**Present Value**

Present value is the value which is today's value. It is the amount of cash in hand today's date. Suppose you invest today Rs 100 at 10% interest for 1 year then after one year, the amount becomes Rs110. This Rs 100 which you are investing today is called present value of Rs 110. Future value is that value which will be the value in the future. So here Rs 110 is the future value of Rs 100 at 10%. Present value helps in taking decisions on investment which is based on the current value. So present value is the current value of the cash flows which will happen in future and these cash flows happen at a discounted rate.

$$\boldsymbol{P = F\left(\frac{1}{1+i}\right)^{N}}$$

Above equation can be written as:

$$\mathbf{P = F(P/F,\ i\%,\ N)}$$

Where the factor in parentheses is read "find F given P at i% interest per period for N interest periods."

**Example:**

An investor (owner) has an option to purchase a tract of land that will be worth $10,000 in six years. If the value of the land increases at 8% each year, how much should the investor be willing to pay now for this property?

Answer: **$6302**

**Key Points:**

- Present value is the concept that states an amount of money today is worth more than that same amount in the future. In other words, money received in the future is not worth as much as an equal amount received today.
- Money not spent today could be expected to lose value in the future by some implied annual rate, which could be inflation or the rate of return if the money was invested.

- Calculating present value involves making an assumption that a rate of return could be earned on the funds over the time period.

**Future Value**

It is the amount of cash that will be received after certain period of time. Future value, on the other hand, can be defined as the worth of that asset or the cash but at a particular date in the future and that amount will be equal in terms of value to a particular sum in the present. Future value calculations play a very important role in the world of finance. It is the basis of most important valuation techniques to value a company. With the help of discounting a cash flow that is projected to be generated at a future period the discounted cash flow technique is used in order to value a company or any order asset class that generates a certain amount of cash and is expected to continue generating cash for a particular future period.

$$\mathbf{F = P(1 + i)^N}$$

Above equation can be written as:

$$\mathbf{F = P(F/P,\ i\%, N)}$$

**Example:**

Suppose that you borrow \$8,000 now, promising to repay the loan principal plus accumulated interest in four years at i = 10% per year. How much would you repay at the end of four years?

## Solution

| Year | Amount Owed at Start of Year | Interest Owed for Each Year | Amount Owed at End of Year | Total End-of-Year Payment |
|---|---|---|---|---|
| 1 | $P = \$\ 8{,}000$ | $iP = \$\ 800$ | $P(1+i) = \$\ 8{,}800$ | 0 |
| 2 | $P(1+i) = \$\ 8{,}800$ | $iP(1+i) = \$\ 880$ | $P(1+i)^2 = \$\ 9{,}680$ | 0 |
| 3 | $P(1+i)^2 = \$\ 9{,}680$ | $iP(1+i)^2 = \$\ 968$ | $P(1+i)^3 = \$10{,}648$ | 0 |
| 4 | $P(1+i)^3 = \$10{,}648$ | $iP(1+i)^3 = \$1{,}065$ | $P(1+i)^4 = \$11{,}713$ | $F = \$11{,}713$ |

**Key Points:**

- Future value (FV) is the value of a current asset at some point in the future based on an assumed growth rate.
- Investors are able to reasonably assume an investment's profit using the future value (FV) calculation.
- Determining the future value (FV) of a market investment can be challenging because of the market's volatility.
- There are two ways of calculating the future value (FV) of an asset: FV using simple interest and FV using compound interest.

**Types of Future Value**

**Future Value Using Simple Annual Interest**

The Future Value (FV) formula assumes a constant rate of growth and a single upfront payment left untouched for the duration of the investment. The FV calculation can be done one of two ways depending on the type of interest being earned. If an investment earns simple interest, then the Future Value (FV) formula is:

FV (Simple Interest)

$$\mathbf{FV = I \times (1 + (R \times N))}$$

Where:

I = Investment Amount

R = Interest Rate

N = Number of years

For example, assume a $1,000 investment is held for five years in a savings account with 10% simple interest paid annually. In this case, the FV of the $1,000 initial investment is $1,000 * [1 + (0.10 * 5)], or $1,500.

**Future Value Using Compounded Annual Interest**

With simple interest, it is assumed that the interest rate is earned only on the initial investment. With compounded interest, the rate is applied to each period's cumulative account balance. In the example above, the first year of investment earns 10% * $1,000, or $100, in interest. The following year, however, the account total is $1,100 rather than $1,000; so, to calculate compounded interest, the 10% interest rate is applied to the full balance for second-year interest earnings of 10% * $1,100, or $110.

The formula for the Future Value (FV) of an investment earning compounding interest is:

FV (Compound Interest)

$$\mathbf{FV = I \times (1 + R)^N}$$

Where:

I = Investment Amount

R = Interest Rate

N = Number of years

**Finding the Interest Rate Given P, F, and N**

There are situations in which we know two sums of money (P and F) and how much time separates them (N), but we don’t know the interest rate (i) that makes them equivalent. For example, if we want to turn $500 into $1,000 over a period of 10 years, at what interest rate would we have to invest it?

$$\boldsymbol{i} = \sqrt[N]{\frac{\boldsymbol{F}}{\boldsymbol{P}}} - \mathbf{1}$$

So, for our simple example, **i = 0.0718 or 7.18%** per year. Inflation is another example of when it may be necessary to solve for an interest rate.

