Average Daily Balance and Compound Interest

Finite Math

18 September 2018

Quiz

If P dollars is invested in a savings account with an annual simple interest rate r, how much is in the account after t years?

$$A = ???$$

Now You Try It!

Example

Suppose a brokerage firm uses the following commission schedule

Principal	Commission
Under $3,000	*$32+1.8% of principal*
$3,000 - $10,000	*$56+1% of principal*
Over $10,000	*$106+0.5% of principal*

An investor purchases 75 shares of a stock at $37.90 per share, keeps the stock for 150 days, then sells the stock for $41.20 per share. What was the annual interest rate earned on the investment? (Again, assume a 360-day year.)

Solution

6.352%

Average Daily Balance

A common method for calculating interest on a credit card is to use the *average daily balance method*. As the name suggests, the average daily balance is computed, then the interest is computed on that.

Example

A credit card has an annual interest rate of 19.99% *and interest is calculated using the average daily balance method. If the starting balance of a* 30*-day billing cycle is* $523.18 *and purchases of* $147.98 *and* $36.27 *are posted on days* 12 *and* 25*, respectively, and a payment of* $200 *is credited on day* 17*, what will be the balance on the card at the start of the next billing cycle?*

Now You Try It!

Example

A credit card has an annual interest rate of 19.99% and interest is calculated using the average daily balance method. If the starting balance of a 28-day billing cycle is $696.21 and purchases of $25.59, $19.95, and $97.26 are posted on days 6, 13, and 25, respectively, and a payment of $140 is credited on day 8, what will be the balance on the card at the start of the next billing cycle?

Solution

$708.92

Compound Interest

In the case of simple interest, the interest is computed exactly once: at the end. Typically, however, interest is usually compounded something like monthly or quarterly.

Example

Suppose $5,000 *is invested at* 12%, *compounded quarterly. How much is the investment worth after* 1 *year?*

Compound Interest

If we generalize this process, we end up with the following result

> **Definition (Compound Interest)**
>
> $$A = P(1 + i)^n, \text{ where } i = \frac{r}{m}$$
>
> *The variables in this equation are*
> - *$A =$ future value after n compounding periods*
> - *$P =$ principal*
> - *$r =$ annual nominal rate*
> - *$m =$ number of compounding periods per year*
> - *$i =$ rate per compounding period*
> - *$n =$ total number of compounding periods*

Compound Interest

Alternately, one can reinterpret this formula as a function of time as

$$A = P\left(1 + \frac{r}{m}\right)^{mt}$$

where A, P, r, and m have the same meanings as above and t is the time in years.

Compound Interest

Example

If $1,000 *is invested at* 6% *interest compounded (a) annually, (b) semiannually, (c) quarterly, (d) monthly, what is the value of the investment after* 8 *years? Round answers to the nearest cent.*