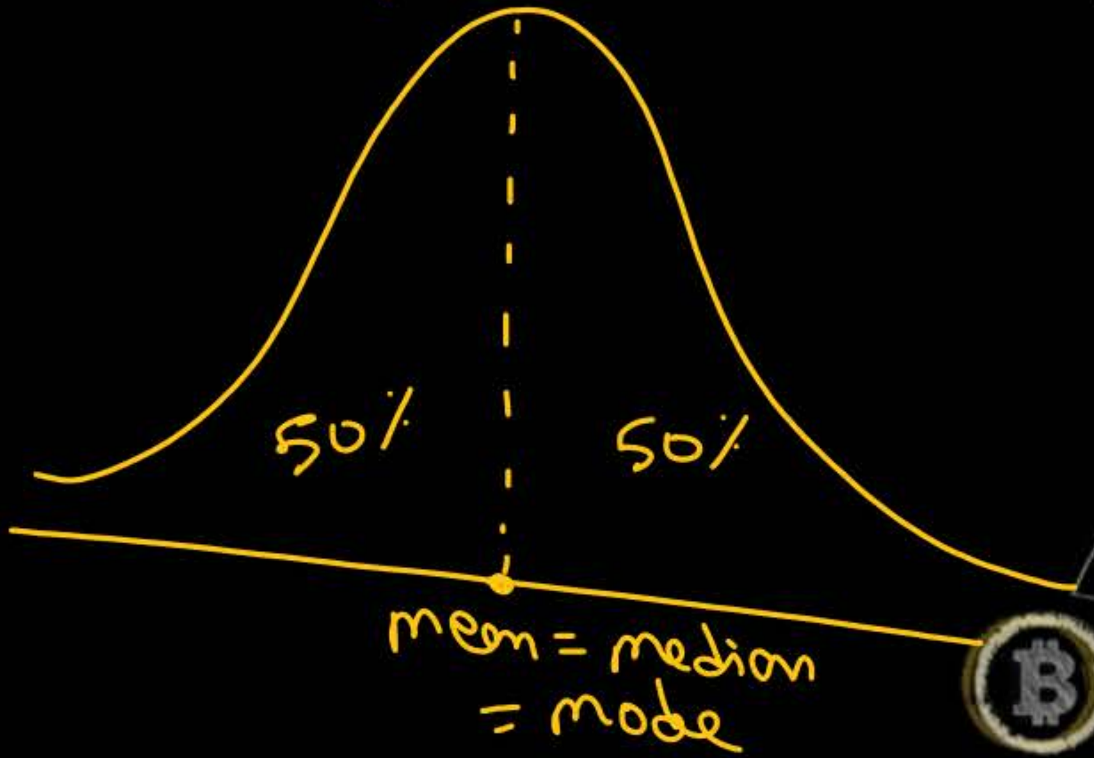
$\boxed{\text{mean} - \text{mode} = 3(\text{mean} - \text{median})}$

Symmetrical Distribution

⇓

mean = median = mode

Bell shape curve



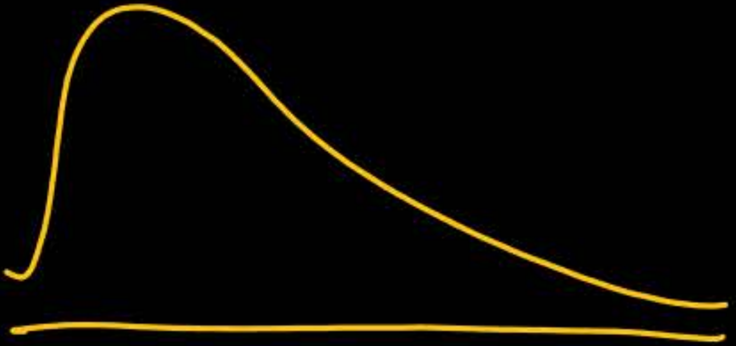
Non symmetrical Distribution

⇓

mean ≠ median ≠ mode

mean < median < mode

mean > median > mode



Geometric Mean

(Avg Rate of increase, Decrease
Avg of %, Avg Depreciation
Avg of Ratios)

