

The two most common methods of calculating interest use the simple interest and the compound interest formulas.

Simple interest: Simple interest is the dollar cost of borrowing money. This cost is based on three elements: the amount borrowed, which is called the **principal**; the **rate** of interest; and the **time** for which the principal is borrowed. The formula used to find simple interest is:

interest = principal x rate of interest x amount of time the loan is outstanding

or

$$I = P \times R \times T$$



Example

Suppose you borrow \$1,000 at 10 percent simple annual interest and repay it in one lump sum at the end of 3 years. To find the amount that must be repaid, calculate the interest:

$$\text{Interest} = \$1,000 \times .10 \times 3 = \$300$$

This computes to \$100 of interest each year. The amount that must be repaid is the \$1,000 principal plus the \$300 interest or a total of \$1,300.

Compound interest: Unlike simple interest, compound interest calculates interest not only on the principal, but also on the prior period's interest. The formula for calculating compound interest is:

Future repayment value = principal x (1 + rate of interest)^{amount of time}

or

$$F = P \times (1 + R)^T$$

The factor $(1 + R)^T$ can be obtained easily using pencil and paper, a calculator, or a compound interest table. Most consumer loans use monthly or, possibly, daily compounding. Thus, if you are dealing with monthly compounding, the "R" term in the above formula relates to the *monthly* interest rate, and "T" equals the number of months in the loan term. Likewise, if the loan in question uses daily compounding, the "R" term relates to the *daily* interest rate, and "T" equals the number of days in the loan term.



Example

Suppose you borrow \$1,000 at 10 percent interest, compounded monthly, and repay it in one lump sum at the end of three years. To find the amount that must be repaid, you must first convert the 10 percent annual interest rate into a monthly interest rate:

$$0.10 \text{ (or 10\%)} / 12 = .00833$$

Plugging this number into the formula yields:

$$F = \$1,000 \times (1 + .00833)^{36}$$

$$F = \$1,000 \times (1.00833)^{36}$$

$$F = \$1,000 \times (1.348021)$$

$$F = \$1,348.03$$

The power of compounding can have an astonishing effect on the accumulation of wealth. This table shows the results of making a one-time investment of \$10,000 for 30 years using 12% simple interest, and 12% interest compounded yearly and quarterly.

Type of Interest	Principal Plus Interest Earned
Simple	46,000.00
Compounded Yearly	299,599.22
Compounded Quarterly	347,109.87

Exercise: If you borrow \$16000 at 8% simple annual interest and repay it in a lump sum at the end of 5 years, how much must be repaid?

Calculate the Interest: _____

Calculate the Principal: _____

Calculating the Payment Amount per Period

The formula for calculating the payment amount is shown below.

$$A = P \frac{r(1+r)^n}{(1+r)^n - 1}$$

where

- A = payment Amount per period
- P = initial Principal (loan amount)
- r = interest rate per period
- n = total number of payments or periods

Example: What would the **monthly** payment be on a 5-year, \$20,000 car loan with a *nominal* 7.5% **annual** interest rate? We'll assume that the original price was \$21,000 and that you've made a \$1,000 down payment.

You can use the amortization calculator below to determine that the Payment Amount (A) is \$400.76 per month.

P = \$20,000

r = 7.5% per year / 12 months = 0.625% per period

n = 5 years * 12 months = 60 total periods

Now calculate the payment from the simple interest loan of \$16,000 at 8% from the previous page, using the annual interest compounded monthly, and making equal monthly payments for 5 years. How much did you have to pay out?

(Teacher Note: The exercise above would result in payments of _____ per month, for a total amount paid of _____, if you were making monthly payments and compounding interest.)

Some home equity loans allow lump sum repayment. Suppose you had a \$30,000 home equity loan for 7 years, at 9% annual interest, compounded monthly, and repay it at the end of the loan. How much would you have to pay back?