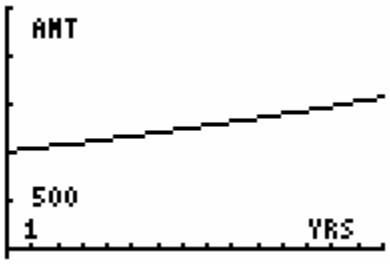
NUMB3RS Activity: Financial Futures
Episode: "Calculated Risk"

Topic: Compounding Interest **Grade Level**: 9 - 12
Objective: Students will use the compound interest formula to predict "futures" for finances.
Time: about 10-15 minutes
Materials needed: graphing calculator

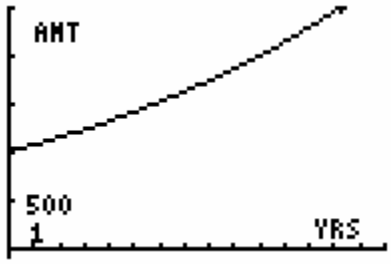
Introduction

Historically, the price of most items we purchase increases over time. Gas prices, for example, 20 years ago were under $1.00 a gallon and now they are over $3.00 a gallon. The ability to predict (or forecast) future prices is an invaluable tool for planning for future events such as college or retirement. Financial institutions are also interested in making sure that there will be enough money to pay their costs at future prices.

Consider how money in a savings account accrues. If you invest the same amount of money in two different banks, then the bank that gives a greater interest rate will produce a greater return on your money, as long as both banks compound the same number of times a year. The money is growing exponentially. This is because the interest paid is added to the invested amount and this new amount earns interest. The graphs below compare the growth of 2 different savings accounts over time. In both cases, the amount deposited is $1000 and the money is compounded quarterly. The first account earns 3% interest and the second earns 7%.



Interest rate of 3%



Interest rate of 7%

Discuss with Students

Numb3rs Example In "**Calculated Risk**," Charlie is helping Don investigate the murder of a businesswoman from an energy company that made its money trading in futures. Trading futures is really just betting on the price of something in the future. It is risky because if the price goes down, you lose money. However, if the price goes up, you make money. Trading futures isn't illegal unless the traders secretly manipulate the future for their benefit. The company relied on predicting how much money it would receive in the future, given that certain events would happen.

Patrick Flynn, Turner High School, Kansas City, KS

One mathematical way to make financial predictions on amounts is by the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$ where *A* is the future money, *P* is the starting amount (principal), *r* is the interest rate written as a decimal, *n* is the number of compounding periods per year, and *t* is time in years. For example, if investing $1,000 at a 7% interest rate, compounded quarterly, for 8 years, *P* = $1,000; *r* = 0.07; *t* = 8; *n* = 4, *A* = the “future dollar amount.” Using the formula, your investment would be worth $1742.21.

Student Page Answers*:* **1.** *A$89331.82;* **2.***$161,103.83* **3.** *0*
4. *Answers vary* **5.** *4444.4 shares* **6.** *$18,888.89* **7.** *approx 47.53%*

Patrick Flynn, Turner High School, Kansas City, KS

Name: _____ Date: _____

NUMB3RS Activity: Financial Futures

Suppose you want to invest $60,000 for ten years. You can invest your money in a CD that earns 4% interest, compounded quarterly and has no risk, or you can invest your money in futures that earn 10% interest, compounded quarterly. However, the second investment has a 25% chance of failing and if it does, you lose all of your money. To determine which investment, you will choose, you will need the compound interest formula: $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where *A* is the future money, *P* is the starting amount (principal), *r* is the interest rate written as a decimal, *n* is the number of compounding periods per year, and *t* is time in years.

1. If you choose to invest in CD's, how much money will you have in 10 years?

2. If you choose to invest in futures, how much money will you have in ten years, if the investment succeeds?

3. How much will you have in ten years if the investment fails?

4. Which investment would you choose? Explain your reasoning.

Many people make investments in individual stocks. Large corporations sell stock to raise money for the company. The way to make money in stocks is to buy it at a low price and sell it at a high price. Suppose you wanted to invest your savings in a stock. This stock was selling for $0.45 a share, and you decided to invest $2,000.

5. How many shares (to the nearest tenth) did you buy? _____

6. After five years your stock is now worth $4.25 per share. How much is your stock investment worth?

_____

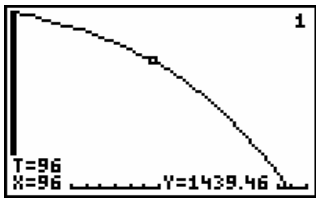
7. At what interest rate would you have had to invest the money to receive the same return, if the money is compounded quarterly?

Patrick Flynn, Turner High School, Kansas City, KS

The goal of this activity is to give your students a short and simple snapshot into a very extensive math topic. TI and NCTM encourage you and your students to learn more about this topic using the extensions provided below and through your own independent research.

Extensions

Activity: Finances on Your Calculator



Using your graphing calculator, you can explore and graph financial situations by setting parameters and seeing how they perform over time.

On the TI-83: use the **FINANCE** button
On the TI-83 Plus or TI-84 Plus families: use the **APPS** button and then select **FINANCE**

The Texas Instruments Activity Exchange lists a number of financial activities. Go to , **education.ti.com/exchange and search on "finance".**

Activity: Playing the Stock Market

Introduction

Most people own stocks in one form or another, and many rely on the money they have tied up in stocks to pay for their retirement years from now. Knowing how the money you invest now will affect your account balance in the future is an important skill to possess.

Additional Resources

For help with investment strategies, visit: **http://www.fool.com/school.htm**

Actual stockbrokers buy and sell stocks daily. See what it is like to be a stockbroker by going to the free web site, "MyStocks" and play. All investors begin with $100,000.
http://investsmart.coe.uga.edu/C001759/stocksquest/mystocks.htm

For the Student

- Pretend you are investing in the stock market. Research stocks in the newspaper or online (for example, at **http://finance.yahoo.com)** and "invest" a given amount. See if you can make your money grow faster than your classmates.
- Explore why the stock market is known as a long-term investment.
- If you enjoy the interplay of business, mathematics, and money, maybe you should look into the field of Actuarial Science. Start your research at: **http://www.utoronto.ca/innis/ProgramHighlights/actuarialscience/**
- In the activity, we assumed that the interest was compounded quarterly. How would the future amounts change if the interest was compounded yearly or monthly (and everything else was the same)? What would it mean to have the interest compounded continuously?
- Determine how much you would have to set aside every two weeks from age 23 to age 65 so that you can retire as a millionaire.

Patrick Flynn, Turner High School, Kansas City, KS

Related Topic:

For an explanation of “present value”, how it is used, and the complexity in calculating it, visit: **http://www.acq.osd.mil/dpap/contractpricing/vol2chap9.htm**

Patrick Flynn, Turner High School, Kansas City, KS