What is the Geometric Mean?

The geometric mean stands for a special kind of average of a set of things, products, and the quantification of which is most extensively used to identify the comparative analysis or performance outcomes of an investment, interest rate or portfolio. A geometric mean is mathematically denoted as the "the nth root product of n numbers." It has best applications while working with percentages, which are extracted from values, while the usual arithmetic mean operates with the values themselves. Thus, the geometric mean becomes an influential tool to calculate portfolio performance for many reasons, but one of the most notable is that it takes into consideration the effects of compounding.

How to Calculate the Geometric Mean

In order to calculate Geometric Mean, we multiply the given numbers altogether and then take a square root (given that there are two numbers), or cube root (for three numbers) 5^{th} root (for five numbers) etc.

Thus, the formula for geometric mean is as in the below image;-

(Image to be added soon)

Calculate Compound Interest Using The Geometric Mean — Instantaneous

Let's get you to Calculate compound interest or any investment portfolio as-easy-as- ABC using the geometric mean. If you or any investor wants to compute the compounding interest of 25years using the geometric mean of an investment's return, you need to first calculate the interest in year one, then add the interest rate to next year principal's amount and the chain will follow until 25years.

Suppose you want to calculate a principal amount of Rs. 10,000 on 10% interest rate. Then, for year one, you will have to do Rs.10, 000 * 10%, or 1,000. In second year, the updated principal amount will be 11,000, and 10% of 11,000 is 1,100. The new principal amount is now 11,000 +1,100, or Rs.12, 100. For the third year, the new principal amount is 12,100 plus 10% of 12,100 which is $1,210, so it will be Rs. 13310. At the end of 25 years, Rs. 10,000 turns into Rs. 108,347.06, which is an addition of Rs. 98,347.05 more than the original investment.

However, geometric mean offers you a quick and accurate shortcut which is to multiply the current principal by 1 + the interest rate, and then increase the factor to the number of years compounded. Thus, the calculation is Rs. 10,000 × (1+0.1) 25 = Rs. 108,347.06. Isn't it really a kid's play?

Solved Examples

Problem 1: What is the geometric mean of a camera?

You look to purchase a new DSLR camera.

One camera has a zoom of 250 and receives a 10 in reviews,

The other has a zoom of 290 and gets a 7 in reviews.

Solution:

On using the general arithmetic mean gives (250+10)/2 = 175 vs. (290+7)/2 = 148.5

However, the zoom is such a huge number that the user rating gets disoriented.

Therefore we use the geometric means of the two cameras are:

$\sqrt{}$ (250 × 10) = 50

$\sqrt{}$ (290 × 7) = 41.71...

Thus, although the zoom is about 10% bigger, the lower user rating of 7 is still imperative.

Note: Remember that geometric mean is quite useful when comparing two items with different properties.

Problem 2:

What is the Geometric Mean of 1, 2, 4, 8, and 16?

Solution:

First we have to multiply the given numbers: $1 \times 2 \times 4 \times 8 \times 16 = 1024$

Now, (since there are 5 numbers) take the 5th root: $\sqrt[5]{1024} = 4$

In one line:

Geometric Mean = $\sqrt[5]{(1 \times 2 \times 4 \times 8 \times 16)} = 4$

Thus it comes true that:

$1, 2, 4, 8, 16 = 4 \times 4 \times 4 \times 4 \times 4$

(Image to be added soon)

Fun Facts/ Key Takeaways

- The longer the time span, the more complex compounding becomes and the more accurate the uses of geometric mean.
- Geometric mean is most workable for series that showcase serial correlation, particularly true for investment portfolios, yields on stocks, bond returns and market risk premiums.
- Geometric mean is always ≤ the arithmetic mean (equality bearing only when A=B {supposing two quantities}.
- For unsteady, wayward numbers, the geometric average gives a far more accurate computation of the true return by considering year-over-year compounding that steamrolls the average.
- Whenever you have a number of factors presenting a product, and you seek to determine the "average" factor, the “way out” is the geometric mean.