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The internal rate of return (IRR) measures an investment's profitability, taking into account the time value of money. It's the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. In simpler terms, IRR helps investors determine the rate of return they can expect to earn on an investment, considering the timing and size of cash inflows and outflows. IRR is an important tool for evaluating and comparing investments. From venture capitalists assessing the potential of a startup to corporate finance professionals weighing the merits of a new project, IRR provides a standardized way to evaluate and compare the profitability of different investments. The internal rate of return (IRR) is a metric used in capital budgeting to estimate the return of potential investments. MS Excel and Google Sheets have three functions for calculating the IRR.When using different borrowing rates of reinvestment, a modified MIRR is the formula to use.The XIRR function accounts for payments coming in at different times.While IRR is popular for assessing the profitability of potential investments, it has several limitations. Excel has three functions to calculate the IRR: IRR, the modified IRR (MIRR), and IRR for different payment periods (XIRR). IRR is the discount rate that makes the net present value (NPV) of all cash flows from a project equal to zero. It's the expected annual rate of return generated by an investment. However, IRR may give misleading results when comparing projects with different durations or cash flow patterns.MIRR addresses some of the limitations of IRR by accounting for the cost of capital and the reinvestment rate of positive cash flows by assuming that positive cash flows are reinvested at the cost of capital rate and that the initial investment is financed at the financing rate. MIRR provides a more realistic annual rate of return than the IRR.XIRR is an extension of IRR that takes into account the specific dates of cash flows. XIRR is useful when cash flows are not periodic or when the time intervals between cash flows are not equal. IRR computes the rate of return that results in a net present value (NPV) equal to zero. NPV is the difference between the present value of cash inflows and the present value of cash outflows over time. The NPV of a project depends on the discount rate used. So when comparing two investments, the choice of the discount rate, which often is given as an educated guess, will have a substantial influence. The main difference between the IRR and NPV is that NPV is an actual amount, while the IRR is the interest yield as a percentage expected from an investment. Investors typically select projects with an IRR that is greater than the cost of capital. However, selecting projects based on maximizing the IRR instead of the NPV could result in worse financial results. IRR is the actual annual return on investment only when the project generates zero interim cash flows or if those investments can be invested at the present IRR. IRR Represents the expected annual rate of return Expressed as a percentage Determines the discount rate that makes NPV equal to zero Assumes reinvestment of positive cash flows at the IRR Useful for comparing similar projects NPV Represents the present value of future cash flows Expressed as a monetary value Uses a preset discount rate to calculate the value Assumes reinvestment of positive cash flows at the discount rate Provides a clear accept/reject decision based on the NPV value The IRR is the discount rate that can bring an investment's NPV to zero. When the IRR has only one value, this criterion becomes more attractive when comparing the profitability of different investments. For the IRR, you need to have regular intervals (e.g., years). If not, then use XIRR. Let's walk you through the steps with an example. Suppose you have two potential investments with the following cash flows: 1. Real Estate Investment Year Cash Flow 0 -100,000 1 10,000 2 12,000 3 14,000 4 16,000 5 150,000 2. Startup Investment Year Cash Flow 0 -50,000 1 -5,000 2 10,000 3 25,000 4 40,000 Open MS Excel or Google Sheets. Put a heading in cell A2: "(1) Year." In B2, put the heading " (1) Cash Flow." The "1" is to remind you that these are the columns for the first investment. Then put in the year numbers in A2 to A7, then enter the cash flows in cells B2 to B6. The 0-year will be for the initial investment put in. Do the same for the second scenario, the startup investment, in columns C and D, as here: In cell B9, type "=IRR(B2:B7)" for the first scenario. Then input "=IRR(D2:D6)" in cell D9 for the second scenario. The formula is the same for MS Excel and Google Sheets. In this case, you haven't entered a "guess" for the IRR in the formula (you would put this after the cell range and a comma). If no parameters are entered, Excel starts testing IRR values differently for the entered series of cash flows and stops as soon as a rate is selected that brings the NPV to zero. If Excel or Sheets doesn't find any rate reducing the NPV to zero, it could show the error "#NUM." Should that occur, you'll need to use an alternative. Optional alternative: If you have a reasonable estimate of the IRR, you can add a "guess" value within the parentheses of the IRR function. (If you don't, then use 0.1 or 10% initially.) This might help the calculation converge faster or avoid errors if multiple solutions are possible. For instance, if you expect a 15% return for the real estate scenario (1), the formula would be "=IRR(B2:B7, 0.15)." If you expect an 8% return for the startup scenario (2), you would type the formula "=IRR(D2:D6, 0.08)." After applying the IRR function in Google Sheets or Excel, we get the following results: Scenario 1 (real estate investment): The calculated IRR is 18%. This means that, on average, the real estate investment is expected to generate an annual return of 18% over its five-year lifespan. Scenario 2 (startup investment): The calculated IRR is 10%. This suggests that the startup business venture is projected to yield an average annual return of 10% over four years. In this scenario, the real estate investment (1) appears more attractive given its IRR because it offers a higher potential return than the startup (2). However, the IRR is just one element when making an investment decision. You should also consider the following: Risk: The real