

Transcript

Understanding How Interest Works

Well, now you've learned what I think is, is, is quite possibly one of the most useful concepts in life and you might already be familiar with it. But if you're not, this will, will hopefully keep you from one day, uh, filing for bankruptcy. So, anyway, I will talk about interest, and, and then simple versus compound interest.

So, what's interest, interest? We all have heard of it, interest rates or interest on your mortgage or, um, you know, how much interest do I owe on my credit card. So, interest, uh, I don't know what the actual formal definition may be, maybe I should look it up on Wikipedia, but it's essentially rent on money. So, it's money that you pay in order to keep money for some period of time.

I, that's probably not the most, um, obvious definition, but let me put it this way: let's say that, uh, I want to borrow \$100 from you, this is now. And let's say that this is one year from now, one year. And this is you and this is me. So, now you give me \$100 and then I have the \$100, and a year goes by and I have \$100 here. And if I were to just give you that \$100 back, you would have collected no rent. You would have just gotten your money back. You would have collected no interest. But if you said, Sal, I'm willing to give you \$100 now if you give me, I don't know, if you give me \$110 a year later. So, in this situation how much did I pay you to keep that \$100 for you? Well, I'm paying you \$10 more, right? I'm returning the \$100, I'm returning the \$100 and I'm returning another \$10. And so this \$10, this extra \$10 that I'm returning to you, is essentially, um, the fee that I paid to be able to keep that money and do whatever I wanted with that money, and maybe save it, maybe invest it, do whatever, um, for a year; and that \$10 is essentially the interest. And a way that it's often calculated is a percentage of the original amount that I borrowed. And the original amount that I borrowed in fancy banker or finance terminology is just called principal, principal, principal.

So, in this case the rent on the money, or the interest, was \$10, and if I wanted to, uh, do it as a percentage, I would say \$10 over the principal, right, which would go over \$100, which is equal to 10 percent. So, you might have said, hey Sal, I'm willing to pay, I'm willing to lend you a dollar, \$100 if you pay me 10 percent interest on it. So, uh, 10 percent of \$100 is \$10 so after a year I pay you \$100 plus the ten percent. And likewise, so, for any amount of money; say you, you're willing to borrow, lend me, any

amount of money for a 10 percent interest. Well then, if you were to lend me \$1,000, then the interest would be 10 percent of that, which would be \$100; so then after a year, I would owe you \$1,000 plus 10 percent, 10 percent times \$1,000, and that's equal to \$1,100. I just added a zero to everything, right? In this case, \$100 would be the interest, but it would still be 10 percent.

So, let me, let me now make a distinction between simple interest and compound interest. So, we, we just did a fairly simple example where you lent money for me for a year at 10 percent, right? So, let's say that someone were to say that my interest rate, interest rate that they

charge, or the interest rate they charge to other people is, uh, well 10 percent's a good number, 10 percent per year. And let's say I'm going to borrow, I'm going to borrow, the principal that I'm going to borrow from this person, the principal I'm going to borrow is \$100.

So, my question to you, and maybe you want to pause it after I, after I've posed it, uh, is how much, how much do I owe, do I owe in 10 years? How much do I owe in 10 years? So, there's really two ways of thinking about it. You could say, okay, I started, let's see, in years, at time zero – like, if I just borrowed the money and I just paid it back immediately, I just paid, you know, it would be \$100, right? I'm not going to do that. I'm going to keep it for at least a year. So, after a year just based on the example that we just did, I could add 10 percent of that amount to the \$100 and it would then, I would then owe \$110. And then after two years I could add another 10 percent of the original principal, right? So, every year I'm just adding \$10. So, in this case it would be \$120, and year three I would owe \$130, essentially my rent per year to borrow this \$100 is \$10, right? Because I'm always taking 10 percent of the original amount. And after, after 10 years, because I would, each year I would have had to pay an extra \$10 in interest, after 10 years I would owe \$200, right? And that \$200 is equal to \$100 of principal, principal, plus \$100 of interest.

Now, that'd be \$10 a year of interest. And this notion of which I just did here, this is actually called simple, uh, simple interest, which is essentially you take the original amount you borrowed, the interest rate, the amount, the, the fee that you pay every year is the interest rate times that original amount. And you just incrementally pay that every year. But if you think about it you're actually paying a smaller and smaller percentage of what you owe going into that year. And maybe when I show you compound interest that will make sense. So, this is one way to interpret 10 percent interest a year.

Another way to interpret it is, okay, so in year zero, right, you still, you know, it's \$100 that you're borrowing, or if you just, and so they handed the money and you said, no, no, I don't want it and you just paid it back, you do \$100. After a year you would essentially pay the \$100 plus 10 percent of \$100, right, which is \$110, so that's \$100 plus 10 percent of \$100. Let me switch colors for this one on this, right? But I think this makes sense to you. And this is where simple and compound interest starts to diverge. In the last situation, we just kept adding 10 percent of the original hundred dollars.

In compound interest, in compound interest now, we don't take 10 percent of the original amount, we now take 10 percent of this amount, right? And so what, what are we doing every, every, so, now we were going to take the original, we were going to take \$110 is going to be our new, we can almost view it as our new principal. It's, like, we, this is how much we offer a year and then we would reborrow it, right? So, now we're going to \$110 plus 10 percent times 110, right? And that is equal to, we could actually undistribute the \$110 and out and that equal,

that's equal to \$110 times 1.1, you can, you can actually, um, uh, actually \$110 times 1.1, right? And so that equals, and actually I could rewrite it this way is to, I could rewrite it as 100 times 1.1 squared, that equals \$121. And then in year two, this is my new principal, this is \$121. This is my new principal and now I have to, in year three, so, this is year two, I'm taking more space, so this is year two. And now in year three I'm going to have to pay the \$121 that I owed at the end of year two plus 10 percent times the amount of money I owed going into the year, \$121. And if we, and so that's the same thing, we can put a parentheses around here, so that's the same thing as one times 121 plus .1 times 121, so that's the same thing as 1.1 times 121. Or another way of doing it that's equal to our original principal times 1.1 to the third power. And if you keep doing this and I encourage you to do it because it'll really give you a hands-on sense.

At the end of 10 years, we will owe, or you, I forgot who's borrowing from whom, \$100 times 1.1 to the tenth power. What does that equal? Let me get my spreadsheet out, just click on a random cell. Plus 100 times 1.1 to the tenth power. So, \$259 and some change. \$259. So, it might seem like a very subtle distinction, but it ends up being a very big difference. When I compound it at 10 percent for 10 years, uh, what, for 10 years using compound interest, I owe \$259. When, when I did it using simple interest, I only owed \$200. So, that \$59 was kind of the increment of how much more compound interest costs me.

I'm about to run out of time, so I'll do a couple more examples in the next one, just so you really get a deep understanding of how to do compound interest, how the exponents work, and, and, and what really is the difference. I'll see you in the next video.