1) If you want $10,000 to grow to $25,000 in eleven years, what simple interest rate would you need to get? Round to the nearest hundredth of a percent.

\[ r = \frac{\log\left(\frac{FV}{PV}\right)}{t \cdot \log(1+i)} \]

\[ = \frac{\log\left(\frac{25000}{10000}\right)}{11 \cdot \log(1+0.12)} \]

\[ = 0.136366 \ldots \]

\[ = 13.64\% \]

2) If you finance a $12,000 car at 11%, making monthly payments for 4 years, how big is each payment? Round to the nearest penny.

\[ \text{Paying back a loan: } P(1+i)^n = pymt \frac{(1+i)^n - 1}{(1+i)^{n-1}} \]

\[ 12000 \left(1 + \frac{0.11}{12}\right)^{48} = pymt \frac{(1+\frac{0.11}{12})^{48} - 1}{\left(1+\frac{0.11}{12}\right)^{48} - 1} \]

\[ \frac{12000 \left(1 + \frac{0.11}{12}\right)^{48} \div \left(1 + \frac{0.11}{12}\right)^{48} - 1}{310.1462714\ldots} = pymt \]

\[ \approx \$310.15 \]
3) I use a time machine to take my life’s savings ($130,000) back to make a deposit in the very first US bank (founded in 1791). If we assume that my money is going to make an average of 5.5% interest, compounded monthly, how much will the money be worth when I return to the present year? Use scientific notation, and round to three decimal places.

\[
FV = P\left(1 + \frac{r}{n}\right)^n
\]

\[
FV = 130,000\left(1 + \frac{0.055}{12}\right)^{2700}
\]

\[
= 2.993 \times 10^{10}
\]

\[
\text{Difference: } 7.79 \%
\]

4) A bank offers 7.5% interest, compounded daily. What would the annual yield be? If the interest was compounded monthly, what would the annual yield be? Round to the nearest hundredth of a percent.

\[
FV = 100\left(1 + \frac{0.075}{365}\right)^{365}
\]

\[
= 107.7632599...
\]

\[
\text{Difference: } 7.76 \%
\]

Just out of curiosity...

\[
\text{Exponent: } 2016 - 1791 = 225 \\
\times 12 \\
\text{2700}
\]
5) If I put away $300 a month for retirement, earning 6% interest, how much is this ordinary annuity going to be worth when I am 65 years old (in 18 years)? Round to the nearest penny.

\[ FV = \text{pymt} \times \frac{(1+i)^n - 1}{i} \]

\[ FV = 300 \times \frac{(1 + 0.06)^{18} - 1}{0.06} \]

\[ 116,205.96 \]

6) If I set up an annuity due with monthly payments of $75 at 8.5% interest, how much will it be worth in 35 years? Round to the nearest penny.

Step 1: Regular annuity: \[ FV = \text{pymt} \times \frac{(1+i)^n - 1}{i} \]

Step 2: \[ FV(\text{Due}) = FV(\text{Ord}) \times (1+i) \]

\[ FV = 75 \times \frac{(1 + 0.085)^{35} - 1}{0.085} \]

\[ 194,667.46 \]

\[ 196,046.36 \]
7) Eddy the Mule is a used-car salesman who does his own financing. He sells you a car for 9000 bucks. He’s going to give you 6 years to pay off the loan, but he tells you that you’ve got bad credit. He’s going to need to charge you 18% interest, and he’s going to need you to make weekly payments. How big is each payment, and how much interest are you going to end up paying Mr. the Mule over the life of the loan? Round to the nearest penny.

\[
P \left(1 + \frac{r}{n}\right)^n = \frac{p \cdot \left(1 + \frac{r}{n}\right)^n - 1}{i}
\]

\[
9000 \left(1 + \frac{0.18}{52}\right)^{312} = p \cdot \frac{\left(1 + \frac{0.18}{52}\right)^{312} - 1}{\frac{18}{52}}
\]

\[
9000 \left(1 + \frac{0.18}{52}\right)^{312} \cdot \frac{18}{52} = p \cdot \left[\left(1 + \frac{0.18}{52}\right)^{312} - 1\right]
\]

\[
p \approx 47.22\text{ per week}
\]

\[
47.22 \times 312 - 9000 = 14732.64 - 9000
\]

\[
\text{Interest} = 5732.64\text{ in interest}
\]

8) The average home price in Modesto is currently about $265,000. The average home loan interest rate is 4.4%. The average home loan is for 30 years. What is the average home loan monthly payment? Round to the nearest penny.

\[
P \left(1 + \frac{r}{n}\right)^n = \frac{p \cdot \left(1 + \frac{r}{n}\right)^n - 1}{i}
\]

\[
265000 \left(1 + \frac{0.044}{12}\right)^{360} = p \cdot \frac{\left(1 + \frac{0.044}{12}\right)^{360} - 1}{\frac{0.044}{12}}
\]

\[
265000 \left(1 + \frac{0.044}{12}\right)^{360} \cdot \frac{0.044}{12} = p \cdot \left[\left(1 + \frac{0.044}{12}\right)^{360} - 1\right]
\]

\[
p \approx 1327.02
\]
9) You’ve just won the lottery! (Woo-Hoo!) You hold in your hand a check for $3.5 million. You decide to use the money to set yourself up with a payout annuity for the rest of your life (Let’s say you’re planning on living about another 70 years. After all, you’ll have GREAT health care!). The bank is happy to give you a 9.25% interest rate. How big will your first monthly payment be? Round to the nearest penny.

\[
\frac{\text{Payout Annuity} = \text{Loan (to the bank)}}{2} \cdot \frac{(1 + \frac{0.0925}{12})^{840} - 1}{(1 + \frac{0.0925}{12})^{840} - 1} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} = \text{Pymt}
\]

\[
\begin{align*}
\text{P}(1 + \frac{0.0925}{12})^{840} - 1 &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
350,000(1 + \frac{0.0925}{12})^{840} &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
350,000 &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
\frac{350,000}{(1 + \frac{0.0925}{12})^{840}} &= \text{Pymt}
\end{align*}
\]

\[
\begin{align*}
\text{P}(1 + \frac{0.0925}{12})^{840} - 1 &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
350,000(1 + \frac{0.0925}{12})^{840} &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
350,000 &= \text{Pymt} \cdot \frac{(1 + \frac{0.0925}{12})^{840}}{.0925} \\
\frac{350,000}{(1 + \frac{0.0925}{12})^{840}} &= \text{Pymt}
\end{align*}
\]

10) You’re setting up a payout annuity for your pet parrot Spike (parrots live a long time, and often out-live their owners!). You expect Spike is going to live another 20 years, and will need about $1,400 a year to pay for his expenses. How much principal will you need to set this up, if you can get only 5% interest? Round to the nearest penny.

\[
\begin{align*}
\text{P}(1 + \frac{0.05}{1})^{20} &= 1400 \cdot (1 + \frac{0.05}{1})^{20} - 1 \\
\text{P}(1.05)^{20} &= 1400 \cdot (1.05)^{20} - 1 \\
1400 \cdot (1.05^{20} - 1) &= \text{P}
\end{align*}
\]