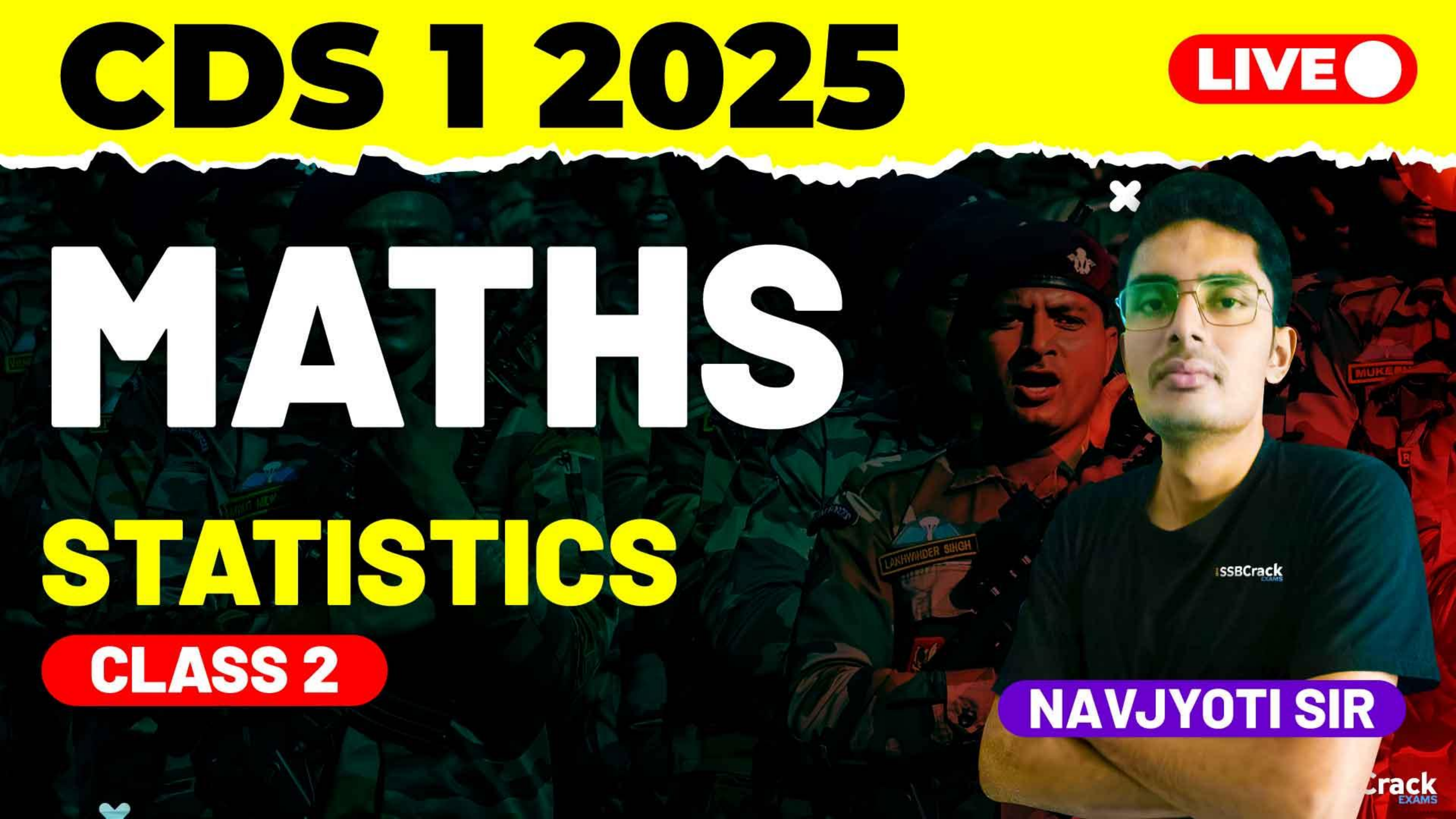
CDS 1 2025
LIVE
MATHS
STATISTICS
CLASS 2
NAVJYOTI SIR
SSBCrack EXAMS
Crack EXAMS