estate investment might carry different risks (e.g., property market volatility, tenant issues) than the startup (e.g., sector-specific competition, macroeconomic context, market acceptance). Investment time horizon: The real estate investment has a longer time horizon (five years) than the startup (four years), which could affect your preference. Other metrics: The NPV and payback period can help you decide about an investment's profitability and whether it's worthwhile. IRR does not account for the riskiness of different projects. A low-risk project with low returns may be a better investment than one with high risk and high returns. When a company uses different borrowing rates or rates of reinvestment, the MIRR applies. Calculating MIRR in Google Sheets and Excel involves a few extra steps than IRR since you need to put in the finance rate (cost of borrowing) and the reinvestment rate. Here's how to do it: We'll use the same cash flows from the two scenarios above, and we will have different finance and reinvestment rates given the distinct characteristics of these investments. We're calculating the IRR of the investment as in the previous example. However, we'll be looking at how the company will borrow money to plow back into the investment (negative cash flows) at a rate different from the rate of reinvesting part of the positive cash flow. Scenario 1 (real estate investment): Finance rate: 6.5% (mortgage rate)Reinvestment rate: 7% (conservative estimate for rental income reinvestment) Scenario 2 (startup business investment): Finance rate: 9% (higher given the increased risk of startups)Reinvestment rate: 10% (potential for higher returns in a growing business) In cell B10, type "=MIRR(B2:B7, 0.065, 0.07)" for the first scenario. You convert the percentage rates for financing and reinvesting into decimals. The first number in the formula, after the cell range, is the finance rate; the second is the reinvestment rate. Then type "=MIRR(D2:D6, 0.09, 0.10)" in cell D10 for the second scenario. Again, convert the rates into decimals and put them in the correct place after the cell range in the formula. Here is what you should see: Let's look at both scenarios: Scenario 1: The calculated MIRR is 16%, slightly lower than the IRR of 18%. This suggests that while the investment still offers a solid potential return, the actual annualized return might be closer to 16% when considering the reinvestment of profits at a more conservative rate of 7%. This still indicates a favorable investment but provides a more realistic expectation of the return compared with the 18% IRR.Scenario 2: Interestingly, the MIRR is 10%, which matches the IRR in this case. This implies that the assumed reinvestment rate of 10% for the business venture doesn't alter the expected annualized return. This could be because the business might not generate large excess cash flows for reinvestment in its early stages. Here are further points to consider: Sensitivity analysis: You can experiment with different finance and reinvestment rates to see how they affect the MIRR and better understand the investment's potential outcomes. Risk: MIRR, like IRR, doesn't account for risk. Always consider the risk profile of each investment alongside the potential returns. Investors should consider the opportunity costs of each investment, as well as their IRR. A long-term project that ties up capital could end up less profitable than a short-term project whose returns can quickly be reinvested. When your cash flows don't occur at regular intervals (e.g., monthly or annually), the XIRR function is the better tool for calculating the IRR. To use this function, Excel and Google Sheets need both the cash flow amounts and the dates on which those cash flows are paid. Since this wasn't the case in the above examples, we'll adjust our scenarios to below: The cash flows for the real estate and startup investments aren't disbursed at the same time each year, as was the case when calculating IRR and MIRR above. Instead, they occur at different periods. We use the XIRR function below to solve this calculation. Instead, you'll enter the dates and cash flow amounts as above. For investments with cash flows received or cashed at different times for a firm with varying rates of borrowing and reinvestments, Excel and Google Sheets don't have functions that can be used, though they are probably more likely to occur. But to keep things simple, we can certainly work with the above. In cell B9, type "=XIRR(B2:B7, A2:A7)" for the first scenario. This provides the range of dates and the cash flows from each column. The formulas are the same for Google Sheets and Excel. Next, input "=XIRR(D2:D6, C2:C6)" in Cell D9 for the second scenario. The formula is the same for Excel and Google Sheets. In this case, you haven't entered a "guess" for the XIRR in the formula. If no parameters are entered, Excel and Google Sheets start testing IRR values differently for the entered series of cash flows and stop as soon as a rate is selected that brings the NPV to zero. If Excel or Google Sheets doesn't find any rate reducing the NPV to zero, it shows the error "#NUM." Optional alternative: If you have a reasonable estimate of the IRR, you can add a "guess" value within the parentheses of the IRR function. (Typically, 0.1 or 10% is a good start.) This might help the calculation converge faster or avoid errors if multiple solutions are possible. For instance, if you expect a 10% return for the real estate scenario (1), the formula would be "=XIRR(B2:B7, 0.10)." If you expect an 8% return for the startup scenario (2), you would type the formula "=XIRR(D2:D6, 0.08)." Below is the XIRR calculated with this range of data for both scenarios: After applying the XIRR function in both Google Sheets or Excel, we obtained the following annualized rates of return: Scenario 1 (real estate investment): The calculated XIRR is 35%. This suggests that the real estate investment, with its irregular cash flow timings, is expected to generate an impressive average annual return of 35% over its holding period.Scenario 2 (startup business investment): The calculated XIRR is 10%. This indicates that despite the irregular cash flow pattern, the startup business venture is projected to yield an average annual return of 10% over its investment period. As such, the real estate investment (Scenario 1) demonstrates a significantly higher