1) (8 points) You deposit $500 at the end of every quarter for 20 years in a bank that pays an 8% annual interest rate, compounded quarterly. How much have you saved at the end of the 20 years?

We are given \( R = 500 \), \( r = .08 \), and \( m = 4 \), so \( i = r/m = .02 \) and \( n = 20 \cdot 4 = 80 \).

Then the value of the increasing annuity is

\[
F = R_{s_{80}.02} = 500 \left( \frac{1.02^{80} - 1}{.02} \right) \approx 500(193.7719578) \approx 96,885.98.
\]

2) (16 points) You obtain a loan of $10,000, to be paid monthly, over 9 years. Your annual interest rate is 7.2% (compounded monthly).

a) Find your monthly payment.

b) After 7 years, what is your outstanding balance (i.e., the amount of principal left to pay)?

c) In the first month of the 8th year, how much interest will you pay? (hint: use part (b))

We have \( P = 10,000 \), \( r = .072 \), and \( m = 12 \), so \( i = r/m = .006 \).

a) \( n = 9 \cdot 12 = 108 \) so

\[
R = \frac{P}{a_{108}.006} = \frac{10,000}{1.006^{108} - 1} \approx \frac{10,000}{79.31587772} \approx $126.08.
\]

b) After 7 years there are \( 9 - 7 = 2 \) years left on the loan, or \( n = 2 \cdot 12 = 24 \) payments. Monthly payments are still $126.08, so

\[
P_{left} = R_{a_{24}.006} = (126.08) \frac{1.006^{24} - 1}{(.006)1.006^{24}} \approx (126.08)22.28993297 \approx $2810.31.
\]

c) You are paying interest on the outstanding balance computed in (b), so the amount of interest paid is \( iP_{left} = (.006)(2810.31) = $16.86. \)

3) (6 points) You plan to buy a car for $12,000. The terms of your loan are an annual interest rate of 12% to be paid monthly, over 5 years. Part of your agreement is to make a balloon payment of $3000 at the end of the 5 years. What is the amount of principal that the lender will use to compute your monthly payments? [do not find the monthly payment]

We have \( F_{balloon} = 3000 \), \( r = .12 \), \( m = 12 \), \( i = r/m = .01 \), and \( n = 5 \cdot 12 = 60 \).

Thus \( P_{balloon} = F_{balloon}/(1 + i)^n = 3000/(1.01)^{60} \approx 3000/1.816696699 \approx $1651.35. \)

To compute the monthly payments the lender then use the principal amount \( P_{monthly} = P_{total} - P_{balloon} = 12,000 - 1651.35 = $10,348.65. \)