LOGISTICS

Webpage: www.math.uic.edu/~jbaldwin
email: jbaldwin@uic.edu
CLASS APR 1 OR MAR 30
office hours: 10:00 AM M; 11 AM T 11 AM W (tentative)
Assignments will be on the web.
There will be 3 essays (2 drafts of each and outline of 2nd two) and various short writing assignments. Some will be in class and some for homework.
What does the following sentence from the Chicago Tribune on Jan. 8, 2004 mean?

Between 6 and 8 p.m. most days in November, up to 70 per cent of flights arrived late at O’Hare.
References

Why do we give references?
Some possible answers

- Justify our statements.
- Enable the reader to learn more.
- Give credit to others.
Plagiarism

What is plagiarism?
Some possible answers

Google: a piece of writing that has been copied from someone else and is presented as being your own work

en.wikipedia.org/wiki/Plagiarism:
Plagiarism is the unauthorized use or close imitation of the language and thoughts of another author and the representation of them as one’s own original work.

What is the interest rate?

A bank issues the following prospectus for a CD.

- minimum investment: $10,000
- interest rate: 3.92%
- Compounded daily:
- annual percentage yield: 4%

What does this mean?
Compound interest formula:

\[ A = P(1 + i)^n. \]

\( A \) is \textit{amount} after \( n \) \textit{periods} when a principal of \( P \) dollars invested at an interest rate of \( i \) per period.
Explanation of Bank situation:

interest rate 3.92 %
annual percentage interest: 4%
With calculator.
Discussion of First Essay

Pull up assignment and discuss.
Some variants:

$10,000 at 3.92% compounded daily for 5 years (365 day year)
12165.14103

$10,000 at 3.92% compounded daily for 5 years (360 day year)
12165.13925

$10,000 at 4% compounded annually for 5 years
12166.53

END OF Jan 14
Derivation of Compound Interest formula

1 period: \( A = P(1 + i) \)
2 periods: \( A = [P(1 + i)](1 + i) \)
3 periods: \( A = [P(1 + i)(1 + i)](1 + i) \)
\( n \) periods: \( A = P(1 + i)^n \)
Compounding at shorter periods

5 % compounded quarterly for 3 years: $10,000 \left(1 + \frac{0.04}{4}\right)^{12}$

Further calculator examples.
Continuous Compounding

Let $i$ be the annual interest rate and $n$ be the number of compounding periods per year. The amount after $t$ years is:

$$A = P(1 + \frac{i}{n})^{nt} = P((1 + \frac{i}{n})^n)^t$$

We want to know what happens as $n$ tends to infinity. What $\lim_{n \to \infty}(1 + \frac{i}{n})^n$? Answer: $e^i$.

$$A = Pe^{it}$$
**Rule of 72**

**Rule:** The product of interest rate $i$ in percent times the number $t$ of periods for the principal to double is 72:

$$it = 72.$$  

Justification: We use continuous interest. We want to know when the amount $A$ is twice the original principal. Thus we want to determine the relation between $i$ and $t$ when

$$2P = Pe^{it}.$$  

I.e.

$$2 = e^{it}.$$  

Taking the ln of each side of the equation we have: $0.693 \approx it$. Taking the interest rate in per cent amounts to multiplying both sides of the equation by 100. And we round off 69.3 to 72 so there will be many divisors.
Calculating the Limit

This is too technical for the papers you are writing.

**Definition** \( \ln x = \int_1^x \frac{1}{t} \, dt. \)

By the fundamental theorem of calculus

**Fact** \( \ln' x = \frac{1}{x} \)

So \( \ln'(1) = 1. \)
But by the definition of derivative:

\[ 1 = \ln'(1) \]

\[ = \lim_{n \to \infty} \frac{\ln(1 + \frac{1}{n}) - \ln 1}{\frac{1}{n}} \]

\[ = \lim_{n \to \infty} n(\ln(1 + \frac{1}{n})) \]

\[ = \lim_{n \to \infty} \ln((1 + \frac{1}{n})^n) \]
So $1 = \ln \lim_{n \to \infty} ((1 + \frac{1}{n})^n)$ and therefore $e^1 = \lim_{n \to \infty} ((1 + \frac{1}{n})^n)$. 