XIRR than the business venture (Scenario 2). This means that the real estate investment is expected to outperform the startup in annualized return despite the uneven timing of cash flows. Here are further considerations: Risk: While the XIRR of 35% for the real estate investment is appealing, it's important to consider the risks with this type of investment. The real estate market can be volatile, especially in changing interest rate environments, and unexpected expenses or vacancies may affect your actual returns. Time horizon: The two investments have slightly different time horizons. While the real estate investment spans about three years, the startup venture spans around two years. This difference in time frame should be taken into account when comparing the XIRR values. Investment decisions shouldn't be based on XIRR or any other single element. Remember to account for your risk tolerance, liquidity and diversification needs, and portfolio goals when deciding on your investments. Internal rate of return measures the profitability of an investment. Investors compare the expected internal rate of return of different projects when they are deciding on the best projects to put their money into. Calculating the internal rate of return requires a complex calculation that accounts for expenses, profits, and how long it takes to generate returns. Spreadsheet software like Excel and Google Sheets make the calculation easy with the built-in IRR, XIRR, and MIRR functions. Excel and Google Sheets have IRR functions programmed to run 20 iterations to find a value that is accurate to within 0.00001%. If the program can’t find one, then it returns "#NUM" in the cell. In addition, ensure there's at least one negative value, that your other fields are formatted correctly, and that you’ve selected the right ones. If there's still a problem, you'll need to enter a "guess" after the range of cells, such as 10% or 0.1, to help it come to an answer. The IRR results in Excel or Google Sheets represent the annual rate of return for a project or investment. If the IRR is greater than the required rate of return (or the cost of capital), the project is considered profitable. However, if the IRR is lower than the required rate of return, the project may not be doable. One notable drawback is that IRR assumes that all cash flows are reinvested at the same rate as the IRR itself, which isn't realistic. In addition, IRR can be misleading when comparing projects of different durations or sizes since it can't account for the scale of an investment or the absolute dollar value of returns. As such, it might favor smaller projects with higher returns over larger projects with lower returns but higher net cash flows. In capital planning, a typical use of IRR is to compare the profitability of establishing new operations versus expanding existing ones. For instance, a company might use IRR to decide whether to open a new retail outlet or to renovate and expand an existing one. While both could add value to the company, IRR can help determine which option is more worthwhile. Using the IRR formula in a spreadsheet application is a potent way to assess the profitability and feasibility of investments. Using the IRR function, you can easily calculate the internal rate of return based on a series of cash flows. The result provides an annual rate of return, which can be compared with the required rate of return or cost of capital to determine the project's viability. Excel and Google Sheets also have XIRR and MIRR functions for projects with irregular cash flows or timing. However, it's crucial to also understand the limitations of IRR, such as its assumptions about reinvestment rates and its potential to give misleading results in specific scenarios. When using IRR in Excel or Google Sheets, it's wise to consider other financial metrics, such as NPV, and carefully evaluate the assumptions and risks associated with the investment as you make your decision. Last week, I covered how to calculate discounted cash flow. In this post, I’ll build off that worksheet and show you how you can calculate the internal rate of return (IRR) in Excel. IRR tells you the return that you’re making on an investment or project, and at what discount rate the net present value of all the cash flows will be zero. In these scenarios, there’s typically an outlay of cash, usually at the beginning. In my previous example, I only looked at cash flows coming in. This time, I’ll look at a scenario where you pay money out at the beginning and generate cash flow in future periods. A common example is paying to upgrade a piece of equipment and then generating cost savings from it for x number of years. Knowing the IRR can tell you if you’re making enough of a return off of the investment and whether you should move forward with it. Using IRR can also be helpful when you’re comparing multiple options to see which one is the best one. This step is about the same as when setting up the discounted cash flow template. You’ll need to enter the different years, the cash you expect to come in or out, and then calculate back what the present value is today. Here’s what the file looks like setting in a scenario where you pay $100,000 upfront and then generate $10,000 in cash flow for 25 years. At a 5% discount rate, in this example the present value of all that cash flow is a positive $40,939.45: The problem here is the discount rate can be difficult to determine, and that can have a significant impact on your overall returns. And so rather than worry about what your discount rate should be, you only need to determine the IRR — which is to say at what point would your present value be worth $0? If you need a higher return than the IRR the project would be a no-go but if you’re okay with anything up to and including the IRR, then the project or investment would be passable. What it comes down to is the lower the IRR is, the worse the investment is There are a couple of different ways to calculate IRR in Excel. One way is through a formula called XIRR. It only has two required arguments — dates and cash flow. This is why in this example I entered dates for my cash flows rather than just numbering the years. This makes it easier for me to use the XIRR formula. In my spreadsheet, I enter the following formula: =XIRR(D6:D31,C6:C31) Column D contains my cash flow and column C contains the dates. Doing this, Excel