Excel Weeks 6-7 Lab – Financial Mathematics Calculator

Microsoft Excel can be used to record expenditures and incomes, create budget plans, forecasts, create data charts, and much more.

I have an Excel secret to share with you!

> **You can also do Financial Calculations using Excel as a Time Value of Money Calculator.**

It can help you in **making Excel Finance decisions** by incorporating the worth of money in relation to time. It is an **extremely useful tool** for investment bankers and financial analysts.

When Using Excel as a Time Value of Money Calculator, you will be working on the following financial functions:

- → **1 – Present Value (PV)**
- → **2 – Future Value (FV)**
- → **3 – Number of Periods (NPER)**
- → **4 – Interest Rate (RATE)**
- → **5 -Periodic Payments (PMT)**

The list of inputs inside ( ) provide the function with necessary (and sometimes optional) information with which it performs the required calculation. We refer to the inputs as arguments of a function. An argument is like the domain of a function in algebra. We can't calculate the square root of a number unless we specify what that number is.

- **rate** – interest rate divided by k; it is also called the periodic rate
- **nper** – number of years * k; the number of payment periods (which is also the number of compounding periods)
- **pmt** – what we call the "regular payment", also could be a regular withdrawal or payment on a loan, or deposit into a savings annuity; this value is 0 in a compound interest situation with a lump sum payment
- **pv** – or **[pv]** – the brackets make it optional, but we will treat it as necessary; this is the present value of a loan, savings/payout annuity, or investment
- **fv** – or **[fv]** – we will treat it as necessary despite the [ ]; this is the future value of a loan, savings/payout annuity, or investment
- **[type]** – this is set to either 0 or 1; 0 if the payments occur at the end of the compounding period (which is most common) or 1 if the payments occur at the beginning of the compounding period

1. Present Value (PV)

If you want to know the present value of an investment based on a series of future payments, assuming constant periodic payments and a fixed interest rate, you can use the **Excel PV function**.

In Excel Finance, future payments can **either be periodic constant payments or a lump sum** amount at the end of the investment period.

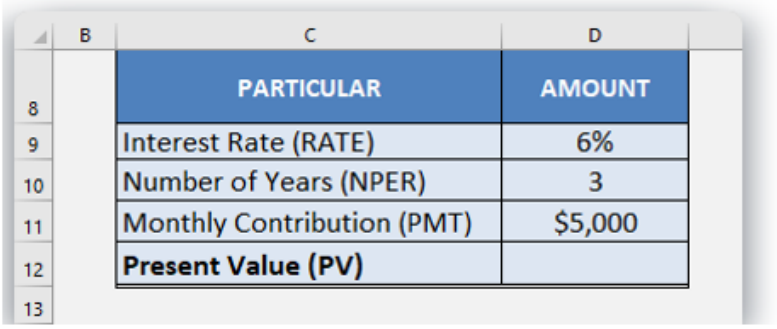
The syntax of the PV Function is:

=PV(rate, nper, pmt, [fv],[type])

Exercise #1: Calculate Present Value of a ***payout annuity*** that involves making regular **monthly** payments

Example 1:

You receive a payment of **$5,000** each month for a **period of 3 years** at an **interest rate of 6%** per annum. Using Excel as a Time Value of Money Calculator, calculate the present value of your payout annuity fund.



	B	C	D
8		PARTICULAR	AMOUNT
9		Interest Rate (RATE)	6%
10		Number of Years (NPER)	3
11		Monthly Contribution (PMT)	$5,000
12		**Present Value (PV)**	
13			

Once we place the appropriate values in for rate, time (in years), and the payment amount, we calculate the present value with

=PV(D9/12, D10*12, D11) We can conclude that the present value is $164,355.

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The reason we see “D9/12” is because interest is compounding monthly.

The reason we see “D10*12” is because payments are made monthly. The number of years is not necessarily the same thing as “NPER = number of periods”. Present value will be negative.

In my own tutorials at youtube.com/@EZMathTV the spreadsheet is set up so that we have a box for the value of k. The Present Value, Future Value, and Regular Payment calculations will work with any value of k we provide.

Exercise #2: Calculate Future Value of an investment (such as a savings annuity) that involves making a lump sum deposit or borrowing a lump sum which needs to be paid in full at the end.

