COMPOUND INTEREST

Compound interest is another type of interest. It is interest that is calculated on the principal plus and interest previously earned. For example, if you keep the interest earned in your account, with **compound interest** the new interest is calculated on the principal plus that interest. Therefore, you will earn more interest than with simple interest.

The formula for calculating compound interest is:

$$A = P \times (1 + r \div n)^{n \times t}$$

where,

A = Compounded or Final amount (principal + interest)

P = Principal (amount of money that was originally borrowed or invested)

r = Rate (interest rate – in decimal form)

Ex. 10% = 0.10
5% = 0.05

t = Term (in years)

Ex. 2 years = 2

n = Compounding period

Annually = 1	Monthly = 12
Semi-annually = 2	Weekly = 52
Quarterly = 4	Daily = 365

For our purposes, the term that is used will **always** be in years. Compound interest can also be paid more than once a year. This is called the **compounding period**, as shown above. The compounding period could be annually (once a year), semi-annually (twice a year) quarterly (4 times a year), monthly (12 times a year), weekly (52 times a year), or daily (365 times a year).

Example 1: What is the compounded amount if $5000 is deposited in an account for 2 years that pays 4.5% interest annually?

Solution: Assign the values to their correct spot, substitute and solve.

A = ? P = \$5000 r = 4.5% ÷ 100 = 0.045 t = 2 y n = 1

$A = P \times (1 + r \div n)^{n \times t}$

Here is the formula from above filled in with the known information:

$A = \$5000 \times (1 + 0.045 \div 1)^{1 \times 2}$

The part of this equation that says "1 × 2" is an exponent. You must know the answer to this expression before you begin calculating the rest of the expression even if it is a simple expression.

$1 \times 2 = 2$

$A = \$5000 \times (1 + 0.045 \div 1)^{2}$

Now type this into the calculator ***EXACTLY*** as it is written above. That means with the brackets. To get an exponent, use the "y^x" button, so your calculator strokes would be like this:

$5000 \times (1 + 0.045 \div 1) y^x 2$

The answer displayed on the calculator would be \$5460.125 which rounds to \$5460.13.

Example 2: Find the compounded amount if you where to put \$400 in a bank account if the interest rate is 4.75% for 5 years and the interest is compounded weekly.

Solution: Assign the values to their correct spot, substitute and solve.

A = ? P = \$400 r = 4.75% ÷ 100 = 0.0475 t = 5 y n = 52

$A = \$400 \times (1 + 0.0475 \div 52)^{52 \times 5}$

$52 \times 5 = 260$

$A = \$400 \times (1 + 0.0475 \div 52)^{260}$

$A = \$507.175 = \$507.18$

Because the compounded amount, A, is made up of the principal and the interest earned, ***A = P + I,*** the amount of interest earned can be calculated by first calculating A, and then subtracting the original principal from that amount.

I = A – P Interest = Compounded Amount - Principal

Example 3: Margaret invested $2000 in an account with an interest rate of 8% for 3 years, compounded quarterly. How much interest does she earn?

Solution: Assign the values to their correct spot, substitute and solve for *A*. Subtract to find the interest.

A = ? P = \$2000 r = 8% ÷ 100 = 0.08 t = 3 y n = 4

$A = \$2000 \times (1 + 0.08 \div 4)^{4 \times 3}$

A = \$2536.48

Interest = A – P = \$2536.48 - \$2000 = \$536.48

ASSIGNMENT 4 – COMPOUND INTEREST

1) Calculate the final amount of a deposit of $5000 invested at 3.1% per year, compounded annually for 5 years.

2) Calculate the final amount of a deposit of $650 invested at 4.75% per year, compounded monthly for 3 years.

3) Calculate the final amount of a deposit of $1000 invested at 7.25% per year, compounded semi-annually for 2 years.

4) Tabitha deposits $4275 into an investment account that offers 3.25% interest per year, compounded daily. How much will her investment be worth after 7 years?

5) Calculate how much **interest** you would earn on a deposit of $8500 at 2.75%, compounded annually, for a term of 4 years.

6) If Greg invested $500 for 5 years, compounded annually, at a rate of 6%, how much interest would he earn on his investment?

THE RULE OF 72

There is an easy and quick way to estimate how long it will take to double your investment if it is compounded annually. It is called the **Rule of 72**. The approximate time, in years, that it will take to double your money is found by dividing 72 by the interest rate after dropping the percent sign. The amount of the investment has no bearing on this "rule".

Years to double investment = 72 ÷ (interest rate as a percent)

Example: How long would it take to double an investment of $10 000 if it is invested at 2.75%, compounded annually?

Solution: Apply the Rule of 72.

Years to double investment = 72 ÷ (interest rate as a percent)
Years to double investment = 72 ÷2.75
Years to double investment = 26.18 years

It would take over 26 years to double an investment at an interest rate of 2.75%.

ASSIGNMENT 5 – THE RULE OF 72

1) Use the Rule of 72 to estimate how long it would take the following investments to double in value. All are compounded annually.

a) $6000 invested at 4%

b) $1500 invested at 9.35%

c) $2500 invested at 1.95%

d) $350 invested at 5.5%

2) If you wanted to double your money in 10 years, at what interest rate would you need to invest your money?

3) How long would it take an investment of $1500 to grow to $3000 if the interest rate it is invested at is 6.5% per year, compounded annually? Round your answer to 1 decimal place.

4) An investment offers a rate of 2.80% interest per year, compounded monthly. Use the Rule of 72 to determine how long it will take for the value to double. Round your answer to the nearest whole year.

5) Use the compound interest formula and an investment of $500 to check your answer to the question above.

ASK YOUR TEACHER FOR QUIZ 1