RELATION B/W MEAN, MEDIAN, MODE

$$3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$$

Mode = 3 Median − 2 Mean

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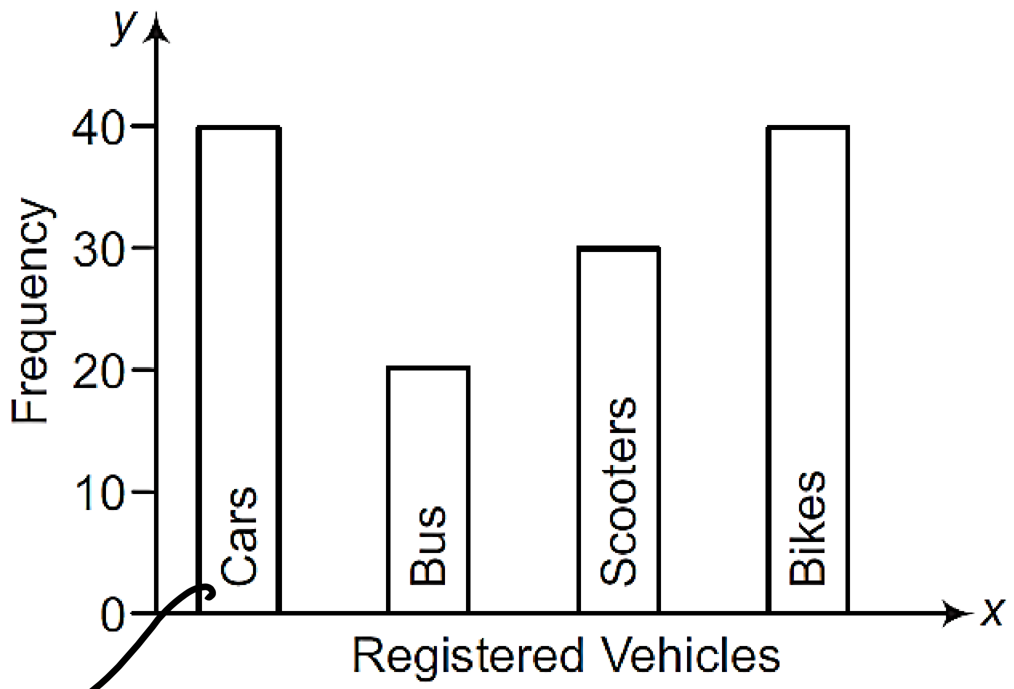
BAR DIAGRAM

In bar diagrams, only the length of the bars are taken into consideration. The width of each bar can be any, but widths of all the bars is same and space between these bars should be same. The width of the bar has no special meaning.

e.g., The bar diagram of the following data is

Registration of vehicles in 2011	Car	Bus	Scooters	Bikes
No. of vehicles	40	20	25	35



discrete data (no intervals — fixed numbers)

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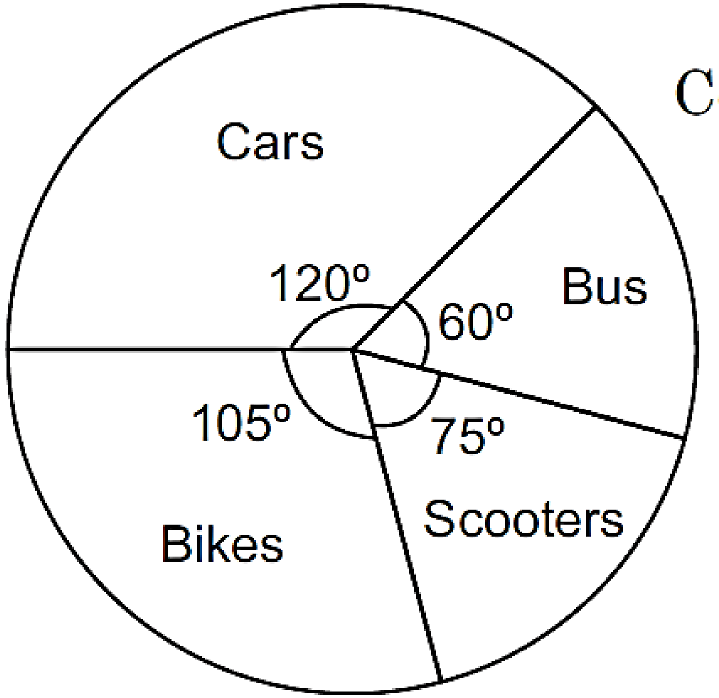
PIE DIAGRAM