Example 2:

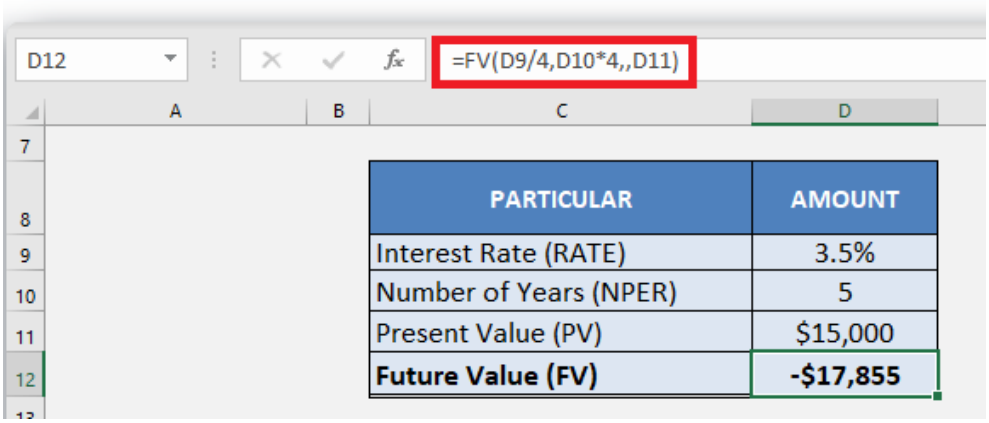
Suppose you have to borrow **$15,000** at an **interest rate of 3.5%** (compounded quarterly) for a period of **5 years**. What will be the loan amount you need to pay at the end of 5 years?

NOTE: This is a lump sum loan! No regular payments/deposits are being made.

Things to note here are:

- *The constant payment amount **(PMT) and the type** of investment will both be **0**.*
- *The **interest rate will be divided by 4** and the **number of years will be multiplied by 4** as the interest rate is compounded quarterly.*

=FV(D9/4, D10*4,,D11)



Exercise #3: Sometimes we know how much we want to invest now, or we know how much we will need in the future but are unsure how long it will take. If we know the interest rate we can solve for the time needed by using the NPER() function.

Example 3:

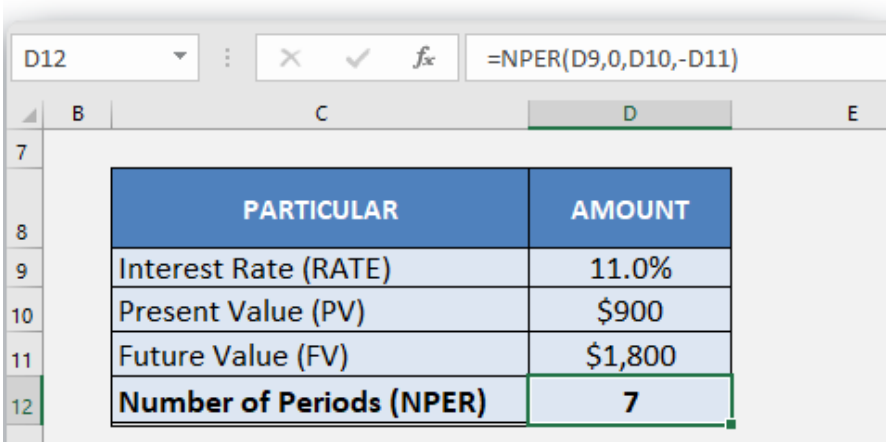
You have **$900** to invest today. In how many years will it **double** if you invest it at an interest rate of **11% compounded annually**?

For this example, the present value will be $900 and the future value will be $1800. Since there is no periodic payment, PMT will be 0.

Lastly, you have to **change the sign of either PV or FV to negative**. It has to done to indicate Excel that one of the amounts is an inflow and the other one is an outflow.

If you skip doing this and leave both PV and FV as positive values, Excel will provide a #NUM error instead of giving you an answer.

=NPER(D9, 0, D10, -D11)



In this example, NPER is also time in years because interest is compounded annually. Our conclusion then is that it will take about 7 years for the account to double in value.

Side note:
Sometimes NPER calculates payment periods, not time in years. In this example, NPER happens to be the same as time in years. But if the compounding periods (k) are multiple times in a year, we need to do this: **YEARS = NPER(#,#,#,,)/k**

Exercise #4: Sometimes we know how much we want to invest now, or we know how much we will need in the future, may even know what our regular payments will be, but we are looking for a favorable rate. We can solve for the interest rate using the RATE() function in Excel.

