Examples:

1. At the end of each quarter year, Emily makes a $500 payment into a mutual fund that earns 7.88% annual interest. What will be the value of her annuity in 20 years?

2. Carlos purchases a new pickup for $18,500. If he takes out a 4-year loan with an APR of 2.9%,
   a. What are his monthly payments if he makes no down payment?
   b. What are his monthly payments if he makes a $2000 down payment?

Problems:

1. Amy contributes $50/month into a fund that earns 7.26% annual interest. What is the value of Amy's investment after 25 years?

2. Mickey contributes $50/month into a fund that earns 15.5% annual interest. What is the value of his investment after 20 years?
3. Yolinda contributes to a fund that earns 12.4% annually. What should her monthly payment be if she wants to accumulate $250,000 in 20 years?

4. Diego contributes to a money market account that earns 4.5% annual interest. What should his monthly payment be if he wants to accumulate $120,000 in 30 years?

5. Gendo obtains a 30-year mortgage worth $86,000 at an APR of 8.75%. What is her monthly payment?

6. Roberta obtains a 25-year loan for $100,000 at a rate of 9.25% APR. What is her monthly payment?

7. Newman would like to refinance his mortgage. He’d like to pay $1000 per month for 20 years at 4.875%. How much can he borrow?

8. Estelle would like her mortgage payments to be $1,500 per month. If she can get a 15 year loan for 4.125%, how much can she borrow?
Accelerated Precalculus/Trig
Section 3.5 – Annuities

Future Value Annuity:  \[ F_n = p \left( \frac{(1+i)^n-1}{i} \right) \]
Present Value Annuity:  \[ P_n = p \left( \frac{1-(1+i)^{-n}}{i} \right) \]

Examples:

1. At the end of each quarter year, Emily makes a $500 payment into a mutual fund that earns 7.88% annual interest. What will be the value of her annuity in 20 years?
   \[ \eta = 20(4) = 80 \]
   \[ i = \frac{0.0788}{4} \]
   \[ F_n = 500 \left( \frac{(1+i)^{80}-1}{i} \right) = \$95,483.39 \]

2. Carlos purchases a new pickup for $18,500. If he takes out a 4-year loan with an APR of 2.9%,
   a. What are his monthly payments if he makes no down payment?
      \[ \eta = 4(12) = 48 \]
      \[ i = \frac{0.029}{12} \]
      \[ 18,500 = p \left( \frac{1-(1+i)^{-48}}{i} \right) \]
      \[ p = \$408.67 \]
   b. What are his monthly payments if he makes a $2000 down payment?
      \[ \frac{18,500}{2,000} = 16,500 = p \left( \frac{1-(1+i)^{-48}}{i} \right) \]
      \[ p = \$364.49 \]

Problems:

1. Amy contributes $50/month into a fund that earns 7.26% annual interest. What is the value of Amy’s investment after 25 years?
   \[ \eta = 25(12) = 300 \]
   \[ i = \frac{0.0726}{12} \]
   \[ F_n = 50 \left( \frac{(1+i)^{300}-1}{i} \right) = \$42,211.46 \]

2. Mickey contributes $50/month into a fund that earns 15.5% annual interest. What is the value of his investment after 20 years?
   \[ \eta = 20(12) = 240 \]
   \[ i = \frac{0.155}{12} \]
   \[ F_n = 50 \left( \frac{(1+i)^{240}-1}{i} \right) = \$80,367.73 \]
3. Yolinda contributes to a fund that earns 12.4% annually. What should her monthly payment be if she wants to accumulate $250,000 in 20 years?

\[ n = 20 \times 12 = 240 \]
\[ 250,000 = P \left[ \frac{(1+i)^{240} - 1}{i} \right] \]
\[ i = \frac{0.124}{12} \]

\[ P = \$239,411 \]

4. Diego contributes to a money market account that earns 4.5% annual interest. What should his monthly payment be if he wants to accumulate $120,000 in 30 years?

\[ n = 30 \times 12 = 360 \]
\[ 120,000 = P \left[ \frac{(1+i)^{360} - 1}{i} \right] \]
\[ i = \frac{0.045}{12} \]

\[ P = \$158,02 \]

5. Gendo obtains a 30-year mortgage worth $86,000 at an APR of 8.75%. What is his monthly payment?

\[ n = 30 \times 12 = 360 \]
\[ 86,000 = P \left[ \frac{1 - (1+i)^{-360}}{i} \right] \]
\[ i = \frac{0.0875}{12} \]

\[ P = \$3676.56 \]

6. Roberta obtains a 25-year loan for $100,000 at a rate of 9.25% APR. What is her monthly payment?

\[ n = 25 \times 12 = 300 \]
\[ 100,000 = P \left[ \frac{1 - (1+i)^{-300}}{i} \right] \]
\[ i = \frac{0.0925}{12} \]

\[ P = \$856.38 \]

7. Newman would like to refinance his mortgage. He'd like to pay $1000 per month for 20 years at 4.875%. How much can he borrow?

\[ n = 20 \times 12 = 240 \]
\[ P_n = 1000 \left[ \frac{1 - (1+i)^{-240}}{i} \right] = \$153,122.93 \]
\[ i = \frac{0.04875}{12} \]

8. Estelle would like her mortgage payments to be $1,500 per month. If she can get a 15 year loan for 4.125%, how much can she borrow?

\[ n = 15 \times 12 = 180 \]
\[ P_n = 1500 \left( \frac{1 - (1+i)^{-180}}{i} \right) \]
\[ i = \frac{0.04125}{12} \]

\[ P = \$201,081.12 \]