Business Math Handout 3:
Compound Interest: Recursion Model– Investing

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CALCULATORS: Casio: *fx-9750G Plus & CFX-9850G Series*

Name _____ **Date** _____

Discussion

Compound interest is calculated periodically depending on the value of the loan or investment. As you are gaining interest on that loan or investment, that interest is added to the value of the loan; and thus you are essentially earning (or paying) interest on interest. Figuring the value at different times during the investment period becomes a complicated calculation due to the compounding interest and the payments being added to the investment. This calculation requires a recursive function, or a function that repeats itself using the answer from the previous repetition to do the calculation. In the case where payment, $, is made on a loan with percent, *i*:

$$a_{n+1} = (1 + i) \bullet a_n + \$$$

where an is the answer from the previous repetition. If your loan has a long payback period, then you would have to do multiple repetitions to find the value of the loan after a certain period of time. In this activity, you will explore the effect of the investment percent on the value of the investment.

Example Calculations:

The following example shows the effect of an 8% investment as compared to a 5% investment.

Given:
Value of Initial Investment: $5000
Interest Rate: 5% (compounded annually)
Payment: $2400 a year
Find:
How long does it take to reach $1,000,000? _____

Recall Equation:
Solve equation and repeat until it reaches a number greater than $1,000,000:
Year 1 (1.05) x 5000 + 2400 = $7,650
Year 2 (1.05) x 7650 + 2400 = $10,432.50
etc.
Year 62 (1.05) x 991,496.70 + 2400 = 1,043,471.53
It takes 62 years to reach a $1,000,000 goal. You have paid $153,800 including your initial investment.

Given:
Value of Investment: $5000
Interest Rate: 8% (compounded annually)
Payment: $2400 a year
Find:
How long does it take to reach $1,000,000? _____

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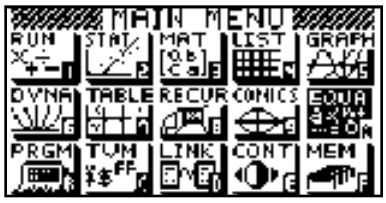
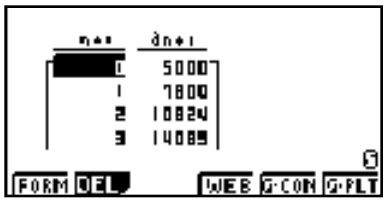
Recall Equation:
Solve equation and repeat until it reaches a number greater than $1,000,000:
Year 1 (1.08) x 5000 + 2400 = $7,800
Year 2 (1.08) x 7800 + 2400 = $10,824
etc.
Year 44 (1.08) x 927832.41 + 2400 = $1,004,459.01
It takes 44 years to reach a $1,000,000 goal. You have paid $110,600 or $43,200 less than at 5%.

Using the Calculator:

- Press the **AC/ON** button, the **MENU** key, and select **8** for RECUR.
- Set the type to $\mathbf{a_{n+1}}$:
  - Press **F3** for type.
  - Select **F2:$\mathbf{a_{n+1}}$**
- Type in the equation:
  - In $\mathbf{a_{n+1}}$ type **1.08 × F4 F2 + 2400 EXE**.
  - Note: the percentage 0.08 and the payment 2400 can be changed depending on the investment parameters.
- Set the table range:
  - Press **F5** for RANG.
  - In start type **0 EXE**. (begin range of years)
  - In end type **70 EXE**. (end range of years)
  - In a_0 type **5000 EXE**. (Initial investment)
  - Press **EXIT** to return to the previous screen.
  - Note: these settings will also change depending on the investment parameters.
- Find where the value is greater than $1,000,000:
  - Press **F6** to view the table.
  - Use the **up and down arrow keys** to scroll through the numbers.





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Practice Problems

Using the following investment parameters, find when the value of each investment is $750,000:

Initial investment: $3000
Interest rate: 7%
Payment: $200 a month _____

Initial investment: $0
Interest rate: 10%
Payment: $10,000 a year _____

Initial investment: $10,000
Interest rate: 5%
Payment: $5,000 a year _____

Initial investment: $6,000
Interest rate: 5%
Payment: $10,000 a year _____