Pie diagram is used to represent a relative frequency distribution. A pie diagram consists of a circle divided into as many sectors or there are classes in a frequency distribution. Sum of all the angles of sectors is 360°



$$\text{Central angle} = \left[\frac{\text{frequency} \times 360^\circ}{\text{total frequency}}\right] \Rightarrow$$

$$\frac{\text{part}}{\text{whole}} = \frac{\text{part }\%}{100} = \frac{\text{angle of the part}}{360^\circ}$$

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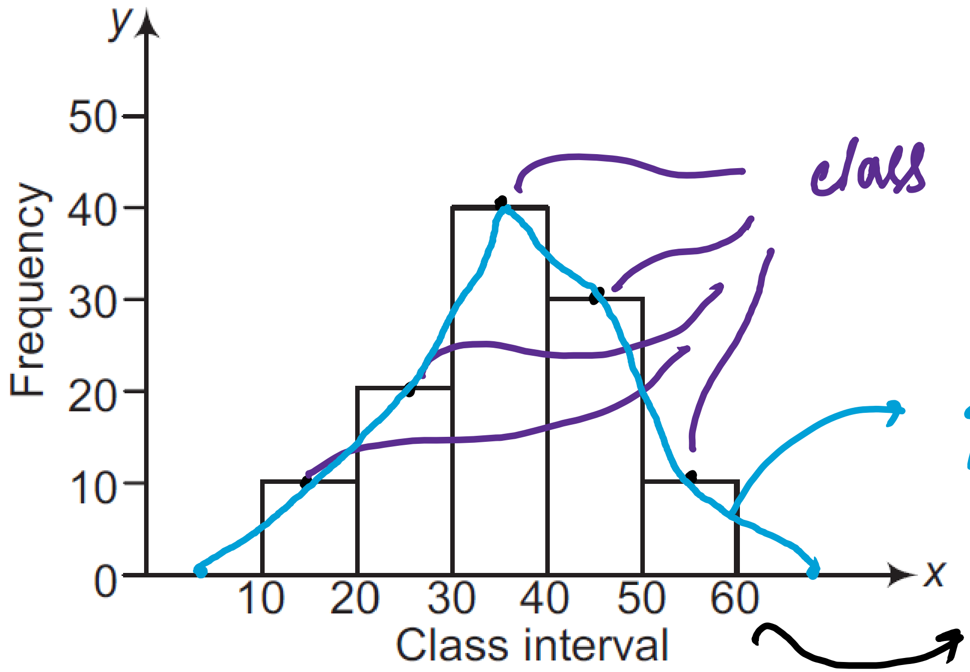
HISTOGRAM

To draw a histogram of a given continuous frequency distribution, we first mark off all the class intervals along x-axis on a suitable scale. On each class interval erect rectangles with heights proportional to the frequency of the corresponding class interval, so that the area of the rectangle is proportional to the frequency of the class.



