1. (8pts) Solve the following equations. Round the answer to 8 decimal places.

\[ 3^x = 45 \]
\[ \log 3^x = \log 45 \]
\[ x \log 3 = \log 45 \]
\[ x = \frac{\log 45}{\log 3} = 2.46497352 \]

\[ (1 + x)^5 = 2.4 \]
\[ (1 + x)^{\frac{1}{5}} = 2.4^{\frac{1}{5}} \]
\[ 1 + x = 2.4^{\frac{1}{5}} \]
\[ x = 2.4^{\frac{1}{5}} - 1 \]
\[ = 0.19135790 \]

2. (4pts) What is the future value of $1000 deposited for 18 months in an account bearing simple interest of 13%?

\[ F = 1000 \left( 1 + 0.13 \cdot 1.5 \right) = 1195.00 \]

18 months = 1.5 years

3. (6pts) A man borrows $200 from a pawn shop that he repays with $260 after 3 months. What simple annual interest rate has he been charged?

\[ r = ?, \ t = 3 \text{ months} = \frac{1}{4} \text{ year} \]

\[ 260 = 200 \left( 1 + r \cdot \frac{1}{4} \right) \]
\[ \frac{260}{200} = 1 + \frac{r}{4} \]

\[ 0.3 = \frac{r}{4} \]
\[ 1.2 = r \]

Rate is 120% per year.
4. (6pts) What is the future value, after 5 years, of $2000 deposited into an account bearing 7% interest compounded daily?

\[ F = 2000 \left( 1 + \frac{0.07}{365} \right)^{365 \cdot 5} = 2838.04 \]

5. (8pts) Jennifer wishes to save $20,000 for a down payment on a house. She can get a savings account bearing 4% compounded quarterly.

a) How much should she deposit at the end of every quarter in order to have $20,000 after 4 years?

\[ 20000 = D \frac{(1 + \frac{0.04}{4})^{4 \cdot 4} - 1}{\frac{0.04}{4}} \]

\[ 20000 = D \cdot 1.0116 - 1 \]

\[ 20000 = D \cdot 17.25786449 \]

\[ D = \frac{20000}{17.25...} = D \]

\[ D = 1158.89 \]

b) Using your answer from a) (instead of the formula), how much should she deposit quarterly under the same terms if she wishes to have $30,000 after 4 years?

\[ \text{Since } 30000 = 1.5 \cdot 20000 \]

The payment is

\[ 1.5 \cdot 1158.89 = 1738.34 \]
6. (10pts) The Bullynator was whacked so hard in the last exam that he landed in this one. Having fallen less than safely, he also incurred a $25,000 emergency room bill, for which he got a 10-year loan from his bank at 6% interest, compounded monthly.

a) What is his monthly payment?

\[ 25000 = R \cdot \frac{1 - \left(1 + \frac{0.06}{12}\right)^{12 \cdot 10}}{0.06} \]

\[ 25000 = R \cdot \frac{1 - (1.005)^{-120}}{0.005} \]

\[ 25000 = R \cdot 90.07345333 \]

\[ \frac{25000}{90.073...} = R \]

\[ R = 277.55 \]

b) What is the balance on the loan after 4 years?

\[ \text{Balance} = \text{present value of remaining 6 years of payments} \]

\[ P = 277.55 \cdot \frac{1 - (1.005)^{-72.6}}{0.005} \]

\[ P = 16747.23 \]
7. (8pts) Suppose you can deposit $100 every month into an account bearing 9% interest compounded monthly. How long will it take you to save $5,000?

\[
5000 = 100 \left( \frac{(1 + \frac{0.09}{12})^{12t} - 1}{\frac{0.09}{12}} \right) \cdot \frac{1}{100}
\]

\[
t = \frac{\log 1.375}{12 \log 1.0075}
\]

3.55 years

\[
50 \cdot 0.0075 = 1.0075^{12t} - 1
\]

1.375 = 1.0075^{12t}

\[
\log 1.375 = 12t \log 1.0075
\]

\[
\log 1.375 = 12t \log 1.0075
\]

Bonus. (5pts) Bank of Shanghai is offering a savings account bearing 4.2% compounded monthly. Competing Bank of Beijing is offering a savings account bearing 4.1% compounded daily. What is the better deal? (Hint: consider a deposit for 1 year).

Compute value of $ deposited with either bank.

Shanghai: \( F = 1 \cdot (1 + \frac{0.042}{12})^{12} = 1.042818007 \) ← more, so a better deal.

Beijing: \( F = 1 \cdot (1 + \frac{0.041}{365.24})^{365.24} = 1.041852006 \)