

Compound interest is the interest paid on the original principal and on the accumulated past interest.

When you borrow money from a bank, you pay interest. Interest is really a fee charged for borrowing the money, it is a percentage charged on the principal amount for a period of a year -- usually.

If you want to know how much interest you will earn on your investment or if you want to know how much you will pay above the cost of the principal amount on a loan or mortgage, you will need to understand how compound interest works.

#### Compound Interest Example

Think of it like this: If you start out with 100 dollars and you receive 10 dollars as interest at the end of the first period, you would have 110 dollars that you can earn interest on in the second period. So in the second period, you would earn 11 dollars interest. Now for the 3rd period, you have  $110 + 11 = 121$  dollars that you can earn interest on. So at the end of the 3rd period, you will have earned interest on the 121 dollars. The amount would be 12.10. So you now have  $121 + 12.10 = 132.10$  of which you can earn interest. The following formula calculates this in one step, rather than doing the calculation for each compounding period one step at a time.

#### Compound Interest Formula

Compound interest is calculated based on the principal, interest rate (APR or annual percentage rate), and the time involved:

P is the principal (the initial amount you borrow or deposit)

r is the annual rate of interest (percentage)

n is the number of years the amount is deposited or borrowed for.

A is the amount of money accumulated after n years, including interest.

When the interest is compounded once a year:

$$A = P(1 + r)^n$$

However, if you borrow for 5 years the formula will look like:

$$A = P(1 + r)^5$$

This formula applies to both money invested and money borrowed.

#### Frequent Compounding of Interest

What if interest is paid more frequently? It's not much more complicated, except the rate changes. Here are a few examples of the formula:

$$\text{Annually} = P \times (1 + r) = (\text{annual compounding})$$

Quarterly =  $P (1 + r/4)^4$  = (quarterly compounding)

Monthly =  $P (1 + r/12)^{12}$  = (monthly compounding)

### Compound Interest Table

Confused? It may help to examine a graph of how compound interest works. Say you start with \$1000 and a 10% interest rate. If you were paying simple interest, you'd pay \$1000 + 10%, which is another \$100, for a total of \$1100, if you paid at the end of the first year. At the end of 5 years, the total with simple interest would be \$1500.

The amount you pay with compound interest depends on how quickly you pay off the loan. It's only \$1100 at the end of the first year, but is up to over \$1600 at 5 years. If you extend the time of the loan, the amount can grow quickly:

| Year | Initial Loan | Interest                            | Loan at End |
|------|--------------|-------------------------------------|-------------|
| 0    | \$1000.00    | $\$1,000.00 \times 10\% = \$100.00$ | \$1,100.00  |
| 1    | \$1100.00    | $\$1,100.00 \times 10\% = \$110.00$ | \$1,210.00  |
| 2    | \$1210.00    | $\$1,210.00 \times 10\% = \$121.00$ | \$1,331.00  |
| 3    | \$1331.00    | $\$1,331.00 \times 10\% = \$133.10$ | \$1,464.10  |
| 4    | \$1464.10    | $\$1,464.10 \times 10\% = \$146.41$ | \$1,610.51  |
| 5    | \$1610.51    |                                     |             |