class mark = $\dfrac{\text{upper limit} + \text{lower limit}}{2}$

frequency polygon

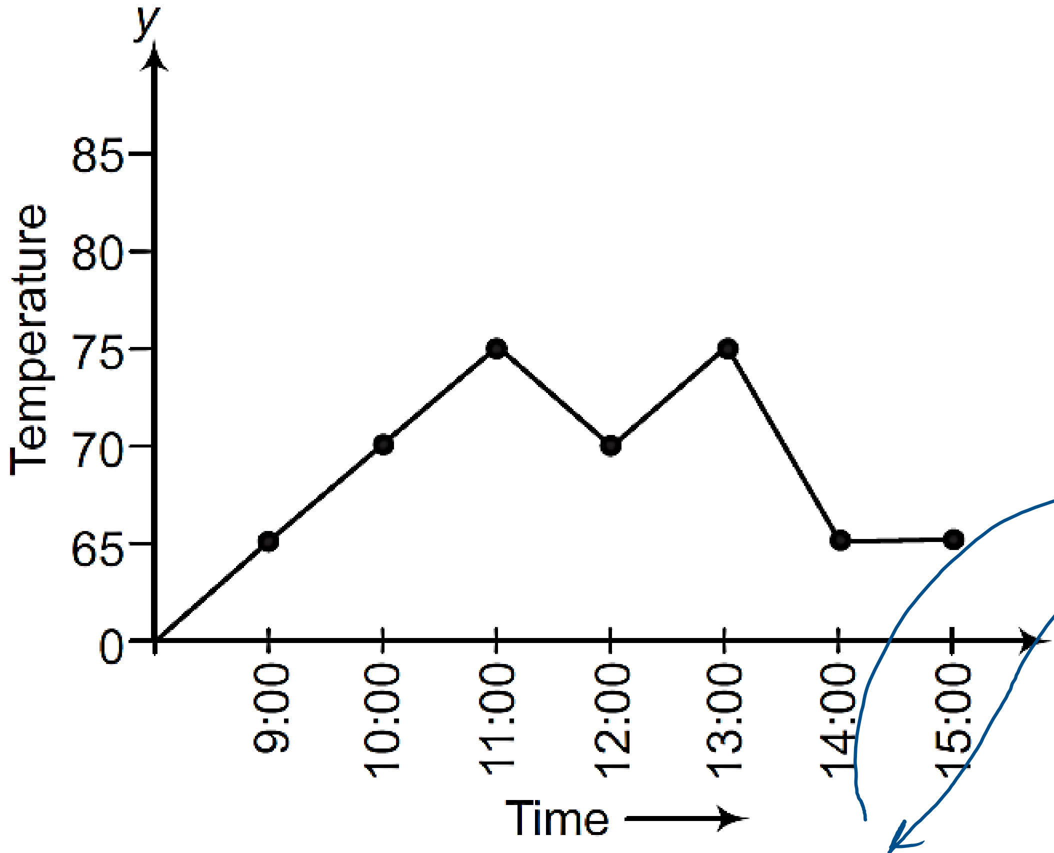
continous data (in form of intervals)

FREQUENCY POLYGON

To draw the frequency polygon of an ungrouped frequency distribution, we plot the points with abscissa as the variate values and the ordinate as the corresponding frequencies. These plotted points are joined by straight lines to obtain the frequency polygon.

OGIVE

When we plot the upper class limit along x-axis and cumulative frequencies along y-axis. And on joining, then we get a curve called an ogive.