⇓

n^{th} Root of the product of 'n' observations

⇓

$$\boxed{GM = [x_1 \times x_2 \times x_3 \times \dots \times x_n]^{1/n}}$$

Q GM of 2 & 8

$= (2 \times 8)^{1/2}$

$= (16)^{1/2} = 4$

Q GM of 2, 4 & 8

$= (2 \times 4 \times 8)^{1/3}$

$= (64)^{1/3} = 4$

Q find GM of 2, 3, 5 & 8

$= (2 \times 3 \times 5 \times 8)^{1/4}$

$= (240)^{1/4}$

$= 3.9386$

$(x)^{1/n} = ?$

$\rightarrow \sqrt{}$ 12 times

$\rightarrow -1$

$\rightarrow \div n$

$\rightarrow +1$

$\rightarrow \boxed{X =}$ 12 times

Q

x_i	f_i
2	3
3	2
4	1
5	2

find GM

Sol:

$$GM = (2\times2\times2\times3\times3\times4\times5\times5)^{1/8}$$

$$= (7200)^{1/8}$$

$$= 3.0382$$

Eg

CI	f_i	x_i
0 – 4	3	2
4 – 8	2	6
8 – 12	5	10

find GM

Sol:

$$GM = (2 \times 2 \times 2 \times 6 \times 6 \times 10 \times 10 \times 10 \times 10 \times 10)^{1/10}$$

$$= \quad = 5.589$$

Find geometric mean of:

3,6,24 and 48

(A.) 28

(B.) 32

(C) 36

(D.) None

$$GM = (3 \times 6 \times 24 \times 48)^{1/4}$$

$$= (20736)^{1/4} = (20736)^{\frac{1}{2} \times \frac{1}{2}}$$

$$= 12.0271 \qquad = 12$$

If all observations are same (let say k)
then $GM = k$

eg GM of 2, 2, 2, 2

$= (2 \times 2 \times 2 \times 2)^{1/4}$

$= (2^4)^{1/4}$

$= (2)$

$$GM = G = \left(x_1 \times x_2 \times x_3 \times \cdots \times x_n\right)^{1/n}$$

$$\log G = \log \left[x_1 x_2 x_3 \cdots x_n\right]^{1/n}$$

$$= \frac{1}{n} \log \left[x_1 x_2 x_3 \cdots x_n\right]$$

$$\log G = \frac{\log x_1 + \log x_2 + \log x_3 + \cdots + \log x_n}{n}$$

$\boxed{\log G = \frac{\sum \log x_i}{N}} \Rightarrow \boxed{G = AL\left[\frac{\sum \log x_i}{N}\right]}$

$\boxed{\log (x)^n = n \log x}$

$\log(xy) = \log x + \log y$

$GM \text{ of } (xy) = GM \text{ of } x \times GM \text{ of } y$

$GM \text{ of } \left(\frac{x}{y}\right) = \frac{GM \text{ of } x}{GM \text{ of } y}$

Eg

x	y	xy	$\frac{x}{y}$
2	3	6	$\frac{2}{3}$
8	27	216	$\frac{8}{27}$

$GM \text{ of } x = (2\times 8)^{1/2} = 4$

$GM \text{ of } y = (3\times 27)^{1/2} = 9$

$GM \text{ of } (xy) = (6\times 216)^{1/2} = 36$

$GM \text{ of } x \times GM \text{ of } y = 4\times 9 = 36$

$GM \text{ of } \left(\frac{x}{y}\right) = \left(\frac{2}{3}\times\frac{8}{27}\right)^{1/2} = 0.4444$

$\frac{GM \text{ of } x}{GM \text{ of } y} = \frac{4}{9} = 0.444444\ldots$

If GM of x is 10 and GM of y is 15, then the GM of xy is

A. 150

B. 1.5

C. Log(150)

D. None

GM (xy)

= GM of x × GM of y

= 10 × 15

= 150

Q If GM of 2 items is 4 &
GM of other 3 items is 8
find combined GM of all 5 items.

