

MATH 132 Simple and Compound Interest + Applications

Formula Sheet

Key to Symbols: **I** is the amount of interest **r** is the interest rate in decimal form

A is the accrued amount (or future value or balance due)

P is the principle amount (or present value, lump sum deposit, or loan amount)

t is time in years **k** is the number of compounding periods in a year

Simple Interest from Present Value

$$I = P * r * t$$

Future Value in a Simple Interest situation

$$A = P * (1 + rt) = P + P * r * t = P + I$$

Compound Interest ($k = 1$)

$$A = P * (1 + r)^t$$

$$P = A * (1 + r)^{-t}$$

Compound Interest ($k \neq 1$)

Lump Sum Payment

$$A = P * \left(1 + \frac{r}{k}\right)^{k*t}$$

$$P = A * \left(1 + \frac{r}{k}\right)^{-k*t}$$

Compound Interest Annuities ($k \neq 1$)

Making or Receiving Regular Payments : **p**

$$A = p * \left[\left(1 + r \div k\right)^{kt} - 1\right] \times k \div r$$

$$P = p * \left[1 - \left(1 + r \div k\right)^{-kt}\right] \times k \div r$$

Monthly Payment on a Loan

Simple Interest Loan

$$payment = P * (1 + rt) \div (12t)$$

Find the **Regular Payment** (Annuities)

Find the regular payment in compound interest:

$$Savings annuity: \left[\left(1 + r \div k\right)^{kt} - 1\right] \times \left(\frac{k}{r}\right) \div A = Answer$$

$$p = (Answer)^{-1}$$

$$Payout annuity: \left[1 - \left(1 + r \div k\right)^{-kt}\right] \times \left(\frac{k}{r}\right) \div P = Answer$$

$$p = (Answer)^{-1}$$

Time needed to reach a financial goal (compound interest):

$$t = \ln(A \div P) \div [k * \ln(1 + r \div k)]$$

Other SIMPLE INTEREST formulas... Solve for P, I, r, or t and Banker's Rule:

$$P = A \div (1 + rt) \quad r = I \div (P \times t) \quad t = I \div (P \times r)$$

$$P = I \div (r \times t) \quad \text{Note: Use of () is extremely important!}$$

$$I = A - P \quad \text{Banker's Rule with } t \text{ in days: } I = P * r * t \div 360$$

Continuously compounded interest formulas:

Future Value:

$$A = P * e^{r*t}$$

Interest rate:

$$r = \ln(A \div P) \div t$$

Time needed:

$$t = \ln(A \div P) \div r$$

Formula Sheet in Microsoft Excel

When you use **FUNCTIONS** in Excel, there are specific **arguments or inputs** which are separated by commas, that you must provide so that the function calculates your result correctly.

Here's what each **argument** means in these formulas... Remember: **4%** is either typed **4%** or **.04**, NOT just **4**.

- **rate** is the periodic interest rate. Example: if the annual interest rate is 6% and you make *monthly* loan payments, the periodic **rate** is 6% divided by 12, or .005. In Excel you may enter it as **6%/12** if you like. If you just type **6/12** without the %, the calculation will be wrong.
- **nper** is the number of periods. Example: if a 10-year loan has monthly payments, the **nper** argument would be 10 times 12, or 120 periods. You may enter it as 10*12 and Excel will do the calculation.
- **pv** is the present value of the account or annuity. Example: if you want to borrow \$12,345.67, the amount borrowed is **pv**. If making monthly deposits, such as a savings annuity, then **pv** = 0.
- **fv** is the ending value (accrued value) of the account or annuity. This typically is zero for a loan or payout annuity.
- **type** is a code that indicates when payments are due. Please ignore/omit the type argument.
- **pmt** is the regular payment/deposit that is being made, or the regular withdrawal (say, for example, monthly you wish to deposit \$200 for 30 years. Then **pmt** is \$200).

For **loans**, you may be interested in the following: (usually **fv** = 0 unless in a leasing situation)

1. How much can you borrow on a fixed monthly payment? **=PV(rate,nper,pmt,fv)**
2. What's the periodic interest rate? **=RATE(nper,pmt,pv,fv)**
3. What's the number of remaining periods? **=NPER(rate,pmt,pv,fv)**
4. What's the ending value? (For car leases, this is the 'residual') **=FV(rate,nper,pmt,pv)**
5. What's the periodic (monthly) payment amount? **=PMT(rate,nper,pv,fv)**

For **savings**, you may be interested in the following:

1. What's the periodic interest rate? **=RATE(nper,pmt,pv,fv)**
2. What's the number of remaining periods for your savings plan? **=NPER(rate,pmt,pv,fv)**
3. What ending amount will you achieve on a fixed deposit schedule? **=FV(rate,nper,pmt,pv)**
4. What's the periodic **deposit** amount when **pv=0** toward a **fv** goal? **=PMT(rate,nper,0,fv)**
5. What's the periodic **withdrawal** amount when **fv=0** from an account with a given **pv**?
=PMT(rate,nper,pv,0)

To find the **effective annual yield**, **nper** = number of compounding periods in 1 year

- Use the Excel formula **=EFFECT(rate,nper)**