10 – 20	4
20 – 30	5
30 – 40	6
40 – 50	3

lower limits

upper limits

cumulative frequency

Less than

Less than 20 — 4

Less than 30 — 4+5 = 9

Less than 40 — 4+5+6 = 13

Less than 50 — 13+5 = 18

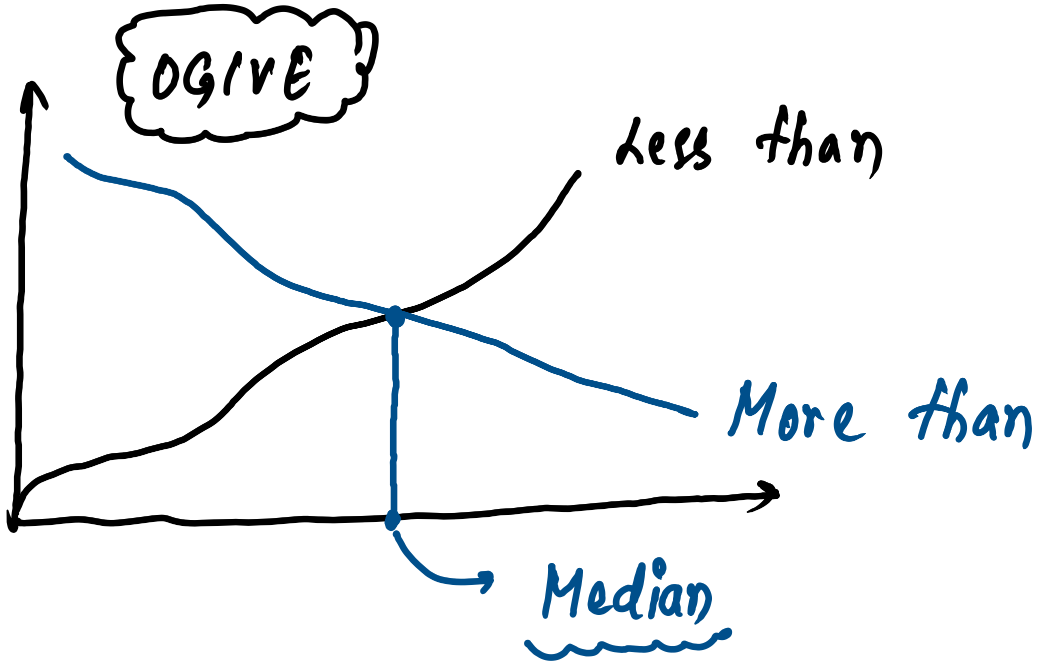
More than

More than 10 — 18

More than 20 — 13

" " 30 — 6+3 = 9

" " 40 — 3



OGIVE — Cumulative frequency curve

Less than — (20, 4), (30, 9), (40, 13), (50, 18)

More than — (10, 18), (20, 13), (30, 9), (40, 3)

ARITHMETIC PROGRESSION

A sequence is called an arithmetic progression, if the difference of any two consecutive terms is constant. The constant difference of terms is known as common difference.

The difference of any two consecutive terms of a, $a + d$, $a + 2d$, ... is constant, then this series is known as arithmetic progression.

Its first term is a and common difference is d.

2, 5, 8, 11, 14, 17

+3 +3 +3 +3

AP

nth term of a series, $T_n = a + (n - 1)\, d$

Last term of a series, $l = a + (n - 1)\, d$

first term

Sum of n terms of a series,

$a_n = a + (n-1)d$ common difference

$$S_n = \frac{n}{2}\,[2a + (n - 1)\, d\,] = \frac{n}{2}\,(a + l)$$

last term n — number of terms,

If a, b, c are in AP,

$$b - a = c - b$$

$$2b = a + c$$

Q) What is the value of $1 - 2 + 3 - 4 + 5 - \ldots\ldots + 101$?

(a) 51 (b) 55

(c) 110 (d) 111

Sum of first 'n' odd numbers $= n^2$

$\underbrace{1+3+5+ \ldots 101}_{AP} + (-2)(1+2+3+4+\ldots 50)$

Sum of first 'n' numbers $= \frac{n(n+1)}{2}$

$S_{51} = \frac{51}{2}(1+101) = (51)^2$

$\frac{(-2)(50)(51)}{2}$

$a = 1$; $d = 2$; $a_n = 101$

$50 = n - 1$

$a_n = a + (n-1)d$

$n = 51$

$101 = 1 + (n-1)2$

$101 - 1 = 2(n-1)$

$(51)^2 - 50(51) = 51(51-50) = 51$

Q) What is the value of $1 - 2 + 3 - 4 + 5 - \ldots\ldots + 101$?

(a) 51
(b) 55
(c) 110
(d) 111

Ans: (a)

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GEOMETRIC PROGRESSION

A sequence is known as geometric progression, if the ratio of any term to its previous term is constant.

If $a_1, a_2, a_3, \ldots, a_n$ are in GP.

Then, $$\frac{a_2}{a_1} = \frac{a_3}{a_2} = \ldots = \frac{a_n}{a_{n-1}} = r$$

where, r is known as common ratio of GP.

$$n\text{th term of GP, } T_n = ar^{n-1}$$

$$\text{Last term of GP, } l = ar^{n-1}$$

Sum of n terms of GP,

$$S_n = \frac{a(r^n - 1)}{r-1}, \text{ when } r > 1 = \frac{a(1-r^n)}{1-r}, \text{ when } r < 1$$

Sum of infinite terms of GP,

$$S_\infty = \frac{a}{1-r}, \text{ where } |r| < 1$$

$r^n \sim 0$

$3, 6, 12, 24, 48, 96$

$\times 2 \quad \times 2 \quad \times 2 \quad \times 2 \quad \times 2$

common ratio

$a_n = ar^{n-1}$

$$S_\infty = \frac{a(1-0)}{1-r} = \frac{a}{1-r}$$

* If a, b, c are in GP,

$$\frac{b}{a} = \frac{c}{b}$$

$$\boxed{b^2 = ac}$$

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Q) The value of the product

$6^{\frac{1}{2}} \times 6^{\frac{1}{4}} \times 6^{\frac{1}{8}} \times 6^{\frac{1}{16}} \times \ldots$ up to infinite terms is

(a) 6 (b) 36 (c) 216 (d) 512

$$6^{\underbrace{\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\cdots}_{\text{Infinite GP}}}$$