Combined GM

$$= \left[G_1^{N_1} \times G_2^{N_2}\right]^{\frac{1}{N_1+N_2}}$$

Sol:

$$(a \times b)^{1/2} = 4$$

$$a \times b = (4)^2 = 16$$

$$(p+q+r)^{1/3} = 8$$

$$p \times q + r = (8)^3 = 512$$

Combined GM

$$= (a \times b \times p \times q \times r)^{1/5}$$

$$= (16 \times 512)^{1/5}$$

$$= (8192)^{1/5}$$

$$(6.07)$$

Combined GM

$$= \left[4^2 \times 8^3\right]^{\frac{1}{2+3}}$$

$$= (8192)^{1/5}$$

$$(2 \times 8)^{1/2} = \sqrt{16} = 4$$

$$\left[(2) \times (-8)\right]^{1/2} = \sqrt{-16} = \text{Not Defined}$$

Any spent
Any want
Any time

Harmonic Mean (H.M.)

"Hm is the Reciprocal of the average of Reciprocal of 'n' items"

$$HM = \frac{1}{\left[\dfrac{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} \dots + \frac{1}{x_n}}{N}\right]} \Rightarrow \boxed{HM = \frac{N}{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \dots + \frac{1}{x_n}}}$$

Eg HM of 2 & 4

$$HM = \frac{2}{\frac{1}{2} + \frac{1}{4}} = \frac{2}{\frac{2+1}{4}}$$

$$= \frac{2}{0.5 + 0.25} = \frac{8}{3}$$

$$= 2.67 \qquad = 2.67$$

eg HM of 2, 3 & 5

$$HM = \frac{3}{\frac{1}{2}+\frac{1}{3}+\frac{1}{5}} = \frac{3}{0.5+0.3333+0.20}$$

$$= \frac{3}{\left(\frac{15+10+6}{30}\right)} = \frac{3}{1.03333}$$

$$= \frac{90}{31} = 2.90$$

$$= 2.90$$

$$\frac{3}{1.03333}$$

Squares

$\Downarrow$

$\boxed{\times =}$

Reciprocal

$\Downarrow$

$\boxed{\div =}$

Find the harmonic mean of 5 numbers 4, 5, 6, 10 and 12.

A. 2.5

B. 6.25

C. 1.50

D. None

$$Hm = \frac{5}{\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\frac{1}{10}+\frac{1}{12}}$$

$$= \frac{5}{0.80}$$

$$= 6.25$$

$$Hm = \frac{N}{\frac{1}{x_1} + \frac{1}{x_2} + \cdots + \frac{1}{x_n}}$$

$$Hm = \frac{N}{\Sigma\left(\frac{f_i}{x_i}\right)}$$

Q

x_i	f_i	$\frac{f_i}{x_i}$
1	2	2
2	5	2.50
3	6	2
4	2	0.50
	$\boxed{N = 15}$	7

find H.M.

$$HM = \frac{15}{\frac{1}{1}+\frac{1}{1}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\cdots}$$

Sol: $HM = \frac{N}{\Sigma\left(\frac{f_i}{x_i}\right)} = \frac{15}{7} = 2.14$

eg

x_i	f_i	$\frac{f_i}{x_i}$
5	10	2
10	20	2
15	45	3
20	15	0.75
	$\boxed{N = 90}$	7.75

