

# GEOMETRIC MEAN

# GEOMETRIC MEAN

## Definition

- Geometric mean is type of average that is calculated by multiplying together a set of numbers by taking  $n^{\text{th}}$  root of their product.
- Geometric Mean is the measure of the central tendency used to find the central value of the data set in statistics. There are various types of mean that are used in mathematics including Arithmetic Mean(AM), **Geometric Mean(GM)**, and Harmonic Mean(HM).
- Geometric Mean is also known as the Multiplicative Mean.

# GEOMETRIC MEAN

## Geometric mean have three type of formulas

- $GM = \sqrt[n]{(x_1 \times x_2 \times \dots \times x_n)}$  and  $GM = \text{Antilog} \frac{\sum \log x}{n}$  these two formula are used for ungroup data where data are given in simple positive numbers. Like 2 , 5 , 8 ,34 etc.
- Where  $GM = \text{Anti log} \frac{\sum f \log x}{n}$  is used for group data which means data are given in class intervals and there is frequency involved/given in data.

## GEOMETRIC MEAN FOR UNGROUP DATA

- $GM = \sqrt[n]{(x_1 \times x_2 \times \dots \times x_n)}$  or  $GM = \sqrt[n]{(\prod_i^n x_i)}$  where  $x_i = (x_1 \times x_2 \times \dots \times x_n)$

Find the G.M of the values 10, 25, 5, and 30

Solution : Given 10, 25, 5, 30

We know that,  $GM = \sqrt[4]{(\prod_i^n x_i)}$  where  $x_i = 10, 25, 5, 30$

$$GM = \sqrt[4]{(\prod_i^n x_i)} = \sqrt[4]{10 \times 25 \times 5 \times 30} = \sqrt[4]{37500} = 13.915$$

Therefore, the geometric mean = 13.915

while '∏' as known is Capital Pi which is use for product - product of all values in range of series

$$\prod x_i = x_1 \cdot x_2 \cdot \dots \cdot x_n$$

## Geometric mean for Ungroup Data

Ungroup Data in table form

$$GM = \text{Antilog} \frac{\sum \log x}{n}$$

$$\sum \log x = 4.573 \text{ \& } n = 4$$

$$GM = \text{Anti log} \frac{\sum \log x}{n} \gg \text{Anti log} \frac{4.573}{4}$$

$$GM = \text{Antilog} (1.14325)$$

$$\underline{GM = 13.915}$$

$\Sigma$  as known is Sigma.  
Used for sum of all values.  
 $\Sigma x_i = x_1 + x_2 + \dots + x_n$

Weight	logx
10	1
25	1.3979
5	0.698
30	1.4771
Total	4.573
GM	<u>13.907</u>

## Geometric mean of Group Data

Group data is that type of data which is given in class intervals and where frequency is involved or given.

Geometric mean formula for group data is given below

$$GM = \text{Anti log } \frac{\sum f \log x}{n}$$

Weight	Frequency f	Mid point x	logx	f logx
60-80	22			
80-100	38			
100-120	45			
120-140	35			
140-160	20			
Total				



## Geometric mean for Group Data

- $GM = \text{Antilog} \frac{\sum f \log x}{n}$
- Here we find  $x$  by finding mid point from Class intervals such as
- $60-80 \rightarrow \frac{60+80}{2} = \frac{140}{2} = 70$
- $80-100 \rightarrow \frac{80+100}{2} = \frac{180}{2} = 90$  And so on
- $n$  is total of frequencies
- $\sum f \log x = 324.2$
- $GM = \text{Anti log} \frac{\sum f \log x}{n} \rightarrow \text{Anti log} \frac{324.2}{160} \rightarrow \text{Anti log} (2.02625) = \underline{106.23}$  is Geometric mean value

Weight	Frequency f	Mid point X	logx	f logx
60-80	22	70	1.845	40.59
80-100	38	90	1.9542	74.25
100-120	45	110	2.0413	91.85
120-140	35	130	2.1139	73.98
140-160	20	150	2.176	43.52
Total	n=160			324.2

## PROPERTIES OF GEOMETRIC MEAN

- The G.M for the given data set is always less than the arithmetic mean for the data set.
- If each object in the data set is substituted by the G.M, then the product of the objects remains unchanged.
- If any data in observations is zero then GM value will also be zero. GM is also not applicable for negative number.
- In calculation of GM the sign of all observations/Data must be same.
- If all observation/data are same then GM is equal to a observation. ( $2 \times 2 \times 2 \times 2$ ) then GM will be 2



## APPLICATION OF GEOMETRIC MEAN

- In manufacturing processes, the geometric mean can be used to calculate average production rates or efficiency levels over time.
- In finance, the geometric mean is used to calculate the average rate of return on investments over multiple periods.
- It is used in finance to find the average growth rates which are also referred to the compounded annual growth rate.
- It is also used in studies like cell division and bacterial growth etc.
- In biology the geometric mean is used to calculate average growth rates in populations.

- That's All
- Feel free to ask me QUESTIONS if there is any?
- Thank you!