

T102 SECTION 6.6 COMPUTING INTEREST

An ad for a bank states that they pay “5% simple yearly interest” on your principal.

Interest is the money that you earn for allowing the bank to use your money. OR, interest is the money that you pay back to the bank (or other lender) when you borrow money.

SIMPLE INTEREST is interest that is paid on only the _____.

BASIC TERMS PRINCIPAL _____

INTEREST _____

INTEREST RATE _____

TIME _____

SIMPLE INTEREST **$I = Prt$**

P = Principal **r = interest rate per year** **t = # of years**

Interest rates are most commonly expressed as percents. So, when performing mathematical computations with them we need to express them as decimals.

15% = _____ 6% = _____ $\frac{1}{2}\%$ = _____ 7.5% = _____

EXAMPLES :

Find interest owed on an investment of \$1200 at 12% simple interest at the end of one year.

Calculate the simple interest owed on a 7 month investment of \$7,000 if the annual interest rate is 5.25%.

Find the annual interest rate if a principal of \$10,000 increased to \$10,900 at the end of 1 year.

The future value of a three month investment of \$4000 is \$4085. What is the annual simple interest rate?

Suppose you borrow \$8,000 at 8% simple interest. How much interest will you owe at:

a. The end of 1 year

b. The end of 9 months

Now, take this loan one step further. How much will you have to pay back at the end of each of the above time periods?

a. b.

If money (principal) is invested at $r\%$, then at the end of t years, the investor will have the future value of the investment – which is the principal plus the interest.

AMOUNT A = FUTURE VALUE:	SIMPLE INTEREST SITUATION
$A = P + I$	where P = Principal
$A = P + Prt$	r = interest rate/ year
$A = P(1 + rt)$	t = time in years

EXAMPLE

Find the future value of a savings account after 18 months if \$500 is deposited at 7.5% simple interest.

In contrast to future value, the principal that you have to invest in an account now to have a specified amount in the account in the future is called the present value.

PRESENT VALUE: SIMPLE INTEREST SITUATION

If you want to earn an annual rate of 10% on your investment, how much (to the nearest cent) should you pay for a note that will be worth \$5,000 in 9 months.

COMPOUND INTEREST

COMPOUND INTEREST is where your money earns interest, but then the interest is reinvested and come the next payment period your money and interest earned in the previous period earns interest.

Example:

Suppose you invest \$2,000 in a bank that pays 10% compounded annually. How much will you have in your account after 3 years?

At the end of the:

1st year

Interest _____

Amount _____

2nd year

Interest _____

Amount _____

3rd year

Interest _____

Amount _____

Notice that the interest earned each year keeps increasing. This is the effect of compound interest!

Each investment (or loan) has a defined number of payment periods:

annually - once per year

semiannually _____ per year

quarterly _____ per year

monthly _____ per year

daily _____ per year

In general, if the number of compounding periods increases, the result is an increase in the interest earned by the account.

EXAMPLE

You deposit \$500 in an account earning 6% interest, compounded semiannually. How much is in the account at the end of 1 year?

Obviously we would not want to “walk” ourselves through this every time – particularly if the number of compounding periods increases (semiannually for 5 years, yikes!). Thus a formula would help.

AMOUNT (FUTURE VALUE):	COMPOUND INTEREST SITUATION
A =	r = Rate per year (as a decimal) n = Number of compounding periods per year P = Principal or Present Value A = Amount Due or Future Value t = time in years

Calculate the future value of an investment account when \$4000 is deposited earning 6% interest, compounded semiannually, for 2 years.

Find the value of \$1,000 invested at 8% for 5 years compounded:

- a. Annually b. Semiannually c. Quarterly d. Monthly

Notice how the interest increases more dramatically from annual to monthly compounding.

EXAMPLE

How much interest is earned in 2 years on \$400 deposited in an account paying 6% interest, compounded quarterly?

To save for their child’s education, a couple deposits \$3,000 into an account that pays 7% annual interest compounded daily. Find the amount in the account after 8 years.

PRESENT VALUE

The present value of an investment is the original principal invested, or the value of the investment before it earns any interest. We use present value to determine how much money must be invested today in order for an investment to have a specific value at a future date.

EXAMPLES

How much should you invest today at 10% compounded quarterly to have \$8,000 toward the purchase of a car 5 years from now?

How much money should be invested in an account that earns 9% interest, compounded semiannually, in order to have \$20,000 in 5 years.

One of the challenges with compounding rates and periods is that they cannot be compared – thus as an investor, it is difficult to make a decision as to which investment is the wisest. Which has the higher return? Use a set amount A (perhaps \$100) and set time period t (perhaps 1 year).

BANK	RATE	COMPOUNDED	COMPARISON
PNC	6.96%	Daily (360)	<i>Lower rate, but more compoundings</i>
IUS Credit Union	6.97%	quarterly	<i>Higher rate, but less compoundings</i>

EFFECTIVE ANNUAL YIELD

The **Effective Annual Yield** is the rate that a bank would have to offer if the principal will be invested using simple interest ($I = Prt$) instead of compound interest.

Suppose you deposit \$1000 in a savings account that pays 6% interest compounded quarterly.

a. What is the balance at the end of 1 year?

b. What is the effective annual yield? That is, what is the rate that would have been paid by the bank if the amount had been invested using simple interest?