HM

$$= \frac{N}{\Sigma\left(\frac{f_i}{x_i}\right)} = \frac{90}{7.75} = 11.61$$

Q

CI	f_i	x_i	$\frac{f_i}{x_i}$
0 - 2	3	1	3
2 - 4	8	3	2.67
4 - 6	5	5	1
6 - 8	4	7	0.57

$$HM = \frac{N}{\Sigma\left(\frac{f_i}{x_i}\right)}$$

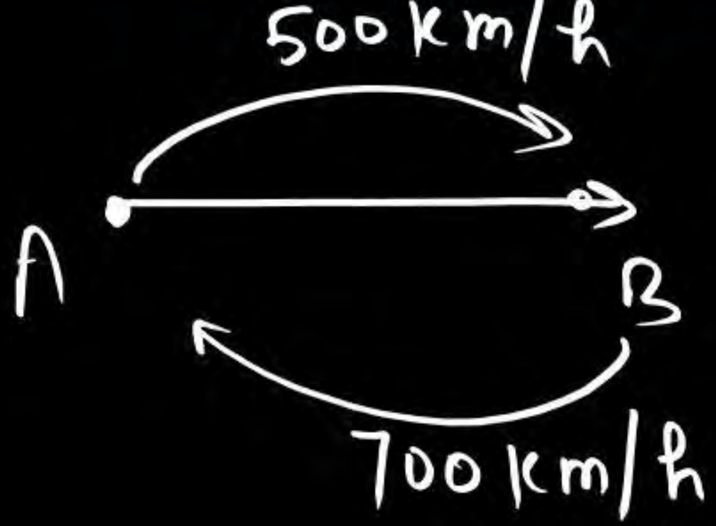
An aeroplane flies from A to B at the rate of 500 km/hour and comes back from B to A at the rate of 700 km/hour. The average speed of the aeroplane is

A. 100

B. 583.33

C. $100\sqrt{35}$

D. 620



$$\text{Avg speed} = HM\,(500\ \&\ 700)$$
$$= \frac{2}{\frac{1}{500}+\frac{1}{700}} = 583.33$$

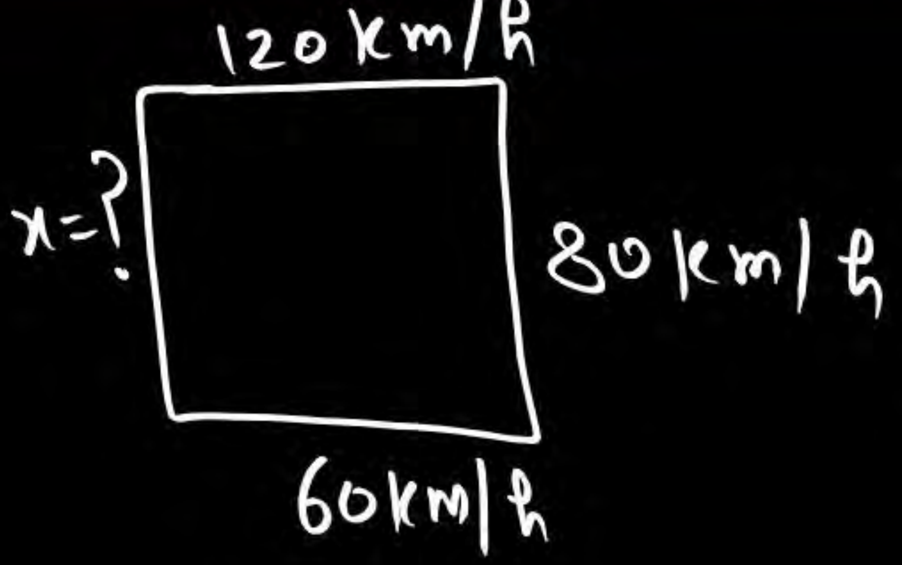
A taxi travelled around a square at an overall speed of 80 kmph. If it travelled at an average speed of 60 kmph on the first side, at 80 kmph on the second side and at 120 kmph on the third side, what must have been the average speed on the fourth side?