tells me the IRR is 9.687% for this specific project. But if I work backwards and calculate the net present value, it doesn’t get me right to 0: It certainly gets close to 0 and it’s probably close enough that it can help you make a decision about your investment. However, there’s another way to calculate IRR and that’s using Excel’s What-If Analysis. On the Data tab, there’s a drop-down for this option in the Forecast section: Depending on which version of Excel you’re using, it may show a bit differently, but what you’re ultimately looking for is Goal Seek. Goal Seek is an accelerated way of doing trial-and-error. Excel’s doing it for you much quicker than you could ever do it by yourself. For IRR, it’s the best solution. Here’s how it works. You’ll need to enter the cell that you want to get to a certain value, what value that is, and which cell Excel should be changing values in. In my spreadsheet, E2 is where my net present value formula is, and I want that to equal 0. In cell B2 is my discount rate, which is what I want Excel to be changing. Here are what my inputs look like: Then, once I click on OK, Excel goes to work. After a few seconds you should see Excel show you that the target value and the current value are a match (e.g. they’re both 0), meaning it’s done its job successfully: Now, if I look at my template, I see a different discount rate and my total present value is netting out to 0: As you can see, this is much more accurate than Excel’s XIRR function. You can repeat these steps and make this table for other projects that you can assess side-by-side. If you’d like to test this out, try downloading the discounted cash flow spreadsheet from my last post and then just using Goal Seek or the XIRR function to determine your IRR. You can remove unnecessary columns from the sheet and then duplicate the table, and then you’ve got a template where you can assess multiple investments against one another. If you liked this post on how to calculate IRR in Excel, please give this site a like on Facebook and also be sure to check out some of the many templates that we have available for download. You can also follow us on Twitter and YouTube. When working with capital budgeting, IRR (Internal Rate of Return) is used to understand the overall rate of return a project would generate based on its future series of cash flows. In this tutorial, I will show you how to calculate IRR in Excel, how is it different from another popular measure NPV, and different scenarios where you can use in-built IRR formulas in Excel. IRR is a discount rate that is used to measure the return of an investment based on periodical incomes. The IRR is shown as a percentage and can be used to decide whether the project (an investment) is profitable for a company or not. Let me explain IRR with a simple example. Suppose you’re planning to buy a company for $50,000 that will generate $10,000 every year for the next 10 years. You can use this data to calculate the IRR of this project, which is the rate of return you get on your investment of $50,000. In the above example, the IRR comes out to be 15% (we will see how to calculate that later in the tutorial). This means that it is equivalent to you investing your money at a 15% rate or return for 10 years. Once you have the IRR value, you can use it to make decisions. So if you have any other project where the IRR is more than 15%, you should invest in that project instead. Or, if you’re planning to take a loan or raise capital and buy this project for $50,000, make sure that the cost of the capital is less than 15% (else you pay more as the cost of the capital than you make from the project). Excel allows you to calculate the internal rate of return using the IRR function. This function has the following parameters: =IRR(values, [guess]) values – an array of cells that contain numbers for which you want to calculate the internal rate of return. guess – a number that you guess is close to the result of the IRR (it’s not mandatory, and by default is 0.1 – 10%). This is used when there is a possibility of getting several results, and in that case, the function returns a result closest to a guess argument value. Here are some important prerequisites for using the function: IRR function will only consider numbers in the specified range of cells. Any logical values or text strings in the array or reference argument would be ignored The amounts in the values parameter must be formatted as numbers The ‘guess’ parameter must be a percentage, formatted as decimal (if it’s provided) A cell where the function result is displayed must be formatted as a percentage The amounts occur at regular time intervals (months, quarters, years) One amount must be a negative cash flow (representing the initial investment), and other amounts should be positive cash flows, representing periodical incomes All amounts should be in chronological order because the function calculates the result based on the order of the amounts In case you want to calculate the IRR value where the cash flow comes at different time intervals, you should use the XIRR function in Excel, which also allows you to specify the dates for each cash flow. An example of this is covered later in the tutorial Now, let’s have a look at some example to better understand how to use the IRR function in Excel. Suppose you have a dataset as shown below, where we have the initial investment of $30,000 and then varying cash flow/income from it for the next six years. For this data, we need to calculate the IRR, which can be done using the below formula: =IRR(D2:D8) The result of the function is 8.22%, which is the IRR of the cash flow after six years. Note: If the function returns a #NUM! error, you should fill the ‘guess’ parameter in the formula. This happens when the formula thinks that multiple values can be correct, and needs to have the guess value, in order to return the IRR nearest to the guess we provided. In most cases, you won’t need to use this though You can also calculate the IRR for every period in a cash flow and see when exactly the investment is starting to have a positive internal rate of return. Suppose we have the below dataset where I have all the cashflows listed in column C. The idea here is to find out the year in which the IRR of this investment turns positive (indicating when the project breaks even and becomes profitable). To do this, instead