The syntax of the RATE function is :

=RATE (nper, pmt, pv, [fv],[type],[guess])

The last argument of this function is "guess". It is an optimal argument that is used to provide Excel with an estimate of what the rate could be. If omitted, the default value will be 10%.

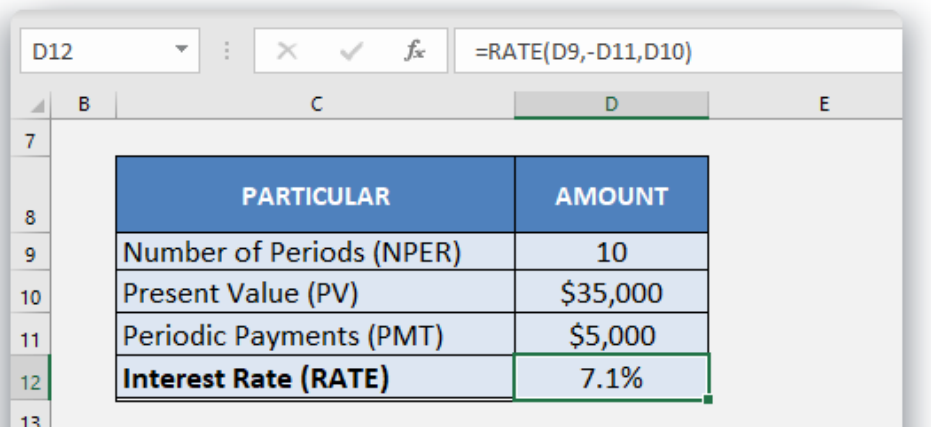
Example 4:

Let's find out the interest rate on a home equity loan of $35,000 that involves annual payments for 10 years with an annual payment of $5000.

Please note that since the monthly payments are an outflow and the present value of the value received is an inflow, you have to **add a negative sign** in front of PMT value to get the answer.

The required formula will be:

=RATE (D9, -D11, D10)



Exercise #5: Sometimes we want to know what our regular payments need to be to pay off a loan or to reach a financial goal in a certain amount of time. We can calculate the regular payment amount using the PMT() function in Excel.

Example 5:

Let's say you borrowed **$15,000** for a period of **3 years**. You have to make **monthly repayments** at the end of each month. What should be the constant monthly payment you should make to repay the entire loan of $15,000 after 3 years?

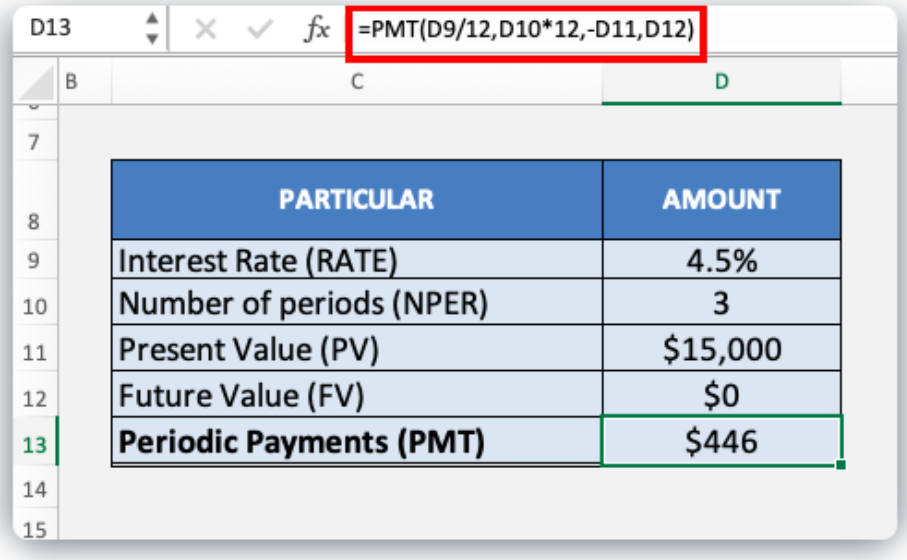
*The payments were made monthly so the **interest rate will be divided by 12** and the **number of years will be multiplied by 12** to give you the number of periods.*

*Also, you have to enter both PV and FV in this example so make sure to **put a negative sign** in front of one of the variables.*

Enter FV as 0 as you aim to repay the entire loan amount!

The formula to be used for this calculation is:

=PMT (D9/12, D10*12, -D11,D12)



You have to make a monthly payment of $446 for a period of 3 years to repay the loan amount of $15,000.