A. 60

B. 80

C. 90

D. None



$$\frac{4}{\frac{1}{x}+\frac{1}{120}+\frac{1}{80}+\frac{1}{60}} = 80$$

Avg speed of all 4 sides = 80 km/h

$$\frac{4}{80} = \frac{1}{x}+\frac{1}{120}+\frac{1}{80}+\frac{1}{60}$$

$$\frac{1}{20}-\frac{1}{120}-\frac{1}{80}-\frac{1}{60}=\frac{1}{x}$$

$$0.05-0.0083-0.0125-0.0166=\frac{1}{x}$$

$$0.0125=\frac{1}{x}$$

$$x=\frac{1}{0.0125}=80 \text{ km/h}$$

A car travels 50 km from plain to a hill station at a speed of 40 kmph. It then makes the return trip at a speed of 60 kmph. Find the average speed per hour by using appropriate average

A. 48

B. 50

C. 54

D. None

40 km/h

D = 50 km

Plain Area — Hilly

60 km/h

$$Hm = \frac{2}{\frac{1}{40}+\frac{1}{60}} = \frac{2}{\frac{3+2}{120}} = \frac{240}{5} = 48 \text{ km/h}$$

If all observations are same (let say k) then $HM = k$

Eg HM of 2, 2, 2, 2 $= \dfrac{4}{\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}} = \dfrac{4}{2} = 2$

Combined $HM = \dfrac{N_1 + N_2}{\left(\frac{N_1}{H_1}\right) + \left(\frac{N_2}{H_2}\right)}$

The harmonic mean for 40 observations of group 1 data is 520 and for 50 observations of group 2 data is 680. What is the combined harmonic mean?

A. 450.60

B. 598.20

C. 800

D. None

$N_1 = 40 \quad | \quad N_2 = 50$

$H_1 = 520 \quad | \quad H_2 = 680$

$$Hm = \frac{N_1 + N_2}{\frac{N_1}{H_1} + \frac{N_2}{H_2}}$$

$$= \frac{40 + 50}{\frac{40}{520} + \frac{50}{680}} = \frac{90}{0.15045} = 598.19$$

Q Hm of 3 items is 5
Hm of 2 items is 10
find combined Hm ?

Sol:

$HM = H_1 = 5$

$$\frac{3}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}} = 5$$

$$\frac{3}{5} = \frac{1}{a}+\frac{1}{b}+\frac{1}{c}$$

$H_2 = 10$

$$\frac{2}{\frac{1}{x}+\frac{1}{y}} = 10$$

$$\frac{2}{10} = \frac{1}{x}+\frac{1}{y}$$

Combined Hm

$$= \frac{5}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{x}+\frac{1}{y}}$$

$$= \frac{5}{\frac{3}{5}+\frac{2}{10}}$$

$$Hm = \frac{N1+N2}{\frac{N1}{H_1}+\frac{N2}{H_2}}$$

$$= \frac{3+2}{\frac{3}{5}+\frac{2}{10}}$$

If all items are same
$AM = HM = GM$

eg

2, 2, 2, 2

$AM = 2$

$GM = 2$

$HM = 2$

If all observations are different

2 & 8

$AM = \frac{2+8}{2} = 5$

$GM = \sqrt{2 \times 8} = 4$

$HM = \frac{2}{\frac{1}{2}+\frac{1}{8}} = \frac{2 \times 8}{5} = 3.2$

$\boxed{AM > GM > HM}$

$\boxed{AM \geq GM \geq HM}$

for only two numbers a & b

$$AM \times HM = GM^2$$

Eg for two numbers
$HM = 5$
$AM = 20$
$GM = ?$

Sol: $GM^2 = AM \times HM$
$= 20 \times 5$
$GM^2 = 100$
$\boxed{GM = 10}$

Weighted AM = $$\frac{\Sigma w_i x_i}{\Sigma w_i}$$

Weighted HM = $$\frac{\Sigma w_i}{\Sigma \left(\frac{w_i}{x_i}\right)}$$

Weighted GM = $$A.L.\left[\frac{\Sigma w_i (\log x_i)}{\Sigma w_i}\right]$$

$$1+2+3+\cdots+n=\frac{n(n+1)}{2}$$

$$1^2+2^2+3^2+\cdots+n^2=\frac{n(n+1)(2n+1)}{6}$$

$$1^3+2^3+3^3+\cdots+n^3=\frac{n(n+1)(2n+1)}{6}$$

A.M. of first 'n' natural no $= \dfrac{n+1}{2}$

Eg AM of first 5 natural no.