of calculating the IRR for the entire project, we will find out the IRR for each year. This can be done by using the below formula in cell D3 and then copying it for all the cells in the column. =IRR($C$2:C3) As you can see, the IRR after year 1 (values D2:D3) is -80%, after year 2 (D2:D4) -52%, etc. This overview shows us that the investment of $30.000 with given cash flow has a positive IRR after the fifth year. This can be useful when you’ve to choose from two project that have a similar IRR. It would be more lucrative to choose a project where the IRR turns positive faster, as it means less risk of recovering your initial capital. Note that in the above formula, the reference of the range is mixed, that is the first cell reference ($C$2) is locked by having dollars signs before the row number and the column letter, and the second reference (C3) is not locked. This makes sure that when you copy the formula down, it always considers the entire column till the row where the formula is applied. The IRR function in Excel can also be used to compare several projects’ investments and returns and see which project is the most profitable. Suppose you have a dataset as shown below, where you have three projects with an initial investment (which is shown in negative as it’s an outflow) and then a series of positive cash flows. To get the best project (that has the highest IRR, we will have to calculated the IRR for each project using the simple IRR formula: =IRR(C2:C8) The above formula will give the IRR for project 1. Similarly, you can also calculate the IRR for the other two projects. As you can see: Project 1 has an IRR of 5.60% Project 2 has an IRR of 1.75% Project 3 has an IRR of 14.71%. If we suppose that the cost of capital is 4.50%, we can conclude that investment 2 is not acceptable (as it will lead to a loss), while Investment 3 is the most profitable, with the highest internal rate of return. So if you have to make a decision to invest in only one project, you should go with Project 3, and if you could invest in more than one projects, you can invest in Project 1 and 3. Definition: If you’re wondering what’s is a cost of capital – it’s the money you will have to pay to get access to the money. For example, if you take $100K on a loan at 4.5% per year, your cost of capital is 4.5%. Similarly, if you issue preferential shares promising a 5% return to get 100K, your cost of capital would be 5%. In real-life scenarios, a company usually raises money from various sources, and its cost of capital is a weighted average of all these capital sources. One of the limitations of the IRR function in Excel is that the cashflows must be periodic with the same interval between them. But in real life, there can be instances where your projects pay off in irregular intervals. For example, below is a dataset where the cashflows take place at irregular intervals (see dates in column A). In this example, we can not use the regular IRR function, but there is another function that can do this – the XIRR function. XIRR function takes the cashflows as well as the dates, which allows it to account for irregular cashflows and give the correcyt IRR. In this example, the IRR can be calculated using the below formula: =XIRR(B2:B8,A2:A8) In the above formula, the cashflows are specified as the first argument and the dates are specified as the second argument. In case this formula returns a #NUM! error, you should enter the third argument with an approximate IRR that you expect. Don’t worry, it doesn’t have to be exact or even very close, just an approximation of what IRR you think it would yield. Doing this helps the formula iterate better and gives the result. When it comes to evaluating projects, both NPV and IRR are used, but NPV is the more reliable method. NPV is the Net Present Value method where you evaluate all the future cash flows and calculate what will be the net present value of all those cashflows. If this value comes out to be higher than your initial outflow, then the project is profitable, else the project is not profitable. On the other hand, when you calculate IRR for a project, it tells you what would be the rate of return all the future cash flow so that you get the amount equivalent to the current outflow. For example, if you’re spending $100K today on a project which has an IRR or 10%, it tells you that if you discount all the future cash flows at 10% discount rate, you will get $100K. While both methods are used while evaluating projects, using the NPV method is more reliable. There is a possibility that you may get conflicting results when evaluating a project using the NPV and the IRR method. In such a case, it is best to go with the recommendation you get using the NPV method. In general, IRR method has some drawbacks, which make NPV method more reliable: Higher or method assumes that all the future cash flows generated from a project would be reinvested at the same rate of return (i.e., the IRR of the project). in most cases, this is an unreasonable assumption, as most of the cash flows would be reinvested into other projects which can have a different IR or insecurity such as bonds which would have a much lower rate of return. In case you have multiple outflows and inflows in the project, there would be multiple IRRs for that project. This again makes comparison a lot difficult. Despite its shortcomings, IRR is a good way to evaluate a project and can be used in conjunction with the NPV method when you are deciding on which project(s) to choose. In this tutorial, I showed you how to use the IRR function in Excel. I also covered how to calculate the IRR in case you have irregular cash flows using the XIRR function. I hope you found this tutorial useful! Other Excel tutorials you may also like: Enter Your Cash FlowsEnter IRR Formula >> Press Enter Preview ResultsEver wondered how businesses decide which projects are worth investing in? The Internal Rate of Return (IRR) is a key financial metric that helps evaluate the profitability of investments. But calculating it manually can be tricky—thankfully, Excel’s IRR function makes it easy. Whether you’re analyzing uneven cash flows, comparing multiple projects, or just learning about financial metrics, this guide will show you how to calculate IRR in Excel step by step.In this article, we’ll break down the Excel IRR formula with examples, explain the difference between IRR