1) The consumer price index (CPI) is 118.3 for the year 1988 and 215.3 for the year 2008. Calculate the average rate of inflation in the period of 20 years from 1988 to 2008.

2) The annual interest rate (APR) in a CD is 5%. How much is the annual yield if the interest is compounded
   (1) yearly,
   (2) monthly,
   (3) 50 times a year,
   (4) continuously.

3) You have taken a loan in the amount $200,000 with APR 6%. You make $2,000 monthly payments on the loan. Calculate the principal after one month and after two months.

In the following formula \( P_m \) is the principal, after \( m \) months, of a loan or a savings plan, with an initial principal \( P_0 \), an annual percentage rate \( r \), and a monthly payment \( p \). The sign \( \pm \) is – if this a loan, and is + if this is a savings plan (if \( p = 0 \) then the formula reduces to the usual compound interest formula):

\[
P_m = (1 + \frac{r}{12})^m \times P_0 \pm \left( \frac{1 + \frac{r}{12}}{\frac{r}{12}} \right)^m - \frac{1}{\frac{r}{12}} \times p.
\]

Use the formula in the following three exercises:

4) Re: loan in exercise 3). What is the remaining principal after: a) 5 years; b) 10 years? How many months will it take to pay off the loan? (This part is hard.)

5) You have taken a loan with in the amount $200,000 with APR 5%. What should be your monthly payments if the loan is to be repaid in 20 years? (In class we figured out that the payment would be $1,430 if APR is 6%).

Solution: Paying off in 20 years means that \( P_{240} = 0 \). Thus

\[
0 = (1 + \frac{0.05}{12})^{240} \times 200,000 - \left( \frac{1 + \frac{0.05}{12}}{\frac{0.05}{12}} \right)^{240} - \frac{1}{\frac{0.05}{12}} \times p.
\]

Solving for \( p \) gives that the monthly payment is $1,320. This is $110 less than with a 6% loan. Over the life of the loan this saves you \( 240 \times \$110 = \$26,400 \).

6) If you start a savings plan where every month you save $2,000 and, at the end of the month, you put this money in a CD paying 5% APR. How much will you have after a) 5 years; b) 10 years; c) the time it takes to pay off the loan in exercise 4)?
Solution: We use the formula with \( + \) in the place \( \pm \), \( P_0 = 0 \), \( r = 5\% \) and \( m = 60 \) (for 5 years) and \( m = 120 \) (for 10 years). If \( m = 120 \), for example,

\[
P_{120} = \frac{(1 + \frac{0.05}{12})^{120} - 1}{\frac{0.05}{12}} \times 2,000 \approx $310,500.
\]