$$= \frac{(1+2+3+4+5)}{5} \quad \text{or} \quad \frac{5+1}{2}$$

$$= \frac{15}{5} \qquad = 3$$

$$= 3$$

The A.M. and G.M. of two numbers are 15 and 12 respectively. Find the H.M. of the numbers

A. 2

B. 15

C. 20

D. 9.6 ✓

$AM = 15$

$GM = 12$

$HM = ?$

$AM \times HM = GM^2$

$15 \times HM = 12^2$

$HM = \frac{144}{15}$

$= 9.6$

The median of $x, x/2, x/3, x/5$ *is* 10

Then the value of x (2009)

A. 24

B. 8

C. 32

D. 16

$x, \frac{x}{2}, \frac{x}{3}, \frac{x}{5}$

$\text{median} = \frac{\left(\frac{x}{2}\right) + \left(\frac{x}{3}\right)}{2}$

$2 \text{ median} = \frac{x}{2} + \frac{x}{3}$

$2 \times 10 = \frac{3x + 2x}{6}$

$120 = 5x$

$\boxed{x = 24}$

If the A and G are the AM & GM of two unequal quantities then

(2009)

A. A<G

B. A>G

C. $A \leq G$

D. $A \geq G$

$A > G > H$

Harmonic mean of 1,1/2,1/3,1/4…,1/n is

(2010)

A. 1/(n+1)

B. 2/(n+1)

C. $\frac{n+1}{2}$

D. $\frac{1}{n-1}$

$\frac{1}{3+1}$

$\frac{2}{3+1} = \frac{2}{4} = \frac{1}{2}$

$$Hm = \frac{n}{1+2+3+\cdots+n} = \frac{\cancel{n}}{\left[\frac{\cancel{n}(n+1)}{2}\right]} = \frac{2}{n+1}$$

$$Hm = \frac{3}{1+2+3} = \frac{3}{6} = \frac{1}{2}$$

$$\boxed{n=3}$$

The difference between mode and mean is 63, then the difference between median and mean will be ? (2011)

A. 63

B. 21

C. 31.5

D. None

$$\text{mode} - \text{mean} = 3(\text{median} - \text{mean})$$

$$63 = 3(\text{med} - \text{mean})$$

$$\frac{\cancel{63}}{\cancel{3}} = \text{med} - \text{mean}$$

$$21$$

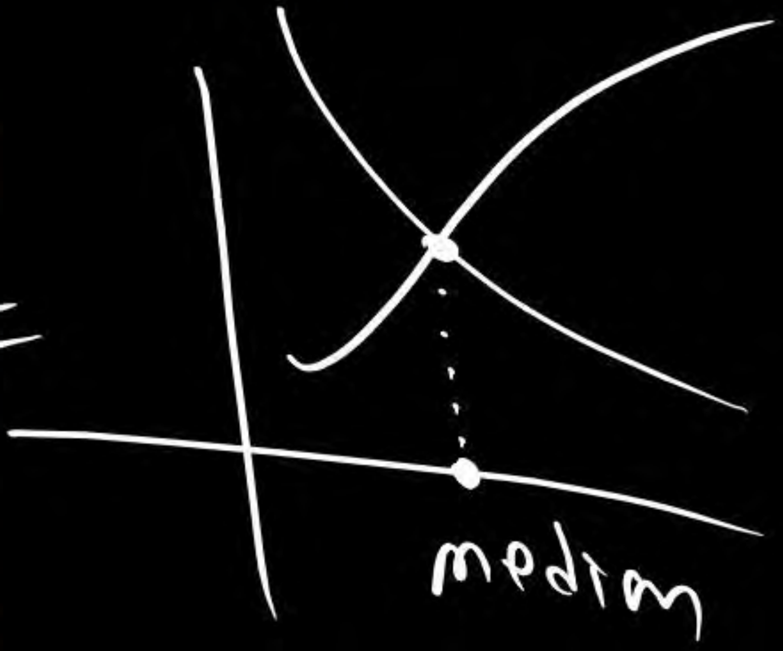
The intersection point of less than ogive and more than ogive gives the ___ of a frequency distribution. (2012)