vs. NPV, and even cover advanced calculations like XIRR and MIRR. By the end, you’ll know how to use the IRR function like a pro and make smarter investment decisions.How to Calculate IRR FunctionWhat Is Internal Rate of Return (IRR)The Internal Rate of Return (IRR) is the annualized rate of return at which the Net Present Value (NPV) of all cash flows (both positive and negative) from an investment equals zero. It’s commonly used to compare the profitability of different investments or projects.IRR > Required Rate of Return: The investment is profitable.IRR < Required Rate of Return: The investment is not profitable.Why Use the IRR Function in ExcelEasy Calculation: Automates complex IRR calculations.Compare Investments: Evaluate multiple projects or investments side by side.Decision-Making: Helps determine whether to proceed with a project or investment.Net Present Value vs Internal Rate of ReturnNet Present Value (NPV) and Internal Rate of Return (IRR) are both used to evaluate investment profitability, but they serve different purposes:NPV calculates the net value of future cash flows in today's terms using a discount rate. It helps determine if an investment will increase value.IRR finds the discount rate where NPV = 0, showing the expected annual return on an investment. It is useful for comparing project profitability.For a detailed comparison, check out Difference between NPV and IRR.Formula for Calculating Internal Rate of Return (IRR) in ExcelThe syntax for the IRR function in Excel is:=IRR(values, [guess])values: A range of cash flows (must include at least one negative and one positive value).guess (optional): An estimated guess for the IRR (default is 10%).How to Calculate IRR in Microsoft Excel: Step by Step GuideThe Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of investments. Excel’s IRR function makes it easy to calculate IRR. Here’s a quick step-by-step guide to calculate basic IRR Calculation. Step 1: Enter Cash Flow Data in ExcelList all cash flows in a column, including the initial investment (as a negative value).Example: Enter Cash FlowsStep 2: Use the IRR Formula In a blank cell, enter the formula:=IRR(A1:A5)A1:A5: The range of cash flows.Step 3: Press Enter & Preview ResultsExcel will calculate and display the IRR as a percentage.Result: 25%Preview ResultsHow to use XIRR Function in Excel (IRR for Irregular Cash Flows)XIRR (Extended Internal Rate of Return) is a financial function used to calculate the annualized return of irregular cash flows over time. Unlike IRR, which assumes equal time gaps between cash flows, XIRR accounts for actual dates, making it more accurate for real-world investments.When to Use XIRRWhen cash flows occur on different dates (e.g., investments, SIPs, loan repayments).To measure the true return on investments in stocks, mutual funds, or private equity.For personal finance planning when tracking irregular deposits and withdrawals.Follow the below steps to calculate IRR Function in Excel: For Example: A venture capitalist invests $50,000 in a startup and receives cash returns at different times:Step 1: Enter the Data into the SheetEnter the Data into the Sheet. Date in Column A and cash flows in Column B.Enter Data into the SheetStep 2: Enter the Formula In an empty cell, write the formula.=XIRR(B2:B5, A2:A5)Step 3: Press Enter and Preview ResultsExcel returns 18.9%, meaning the investment has an annualized return of 18.9%.Preview ResultHow to use MIRR Function in Excel (Modified Internal Rate of Return)MIRR (Modified Internal Rate of Return) is an improved version of IRR (Internal Rate of Return) that considers both the cost of investment and the reinvestment rate of cash flows. This makes MIRR more realistic for evaluating project profitability.You can easily calculate MIRR in Excel using the built-in MIRR Function. Here are the following steps to calculate MIRR in Excel:Example: A company invests $100,000 in expanding its operations with varying annual returns. The company borrows at 8% and reinvests at 10%.Step 1: Enter the DataEnter the year in Column A and cash flows in Column B.Calculate MIRR Function in ExcelStep 2: Assume Finance rate = 8%Reinvestment rate = 10%Step 3: Use the Below FormulaIn the blank cell, use the below formula:=MIRR(B2:B6, D3, D4)Step 4: Preview ResultsPress Enter and Preview Results. Excel returns 18%, showing a more realistic return than standard IRRPreview ResultsExample 1: Calculate IRR with Uneven Cash FlowsScenario: You have irregular cash flows over five years.Step 1: Enter the Data into the Sheet Enter the cash flows in a columnEnter the DataStep 2: Enter the Formula and Press Enter In a blank cell, enter the formula:=IRR(A2:A6)Enter the Formula and Press Enter Step 3: Preview ResultPreview the Result that is 23%.Preview ResultExample 2: IRR for Multiple ProjectsScenario: Compare two projects to determine which is more profitable.Step 1: Enter Cash Flows Enter cash flows for Project A and Project BEnter Cash Flows Step 2: Enter the FormulaSelect a Blank Cell and Enter the Formula =IRR(A2:A6)=IRR(B2:B6)Step 3: Preview ResultsPreview the Results that is: For Project A: 22%For Project B: 24%Conclusion: Project B has a higher IRR and is more profitable.Preview ResultsShortcut Keys for IRR, XIRR, and MIRR in ExcelActionShortcut KeyOpen Formula BarF2Apply FormulaEnterOpen Function WizardShift + F3Recalculate FormulasF9How to Fix if XIRR, IRR, and MIRR Errors in ExcelWhen working with XIRR, IRR, and MIRR functions in Excel, you may encounter various errors due to incorrect data formatting, missing values, or calculation issues. Below are some of the most common errors and their solutions to help you resolve them quickly..1. Getting #NUM! ErrorReason: Incorrect cash flow order or missing dates.Fix: Ensure dates are in chronological order.2. XIRR Returns a Negative ValueReason: Net cash inflows are less than the initial investment.Fix: Verify that future cash flows are positive.3. IRR Calculation Doesn't ConvergeReason: Multiple IRRs exist due to fluctuating cash flows.Fix: Use MIRR, which provides a more stable return estimate.Limitations of the IRR FunctionMultiple IRRs: Projects with alternating cash flows may have multiple IRRs.Reinvestment Assumption: IRR assumes reinvestment at the same rate, which may not be realistic.No Scale Consideration: IRR does not account for the size of the investment.Tips for Using the IRR FunctionUse Consistent