$a^m \times a^n = a^{m+n}$

$a = \frac{1}{2}$; $r = \frac{1/4}{1/2} = \frac{1}{2} < 1$

$6^1 = 6$

$S_\infty = \frac{a}{1-r} = \frac{\frac{1}{2}}{1-\frac{1}{2}} = 1$

Q) The value of the product

$6^{\frac{1}{2}} \times 6^{\frac{1}{4}} \times 6^{\frac{1}{8}} \times 6^{\frac{1}{16}} \times \ldots$ up to infinite terms is

(a) 6 (b) 36 (c) 216 (d) 512

Ans: (a)

ARITHMETIC, GEOMETRIC & HARMONIC MEAN

Let a and b be two quantities, then arithmetic mean of a and b is $A = \dfrac{a+b}{2}$.

AM $\geq$ GM $\geq$ HM

If three numbers a, G, and b are in GP, we say that G is the geometric mean between a and b.

Thus, G is the GM between a and b.

$\Leftrightarrow \quad a,\ G$ and b are in GP.

$$\Leftrightarrow \quad \frac{G}{a} = \frac{b}{G} \quad \Leftrightarrow G^2 = ab \text{ i.e., } G = \sqrt{ab}$$

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

Let two quantities are a and b respectively, then harmonic mean of a and $b = \dfrac{2ab}{a+b}$

EXAMPLE

Two numbers whose arithmetic mean is 34 and the geometric mean is 16 are

(a) 60, 3 ✗ (b) 64, 4 ✓ (c) 20, 4 ✗ (d) 18, 4 ✗

$$\frac{a+b}{2} = 34$$

$$\sqrt{ab} = 16$$

$$a+b = 68$$

$$ab = 256$$

EXAMPLE

Two numbers whose arithmetic mean is 34 and the geometric mean is 16 are

(a) 60, 3 (b) 64, 4 (c) 20, 4 (d) 18, 4

Ans: (b)

EXAMPLE

If the harmonic mean of 60 and x is 48, then what is the value of x?

(a) 32 (b) 36

(c) 40 ✓ (d) 44

$$HM = \frac{2ab}{a+b}$$

$$48 = \frac{2 \times 60 \times x}{60 + x}$$

$$2880 + 48x = 120x$$

$$x = \frac{\cancel{2880}^{240}}{\cancel{72}_{6}} = 40$$

EXAMPLE

If the harmonic mean of 60 and x is 48, then what is the value of x?

(a) 32 (b) 36

(c) 40 (d) 44

Ans: (c)

RELATION OF AM, GM, HM

If a and b are two real numbers and A, G and H are arithmetic mean, geometric mean and harmonic mean, respectively.

$$\therefore \quad A = \frac{a+b}{2}, G = \sqrt{ab} \text{ and } H = \frac{2ab}{a+b}$$

$$\Rightarrow \quad A > G > H \text{ and } G^2 = AH.$$

Q) The harmonic mean H of two numbers is 4 and the arithmetic mean A and geometric mean G satisfy the equation $2A + G^2 = 27$. The two numbers are

(a) 6, 3 ✓ (b) 9, 5 ✗

(c) 12, 7 ✗ (d) 3, 1 ✗

$$\underbrace{\frac{2ab}{a+b}}=4$$

$$2\left(\frac{a+b}{2}\right)+\underbrace{ab}=27$$

(a) only is satisfying.

Q) The harmonic mean H of two numbers is 4 and the arithmetic mean A and geometric mean G satisfy the equation $2A + G^2 = 27$. The two numbers are

(a) 6, 3 (b) 9, 5

(c) 12, 7 (d) 3, 1

Ans: (a)

Q)

x X	1	2	3	4
f Frequency	2	3	f	5

The frequency distribution of a discrete variable X with one missing frequency f is given above. If the arithmetic mean of X is $\frac{23}{8}$, what is the value of the missing frequency?