A. mean

B. median

C. *Mode*

D. *None*



The harmonic mean of two numbers is 4, their A.M. A, and G.M. G. satisfy the relation $2A + G^2 = 27$. (2014)

A. 1,3 × 2

B. 9,5 × 7

C. 6,3 = 4.5

D. 12, 7 ×

$\boxed{Hm = 4}$

$Am = A$

$Gm = G$

$Gm^2 = Am \times Hm$

$G^2 = A \times 4$

$G^2 = 4A$

$2A + G^2 = 27$

$2A + 4A = 27$

$6A = 27$

$\boxed{A = 4.5}$

$\frac{a+b}{2} = 4.5$

$a + b = 9$

The average of 10 observations is 14.4. If the average of first 4 observations is 16.5. The average of remaining 6 observations is: (2016)

A. 13.6

B. 12.8

C. 13

D. *None*

$N_1 = 4$, $\bar{x}_1 = 16.5$

$N_2 = 6$, $\bar{x}_2 = ?$

$\bar{x}_{12} = 14.4$

$$\frac{N_1\bar{x}_1 + N_2\bar{x}_2}{N_1+N_2} = 14.4$$

$$\frac{16.5(4) + 6(\bar{x}_2)}{10} = 14.4$$

$$66 + 6\bar{x}_2 = 144$$

$$\bar{x}_2 = 13$$

When all observation have same frequency then which central tendency does not exist ? (2017)

A. Mean

B. Median

C. Mode

D. Gm

x_i	f_i
2	10
3	10
4	10

Relation between mean median and mode ? (2018)

3 median = mode + 2 mean

A. Mean –median =Mode-mean

B. Mean –Mode=2(Mode-median)

C. $\boldsymbol{Mode - Mean = 3(Median - Mean)}$

D. $\boldsymbol{Mode - Mean = 3(Mean - Median)}$

Which of the following is a positional average ? (2019)

A. Mean

B. Median

C. *Mode*

D. Gm

50%

The AM and GM of two observations are 30 and 24

The two numbers are ? (2019)

A. 12,24 ✗

B. 12,48

C. 30, 30 ✗

D. 20,40 ✗

$AM = 30$ & $GM = 24$

$\frac{a+b}{2} = 30$

$a+b = 60$

$\sqrt{a \times b} = 24$

$a \times b = 24^2 = 576$

50^{th} percentile is ? (2020)

A. Median

B. Mean

C. *HM*

D. GM

$Q_2 = P_{50} = D_5 = \text{median}$

There are n numbers. When 50 is subtracted from each of these number the sum of the numbers so obtained is -10 . When 46 is subtracted from each of the original *n* numbers, then the sum of numbers, So obtained is 70 . What is the mean of the original *n* numbers? (2021)

$\bar{x} = ?$

A. 56.8

B. 25.7

C. 49.5

D. 53.8

$$\Sigma (x_i - 50) = -10 \quad \& \quad \Sigma (x_i - 46) = 70$$

$$\Sigma x_i - 50n = -10 \qquad \Sigma x_i - 46n = 70$$

$$\boxed{\Sigma x_i = 50n - 10} \quad \text{— (1)} \qquad \boxed{\Sigma x_i = 46n + 70} \quad \text{— (2)}$$

$$50n-10=46n+70$$
$$4n=80$$
$$\boxed{n=20}$$

Now $\Sigma x_i = 50n-10$
$$= 50(20)-10$$
$$= 1000-10$$
$$\Sigma x_i = 990$$

Now $\overline{X} = \dfrac{\Sigma x_i}{N} = \dfrac{99\cancel{0}}{2\cancel{0}} = 49.5$

$$\Sigma(2x_i)$$
$$= 2\,\Sigma x_i$$

$$\Sigma(2)$$
$$= 2n$$

$$\Sigma(3)$$
$$= 3n$$

$$\Sigma(1)$$
$$= n$$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