**Finding the N Given P, F, and I**

Sometimes we are interested in finding the amount of time needed for a present sum to grow into a future sum at a specified interest rate. For example, how long would it take for $500 invested today at 15% interest per year to be worth $1,000? **Answer: 5 years**

$$F = P(1+i)^N$$

$$(1+i)^N = (F/P)$$

Using logarithms,

$$N \log(1+i) = \log(F/P)$$

and

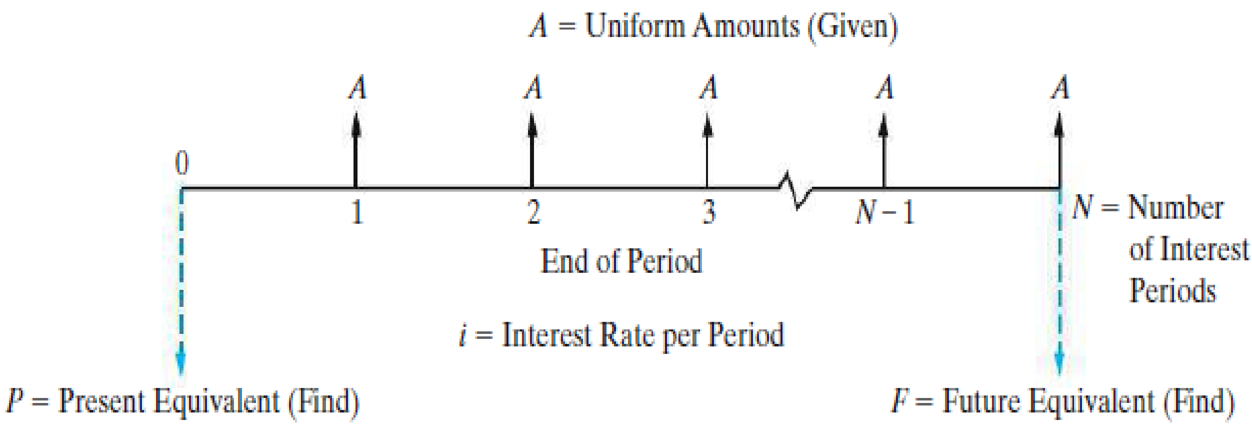
$$N = \frac{\log(F/P)}{\log(1+i)}.$$

**Annuity:**

An annuity is a series of payment made at equal intervals. Examples of annuities are regular deposit to savings account, monthly home rent payment, monthly insurance payments and pension payments.

**Finding F when Given A**

If a cash flow in the amount of A dollars occurs at the end of each period for N periods and i% is the interest (profit or growth) rate per period, the future equivalent value, F, at the end of the Nth period is obtained by summing the future equivalents.




$$\boldsymbol{F = A\left(\frac{(1+i)^N - 1}{i}\right)}$$

$$\mathbf{F = A(F/A,\ i\%,N)}$$

**Example:**

If you are 20 years of age and save $1.00 each day for the rest of your life. Let's assume that you live to age 80 and that the annual interest rate is 10% (i = 10%). Under these specific conditions, we would be the future compound amount (F) to be

**F = $365/year (F/A, 10%, 60 years)**

**= $365 (3,034.81)**

**= $1,107,706**

Saving money early and preserving resources through frugality (avoiding waste) are extremely important ingredients of wealth creation in general. Often, being frugal means postponing the satisfaction of immediate material wants for the creation of a better tomorrow. In this regard, be very cautious about spending tomorrow's cash today.

**Finding P when Given A**

$$\boldsymbol{P = A\left(\frac{(1+i)^N - 1}{i(1+i)^N}\right)}$$

Thus, Equation is the relation for finding the present equivalent value (as of the beginning of the first period) of a uniform series of end-of-period cash flows of amount A for N periods. The quantity in brackets is called the uniform series present worth factor.

$$\mathbf{P = A(P/A,\ i\%,N)}$$

**Example:**

A micro-brewery is considering the installation of a newly designed boiler system that burns the dried, spent malt and barley grains from the brewing process. The boiler will produce process steam that powers the majority of the brewery's energy operations, saving $450,000 per year over the boiler's expected life of 10 years. If the interest rate is 12% per year, how much money can the brewery afford to invest in the new boiler system?

The increase in annual cash flow is $450,000, and it continues for 10 years at 12% annual interest. The upper limit on what the brewery can afford to spend on the new boiler is:

**P = $450,000 (P/A, 12%, 10)**

**= $450,000 (5.6502)**

**= $2,542,590**

**Finding A when Given F**

$$\boldsymbol{A = F\left(\frac{i}{(1+i)^N - 1}\right)}$$

Thus, Equation is the relation for finding the amount, A, of a uniform series of cash flows occurring at the end of N interest periods that would be equivalent to (have the same value as) its future value occurring at the end of the last period. The quantity in brackets is called the sinking fund factor. We shall use the functional symbol as follows:

$$A = F(A/F, i\%, N)$$

**Finding A when Given P**

$$A = P\left(\frac{i(1+i)^N}{(1+i)^N - 1}\right)$$

Thus, Equation is the relation for finding the amount, A, of a uniform series of cash flows occurring at the end of each of N interest periods that would be equivalent to, or could be traded for, the present equivalent P, occurring at the beginning of the first period. The quantity in brackets is called the capital recovery factor.

$$A = P(A/P, i\%, N)$$

**Example:**

You borrow $15,000 from your credit union to purchase a used car. The interest rate on your loan is 0.25% per month∗ and you will make a total of 36 monthly payments. What is your monthly payment?

**A = $15,000(A/P, 1/4%, 36)**

**= $15,000(0.0291)**

**= $436.50 per month**