Cash Flows: Ensure cash flows are entered in chronological order.Include Initial Investment: Always include the initial investment as a negative value.Compare with NPV: Use IRR alongside NPV for better decision-making.Adjust Guess for Accuracy: If Excel returns an error, adjust the guess value.ConclusionMastering the IRR function in Excel is a game-changer for anyone involved in financial analysis or investment planning. With this step-by-step guide for the IRR function, you’ve learned how to calculate IRR in Excel, handle uneven cash flows with XIRR, and adjust for reinvestment rates using MIRR. You’ve also explored the differences between IRR vs. NPV and tackled common errors and limitations.Whether you’re evaluating a single project or comparing multiple investments, the IRR formula is a powerful tool to measure profitability. Ready to put your new skills to work? Open Excel, follow the examples, and start making data-driven decisions today. The tutorial shows how to calculate IRR of a project in Excel with formulas and the Goal Seek feature. You will also learn how to create an internal rate of return template to do all IRR calculations automatically. When you know the internal rate of return of a proposed investment, you may think you have all you need to evaluate it - the bigger the IRR the better. In practice, it's not that simple. Microsoft Excel provides three different functions to find the internal rate of return, and truly understanding what you are actually calculating with IRR will be very helpful. The internal rate of return (IRR) is a commonly used metric to estimate the profitability of a potential investment. Sometimes, it is also referred to as discounted cash flow rate of return or economic rate of return. Technically, IRR is the discount rate that makes the net present value of all cash flows (both inflows and outflows) from a certain investment equal to zero. The term "internal" indicates that IRR takes into account only internal factors; external factors such as inflation, the cost of capital and various financial risks are excluded from calculation. In capital budgeting, IRR is widely used to evaluate the profitability of a prospective investment and rank multiple projects. The general principle is as simple as this: the higher the internal rate of return, the more attractive the project is. When estimating a single project, finance analysts typically compare the IRR to a company's weighted average cost of capital or hurdle rate, which is the minimum rate of return on an investment that the company can accept. In a hypothetical situation, when IRR is the only criterion for making a decision, a project is considered a good investment if its IRR is greater than the hurdle rate. If the IRR is lower than the cost of capital, the project should be rejected. In practice, there are a lot of other factors that influence the decision such as the net present value (NPV), payback period, absolute return value, etc. Though IRR is a very popular method for assessing capital projects, it does have a number of inherent flaws that may lead to suboptimal decisions. The main problems with IRR are: Relative measure. IRR considers percentage but not the absolute value, as the result, it can favor a project with a high rate of return but a very small dollar value. In practice, companies may prefer a large project with a lower IRR over a small one with a higher IRR. In this respect, NPV is a better metric because it considers an actual amount gained or lost by undertaking a project. The same reinvestment rate. IRR assumes that all cash flows generated by a project are reinvested at the rate equal to the IRR itself, which is a very unrealistic scenario. This problem is solved by MIRR that allows specifying different finance and reinvest rates. Multiple results. For projects with alternating positive and negative cash flows, more than one IRR can be found. The issue is also resolved in MIRR, which is designed to produce only one rate. Despite these deficiencies, IRR continues to be an important measure of capital budgeting and, at the very least, you should cast a skeptical look at it before making an investment decision. As the internal rate of return is the discount rate at which the net present value of a given series of cash flows is equal to zero, the IRR calculation is based on the traditional NPV formula: If you are not very familiar with the summation notation, the extended form of the IRR formula may be easier to understand: Where: CF0 - the initial investment (represented by a negative number) CF1, CF2 … CFn - cash flows i - the period number n - periods total IRR - internal rate of return The nature of the formula is such that there is no analytical way to calculate IRR. We have to use the "guess and check" approach to find it. To better understand the concept of the internal rate of return, let's perform an IRR calculation on a very simple example. Example: You invest $1000 now and get back $500 and $660 in the next 2 years. What discount rate makes the Net Present Value zero? As our first guess, let's try 8% rate: Now: PV = -$1,000 Year 1: PV = $500 / (1+0.08)1 = $462.96 Year 2: PV = $660 / (1+0.08)2 = $565.84 Adding those up, we get the NPV equal to $28.81: Oh, not even close to 0. Maybe a better guess, say 10%, can change things? Now: PV = -$1,000 Year 1: PV = $500 / (1+0.1)1 = $454.55 Year 2: PV = $660 / (1+0.1)2 = $545.45 NPV: -1000 + $454.55 + $545.45 = $0.00 That's it! At 10% discount rate, the NPV is exactly 0. So, the IRR for this investment is 10%: That's how you calculate the internal rate of return manually. Microsoft Excel, other software programs and various online IRR calculators also rely on this trial and error method. But unlike humans, computers can do multiple iterations very quickly. Microsoft Excel provides 3 functions for finding the internal rate of return: IRR - the most commonly used function to calculate the internal rate of return for a series of cash flows that occur at regular intervals. XIRR – finds IRR for a series of cash flows that occur at irregular intervals. Because it takes into consideration the exact dates of payments, this function provides a better calculation accuracy. MIRR – returns the modified internal rate of return, which is a variant of IRR that considers both the cost of borrowing and compounded interest received on the reinvestment of positive cash flows. Below you will find the examples of all these functions. For the sake of consistency, we will be using the same data set in all the formulas. Suppose you are considering a 5-year investment with the cash flows in B2:B7. To work out the IRR, use this simple formula: =IRR(B2:B7) Note. For the IRR formula to work correctly, please make sure that

