Continuous Compounding

Compounding periods can be yearly, monthly, daily, or hourly. What if compounding occurs every minute, or every second? The number of compounding periods per year is determined by the length of each compounding period.

Objectives:

- Determine the future value of an investment compounded continuously.
- Compare effective annual rates.
- Given an effective annual rate, compute the nominal annual rate.
- Determine the future value of an investment compounded daily.

Example 1:

If $1,000 is invested for 20 years at 8% compounded continuously, what is its future value?

1. Press ⌂on, and select **New** to start a new document. Select **Add Calculator**.

   Note: To round computations to two decimal places, change the Display Digits setting in the Documents Settings to **Fix 2**.

2. Press **Menu > Finance > TVM Functions**. Select **Future Value**.
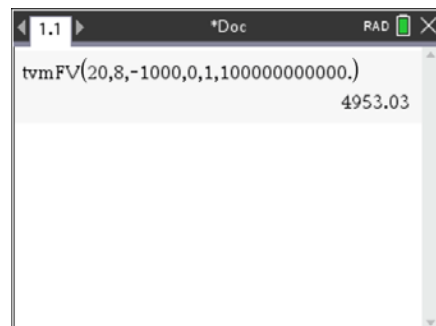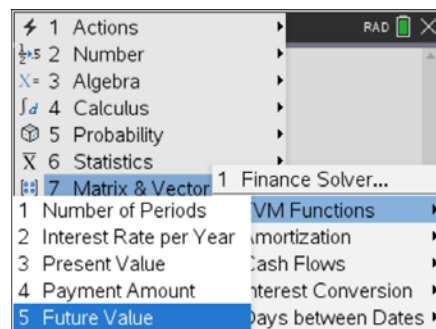
3. The syntax for Future Value is

   tvmFV(N, I, PV, Pmt, [PpY], [CpY], [PmtAt]).

   For this example, enter N = 20, I = 8, PV = -1000, Pmt = 0, PpY =1, and CpY = 1 [EE] 11.

   Note: For continuous compounding, the number of compounding periods per year, CpY, must be a very large number.

   Note: If no value is entered for [PmtAt], the default is at the end of each payment period. The default value for PmtAt is 0.0, which indicates a PmtAt selection of END. To change PmtAt to BEGIN, enter a value of 1.0 for PmtAt.
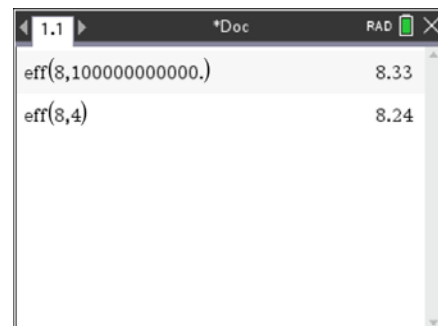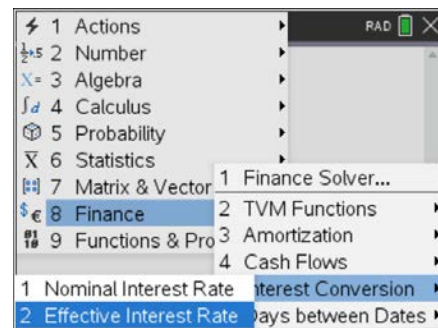
The future value is $4,953.03

Example 2:

What is the effective annual rate for 8% compounded continuously? Compare this with the effective annual rate of 8% compounded quarterly.

1. Press ⌂ on, select **New** to start a new document, and select **Add Calculator**. Alternatively, to add a Calculator page to a current document, press ctrl doc▾, and select **Add Calculator**.

2. Press **Menu > Finance > Interest Conversion** and select **Effective Interest Rate**. The syntax is **eff**(nominal rate, compounding periods per year).

3. For the effective annual rate of 8% compounded continuously, a large number (in this example, 1×10^{11}) is entered for the number of compounding periods per year. Complete the command by typing 8 , 1 EE 11 enter .

4. For the annual rate of 8% compounded quarterly, complete the **eff(** command by typing 8 , 4 enter .
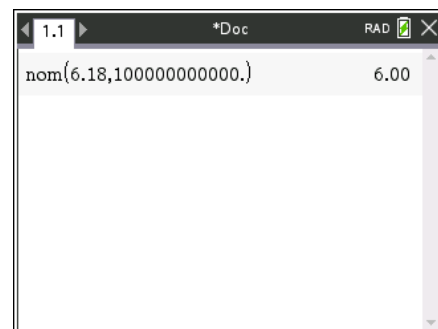
Notice the difference in the effective rates for continuous compounding and quarterly compounding.

Example 3:

Given an effective annual rate of 6.18% compounded continuously, what is the nominal annual rate?

1. Press ⌂ on, select **New** to start a new document, and select **Add Calculator**. Alternatively, to add a Calculator page to a current document, press ctrl doc▾, and select **Add Calculator**.

2. Press **Menu > Finance > Interest Conversion** and select **Nominal Interest Rate**. The syntax is **nom**(effective rate, compounding periods per year).

    The compounding periods for continuous compounding should be entered as a very large number, 1×10^{11}.

3. Complete the command by typing 6.18 , 1 EE 11 enter .

The nominal rate is 6%.

Example 4:

Rachael deposits $100 a month for 5 years in an account that is compounded daily at 8%. How much money will be in her account at the end of 5 years?

1. Press 🏠 on, select **New** to start a new document, and select **Add Calculator**. Alternatively, to add a Calculator page to a current document, press ctrl doc▼, and select **Add Calculator**.

2. Press **Menu > Finance**. Select **Finance Solver**, and enter the values shown except for FV.

    To move from row to row in the Finance Solver, press tab.

3. Place the cursor in the Future Value (FV) row. Press enter to calculate the Future Value.

Rachael will have $7,352.64.

Tab to another row to display the Future Value rounded to two decimal places.