## Real-World Problem: Compound Interest

**Scenario**: Imagine you have $1,000 to invest in a savings account. The bank offers an annual interest rate of 5%, compounded continuously. How long will it take for your investment to double?

1. We know that the formula for continuous compound interest is given by:

A=P⋅ert

Where:

* + (A) is the final amount (in this case, double the initial investment, so (A = 2P))
  + (P) is the initial principal (initial investment)
  + (r) is the annual interest rate (expressed as a decimal)
  + (t) is the time (in years)
  + (e) is Euler’s number (approximately 2.71828)

1. We want to find the time it takes for the investment to double, so we set up the equation:

2P=P⋅e0.05t

1. Divide both sides of the equation by (P):

2=e0.05t

1. Take the natural logarithm (ln) of both sides:

ln(2)=0.05t

1. Solve for (t):

t=0.05ln(2)​

1. Calculate:

t≈0.050.6931​≈13.86 years

### Answer:

It will take approximately **13.86 years** for your investment to double at an annual interest rate of 5%, compounded continuously.

Remember, logarithms help us solve problems related to exponential growth and decay, making them valuable tools in various real-world scenarios! 🌟

Logarithms are everywhere, even if we don’t always recognize them. Here are some practical applications:

1. **Interest Rates**: When we talk about interest rates, we’re essentially describing numbers in terms of their powers of 10. An interest rate is the logarithm of the growth in an investment. For instance, if an investment grows from $100 to $150 in 5 years, a continuous return of approximately 8.1% (calculated using the natural logarithm) would account for that change.
2. **Scaling Down Large Numbers**: Logarithms simplify insights involving large figures. For example:
   * Google’s daily search page visits
   * Earthquake intensity readings (Richter scale)
   * Sound intensity readings during takeoff (decibel scale)
3. **Human-Friendly Scale**: Large numbers can overwhelm us. Logarithms put numbers on a more manageable scale. Consider:
   * 100=1 (single item)
   * 101=10
   * 103=thousand
   * 106=million
   * 109=billion
   * 1012=trillion
   * 1023 = Number of molecules in a dozen grams of carbon
   * 1080 = Number of molecules in the universe
4. **Counting Multiplication Steps**: Logarithms describe changes in terms of multiplication. With the natural log, each step is approximately e (around 2.71828) times more. Logarithms help us “count” multiplications.

**Follow-Up Questions:**

1. **What is the relationship between logarithms and exponential growth?**
2. **How do logarithms simplify calculations involving large numbers?**

Feel free to explore these questions further! 🤓🔍

[1](https://betterexplained.com/articles/using-logs-in-the-real-world/): [Using Logarithms in the Real World – BetterExplained](https://betterexplained.com/articles/using-logs-in-the-real-world/) [2](https://www.byjusfutureschool.com/blog/how-logarithms-are-used-in-real-life/): [How Logarithms are Used in Real Life? - BYJU’S Future School Blog](https://www.byjusfutureschool.com/blog/how-logarithms-are-used-in-real-life/)[3](https://en.neurochispas.com/algebra/applications-of-logarithms/): [Applications of Logarithms - Neurochispas](https://en.neurochispas.com/algebra/applications-of-logarithms/)

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1 to 3 sentence summary of the article:

New Vocabulary – find 4 words which you are unsure of the definition of, list the word and definition.

1)

2)

3)

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