your cash flows have at least one negative (outflow) and one positive value (inflow), and all the values are listed on chronological order. For more information, please see the Excel IRR function. In case of cash flows with unequal timing, using the IRR function can be risky, as it assumes that all payments occur at the end of a period and all time periods are equal. In this case, XIRR would be a wiser choice. With the cash flows in B2:B7 and their dates in C2:C7, the formula would go as follows: =XIRR(B2:B7,C2:C7) Notes: Though the XIRR function does not necessarily require dates in chronological order, the date of the first cash flow (initial investment) should be first in the array. The dates must be provided as valid Excel dates; supplying dates in text format puts Excel at risk of misinterpreting them. The Excel XIRR function uses a different formula to arrive at a result. The XIRR formula discounts subsequent payments based on a 365-day year, as the result, XIRR always returns an annualized internal rate of return. For more details, please see the Excel XIRR function. To handle a more realistic situation when the project funds are reinvested at a rate closer to a company's cost of capital, you can compute the modified internal rate of return by using a MIRR formula: =MIRR(B2:B7,E1,E2) Where B2:B7 are cash flows, E1 is the finance rate (the cost of borrowing the money) and E2 is the reinvest rate (the interest received on the reinvestment of earnings). Note. Because the Excel MIRR function computes compound interest on profits, its result may be substantially different from those of the IRR and XIRR functions. I believe no one can give a generic answer to this question because the theoretical basis, advantages and drawbacks of all three methods are still disputed among finance academics. Perhaps, the best approach would be to do all three calculations and compare the results: Generally, it is considered that: XIRR provides better calculation accuracy than IRR because it takes into consideration the exact dates of cash flows. IRR often gives an unduly optimistic assessment of the project's profitability, while MIRR gives a more realistic picture. If you need to do IRR calculation in Excel on a regular basis, setting up an internal rate of return template can make your life a lot easier. Our calculator will include all three formulas (IRR, XIRR, and MIRR) so that you won't have to worry which result is more valid but could consider them all. Input the cash flows and dates in two columns (A and B in our case). Enter the finance rate and reinvest rate in 2 separate cells. Optionally, name these sells Finance_rate and Reinvest_rate, respectively. Create two dynamic defined ranges, named Cash_flows and Dates. Assuming your worksheet is named Sheet1, the first cash flow (initial investment) is in cell A2, and the date of the first cash flow is in cell B2, make the named ranges based on these formulas: Cash_flows: =OFFSET(Sheet1!$A$2,0,0,COUNT(Sheet1!$A:$A),1) Dates: =OFFSET(Sheet1!$B$2,0,0,COUNT(Sheet1!$B:$B),1) The detailed steps can be found in How to create a dynamic named range in Excel. Use the names you have just created as arguments of the following formulas. Please note that the formulas can be entered in any column other than A and B, which are reserved exclusively for cash flows and dates, respectively. =IRR(Cash_flows) =XIRR(Cash_flows, Dates) =MIRR(Cash_flows, Finance_rate, Reinvest_rate) Done! You can now input any number of cash flows in column A, and your dynamic internal rate of return formulas will recalculate accordingly: As a precaution against careless users who may forget to fill all the required input cells, you can wrap your formulas in the IFERROR function to prevent errors: =IFERROR(IRR(Cash_flows), "") =IFERROR(XIRR(Cash_flows, Dates), "") =IFERROR(MIRR(Cash_flows, Finance_rate, Reinvest_rate), "") Please keep in mind that if the Finance_rate and/or Reinvest_rate cells are blank, the Excel MIRR function assumes they are equal to zero. The Excel IRR function only performs 20 iterations to arrive at a rate and XIRR performs 100 iterations. If after that many iterations a result accurate within 0.00001% is not found, a #NUM! error is returned. If you are looking for more accuracy for your IRR calculation, you can force Excel to do over 32,000 iterations by using the Goal Seek feature, which is part of What-If Analysis. The idea is to get Goal Seek to find a percentage rate that makes the NPV equal to 0. Here's how: Set up the source data in this way: Enter the cash flows in a column (B2:B7 in this example). Put the expected IRR in some cell (B9). The value that you enter does not actually matter, you just need to "feed" something to the NPV formula, so just put any percentage that comes to mind, say 10%. Enter the following NPV formula in another cell (B10): =NPV(B9,B3:B7)+B2 On the Data tab, in the Forecast group, click What if Analysis > Goal Seek… In the Goal Seek dialog box, define the cells and values to test: Set cell - the reference to the NPV cell (B10). To value – type 0, which is the desired value for the Set cell. By changing cell - the reference to the IRR cell (B9). When done, click OK. The Goal Seek Status dialog box will appear and let you know if a solution has been found. If successful, the value in the IRR cell will be replaced with a new one that makes NPV zero. Click OK to accept the new value or Cancel to get back the original one. In a similar manner, you can use the Goal Seek feature to find XIRR. The only difference is that you will need to use the XNPV formula instead of NPV. Note. The IRR value found with Goal Seek is static, it does not recalculate dynamically as formulas do. After each change in the original data, you will have to repeat the above steps to get a new IRR. That's how to do IRR calculation in Excel. To have a closer look at the formulas discussed in this tutorial, you are welcome to download our sample workbook below. I thank you for reading and hope to see you on our blog next week! Excel IRR Calculator - examples (.xlsx file)