8.4 Compound Interest

# Objective 1: Use Compound Interest Formulas

**Compound interest** is interest computed on the original principal as well as on any accumulated interest. The period of time between two interest payments is called the **compounding period**. When compound interest is paid *n* times per year, there are *n* compounding periods per year.

| **Compounding Period** | **Periods per year (n)** |
| --- | --- |
| Annual | 1 |
| Semiannual | 2 |
| Quarterly | 4 |
| Monthly | 12 |
| Daily | 365 \* |
| Continuous | infinite |

\*sometimes 360 is used for convenience

**CALCULATING FUTURE VALUE**

For a deposit of *P* dollars at interest rate *r*, subject to compound interest paid *n* times per year, the amount of money in the account after *t* years is given by the compound interest formula.



*A* is the account’s **future value** and the principal *P* is its **present value**.

**Annual compounding** is a special case. Since *n* = 1, the formula can be simplified.



Another special case is **continuous compounding.** In this case, interest is compounded over an infinitesimally small period and *n* gets infinitely large. More advanced mathematics using the natural exponential base, *e,* provides a formula for this case.



# Objective 2: Calculate present value

The amount of money that should be invested today to yield a future value of *A* can be calculated by solving the future value equation for *P.* Present value should always be rounded up to the nearest dollar or cent, depending on the problem, so that there is enough money to achieve the future value.

**CALCULATING PRESENT VALUE**

If *A* dollars are to be accumulated in *t* years in an account that pays an interest rate *r,* compounded *n* times per year, then the present value, *P*, that needs to be invested now is

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# Objective 3: Understand and compute effective annual yield

The **effective rate** is the simple interest rate that produces the same amount of money in an account at the end of one year as when the account is subjected to compound interest at a stated rate. When investing money, the effective rate is usually called the **effective annual yield**. When borrowing money, the effective rate is usually called the **annual percentage rate**, or **APR**.

The best choice among investment options is the one with the highest effective annual yield. The best loan, from the borrower’s perspective, is the one with the lowest *APR.*

**CALCULATING EFFECTIVE ANNUAL YIELD**

Suppose that an investment has a nominal interest rate, *r*, in decimal form, and pays compound interest *n* times per year. The investment’s effective annual yield is

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The decimal form of *Y* given by the formula should then be converted to a percent.