

Simple Interest, Compound Interest, and Time Value of Money

SIMPLE INTEREST

Determining the amount of interest owed or earned can be easy or it may be complicated. The formula for determining simple interest is

$$i = Prt$$

i = interest

P = principal

r = interest rate

t = time (the length of the loan or investment in years)

So, if you borrow \$100 at 10% simple interest, the interest owed at the end of one year is

$$i = \$100 \times 0.10 \times 1 = \$10$$

If you borrow the same amount for three years, the amount of simple interest owed would be

$$i = \$100 \times 0.10 \times 3 = \$30$$

Simple Interest Practice Problem

1. You borrow \$5,000 from your Uncle Charlie at 5 percent simple interest. What is the amount of interest that you have paid your uncle after ...

One Year?

Two Years?

COMPOUND INTEREST

If the interest is compounded annually, the interest at the end of the first year is added to the amount loaned and that amount is used to calculate the interest earned at the end of the second year. The actual formula we'll talk about a little later, but the calculation looks like this

If you borrow \$100 at 10% compound interest, the interest owed at the end of one year is

$$\$100 \times 0.10 \times 1 = \$10 \text{ (which is the same as simple interest in this case)}$$

If you borrow the same amount for five years, the amount of compound interest owed would be

$$\text{YEAR 1: } \$100 \times 0.10 = \$10.00$$

$$\text{YEAR 2: } \$110 \times 0.10 = \$11.00$$

$$\text{YEAR 3: } \$121 \times 0.10 = \$12.10$$

So the interest that you owe after three years of COMPOUND interest is \$33.10.

Compound Interest Practice Problem

2. You borrow \$15,000 to pay for college at 8 percent compound interest. What is the amount of interest that you have paid on your student loan after ...

One Year?

Two Years?

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TIME VALUE OF MONEY

As you can probably tell, the effects of compounding interest is a bit more complex than simple interest. The formula has to account for the rate and amount of compounding during the time of the loan or investment.

Future Value (or FV) is the amount of money that you will have (or owe) after a certain period of time at a certain compound interest rate. The formula for calculating the future value of a loan or investment with compound interest is

$$FV = P (1 + i)^n$$

FV = future value

P = principal

i = interest rate per period of compounding

n = number of compounding periods in the length of the loan

For now, let's look at ANNUAL compounding, which makes things easier.

If you borrow \$3000 at a compound annual interest rate of 7 percent for 4 years, the future value of the loan (principal and interest) is

$$FV = \$3000 \times (1.07)^4 = \$3000 \times (1.07) \times (1.07) \times (1.07) \times (1.07) = \$3932.39$$

Future Value Practice Problems

3. You invest \$600 in a 3-year bond that pays an compound annual rate of 6 percent. How much money will you receive back (principal and interest) over the three years? (use FV)

4. A business borrows \$125,000 to build a new factory. The bank charges 6.5 percent interest, compounded annually. The term of the loan is 10 years. What is the total amount that you will pay to the bank (interest and principal) over the 10 years? (use FV)