(a) 5 (b) 6
(c) 8 (d) 10

$$\frac{\Sigma xf}{\Sigma f} = \text{Mean } (\bar{x})$$

$$\frac{(1\times2) + (2\times3) + (3\times f) + (4\times5)}{2+3+f+5} = \frac{23}{8}$$

$$(28+3f)8 = 23(10+f)$$

$$224 + 24f = 230 + 23f$$

$$(f = 6)$$

Q)

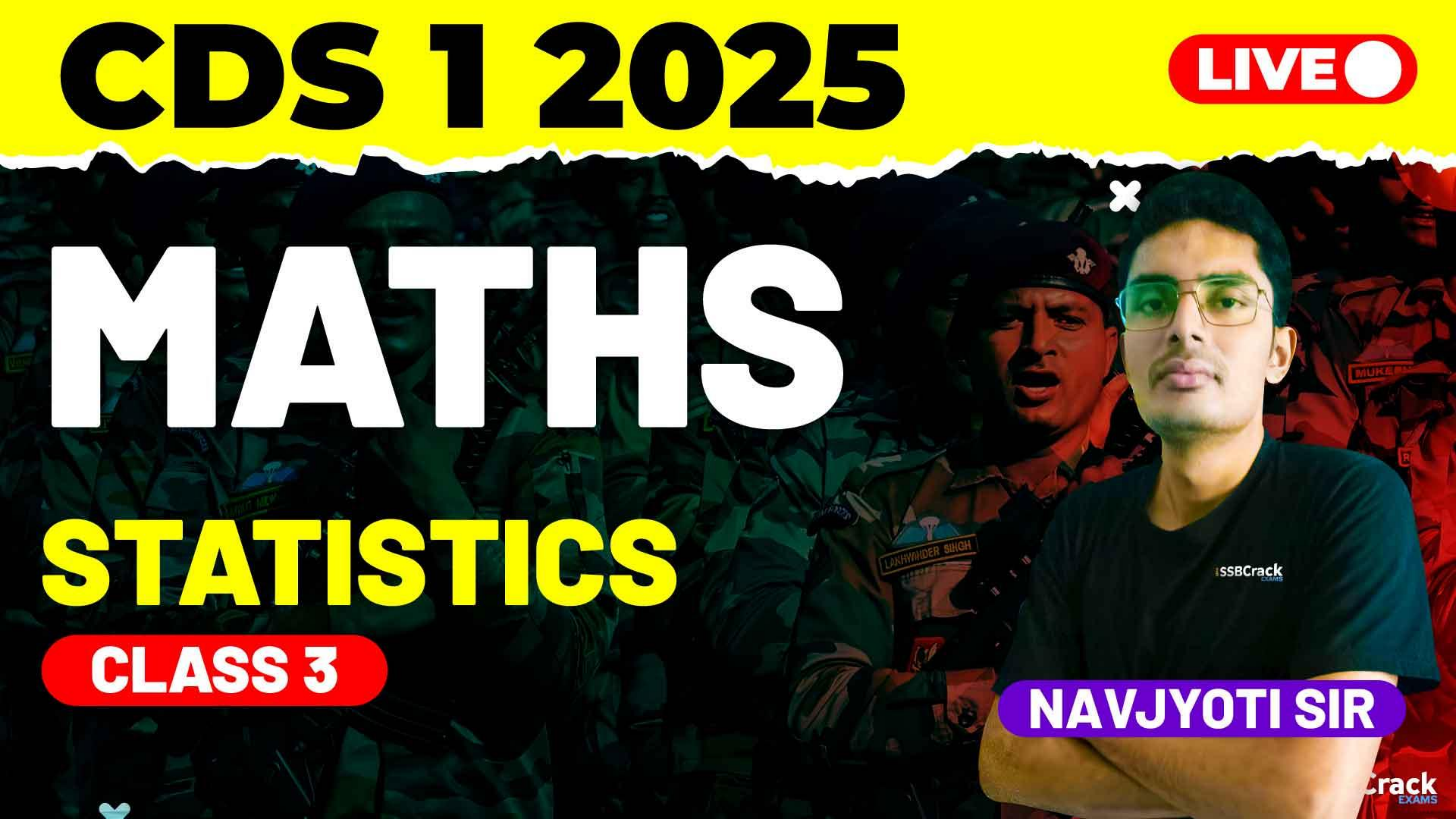
X	1	2	3	4
Frequency	2	3	f	5

The frequency distribution of a discrete variable X with one missing frequency f is given above. If the arithmetic mean of X is $\frac{23}{8}$, what is the value of the missing frequency?

(a) 5 (b) 6

(c) 8 (d) 10

Ans: (b)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