Chapter 4 Overview ANSWERS

These ARE NOT full solutions, they explain the choosing which formulas are appropriate, and give the answers (with maybe one or two other steps). You Must Show More Work Than This For Quiz/Test Questions.

1. Maeby Funke is at a BMW dealership. She has saved up $10,000 to use as a down payment, and because of her salary as a movie executive she determines she can afford to pay $700 a month in car payments. If she qualifies for 4.05% interest and plans to take out a 4 year loan, making monthly payments, what is the most expensive car she can buy?

- Ordinary Annuity (by default)
- $PV/\bar{a}_r$ Type (She’s trying to take out a loan that she will slowly repay over time)
- $PV = PMT \bar{a}_r$
  
  $\bar{a}_{38.0405/12} = 44.24497666$
  
  She can afford to BORROW (up to) $30,971.48 = PV$
  
  So the Most expensive car she can BUY is $40,971.48$

2. Lindsay Funke is irresponsible and decides to buy a new car without first considering her budget. She buys a Volvo for $41,050. Because her credit isn’t great she qualifies for 7.4% interest and will take out a 5 year loan. Because she looks drunk while making the purchase, the dealership demands that she make her first monthly payment today, and her second payment will be due in one month, and so on. What are Lindsay’s monthly payments and how much in interest will she pay over the life of the loan?

- Annuity Due (we’re explicitly told her first payment is due immediately)
- $PV/\bar{a}_r$ Type (She’s trying to take out a loan that she will slowly repay over time)
  
  (Lindsay’s debt looks like this as time progresses)
  
  $\$\$\$\$ \rightarrow \$\$$ \rightarrow \$$ \rightarrow 0$

- $PV = PMT \bar{a}_r (1+i)$
  
  $\bar{a}_{30.074/12} = 50.02385438$
  
  Her monthly payments are $\$815.58 = PMT$

- Lindsay will spend $815.58 \cdot 60 = \$48,934.80$ repaying her loan, (some of that is repaying the principal she borrowed, the rest is interest)

  Lindsay will pay $\$7,884.80$ in interest over the life of the loan.
  
  ($48,934.80 - 41,050 = \$7,884.80$)

3. George Michael Bluth is responsible, and has been saving $20 a week from his job at the banana stand for the past 4 years in an account that earns 2.99% interest. Today he takes out that money and goes down to a used car lot to buy a car, what is the most expensive car he can buy?

- Ordinary Annuity (by default)
- $FV/\bar{s}_r$ Type (He slowly made payments into an account, and after all that time he’s got a pile of money)

  $0 \rightarrow \$$ \rightarrow \$\$$ \rightarrow \$\$\$\$\$\$

- $FV = PMT \bar{s}_r$
  
  $\bar{s}_{2.99%/52} = 220.8820958$

  The most expensive car George Michael can afford to buy is $\$4417.64 = FV$
4. The City of Newport Beach had to borrow $500,000 from an investment group to cover some budget gaps in their law enforcement budget. The loan has an effective interest rate of 6%, and the City of Newport beach will repay the entire amount (including interest) in 7 years, but will make no payments on the loan before then. To cover this expense they set up a sinking fund and make quarterly payments into an account that earns 4.1% interest. What will their quarterly payments be?

- First we need to determine how much they will owe. This is a “Midterm1” question:
  The City of Newport Beach had to borrow $500,000 from an investment group to cover some budget gaps in their law enforcement budget. The loan has an effective interest rate of 6%, and the City of Newport beach will repay the entire amount (including interest) in 7 years.
  What is the total amount they will repay in 7 years?
  Answer: $751,815.13 (This was found using compound interest, compounded yearly)

- Now Onto the new stuff:
  - Ordinary Annuity (by default)
  - FV/s_{\overline{n}|i} Type (For the sinking fund they are slowly making deposits, and hoping to have a pile of $751,815.13 at the end)
  
  \[
  0 \rightarrow \$$ \rightarrow \$$ \rightarrow \$$ \rightarrow \$$ \rightarrow \$$
  \]

  - \( FV = PMT \times s_{\overline{n}|i} \)
  
  \[
  s_{\overline{7|0.041}/4} = 32.24186295
  \]
  Their quarterly payments are \(23,317.98 = PMT\)

5. The City of Newport found an different lender who will loan them the $500,000 at 6.9% interest. This lender will expect monthly payments that result in the loan being paid of in 7 years. What will their monthly payments be?

- Ordinary Annuity (by default)
- PV/a_{\overline{n}|i} Type (City of Newport is getting a pile of money now, and they will slowly repay it)

\[
PV = PMT \times a_{\overline{n}|i}
\]

\[
a_{\overline{7|0.069}/12} = 68.64596704
\]
Their monthly payments are \(7,283.75 = PMT\)

6. Compare the Lenders in Question 4 and Question 5, which lender is the cheapest for the city of Newport Beach, explain.

- With option one (sinking fund) they make 28 quarterly payments, each \(23,317.98\), so they spend a total of \$652,903.44 repaying the loan.
- With option two, they make 84 monthly payments of \(7,283.75\), so they spend a total of \$611,835.00 repaying the loan.
- Since in both cases they got \$500,000, then spend 7 years making payments (or setting aside money into the sinking fund), they should choose the option that costs the less. This is option 2. (they save over \$40,000).
7. Lucille Bluth was forced to quit drinking by some health problems. Her son convinced her to take the $80 a week she was spending on alcohol, and deposit it into an account that earns 3.83% interest. If Lucille’s first deposit was the day she opened the account, and that was 5 years ago, how much is in the account today? How much in interest did Lucille earn?

- Annuity Due (her first deposit was immediately)
- Imagine a cartoon with the money (you watch it play out over time)

\[ 0 \rightarrow \$80 \rightarrow \$80 \rightarrow \$80 \rightarrow \$80 \rightarrow \$80 \]

(she starts with nothing, and keeps adding money to the account, building up to some large amount of money)

FV/$s_{\overline{n}|i}$ Type

\[ FV = PMT \cdot s_{\overline{n}|i}(1 + i) \]

\[ s_{\overline{260}|0.0383/52} = 286.4473215 \]

Lucille has \$22,932.66 = FV in the account today.

- Lucile deposited a total of \$80 \cdot 260 = \$20,800 into the account, the rest of the money came from interest, so \$2,132.66 is what Lucile Earned in interest.

8. Michael Bluth is responsible and has been saving money in a ‘rainy day’ account that has been earning 4.5% interest. Michael works for the family business, and because of some legal trouble the business is in, he will not be getting paychecks for the foreseeable future. Michael’s ‘rainy day’ account has \$34,877 in it today. Michael needs to begin paying himself monthly payments out of this account today (to cover expenses for him and his son). He assumes he will need to make these payments over 2 years (while his family business deals with their legal troubles), and he assumes his account will continue earning 4.5% interest. What is the largest monthly payment Michael can afford to pay himself?

- Annuity Due (he needs to start paying himself today)
- Imagine a cartoon with the money (you watch it play out over time). There is a big pile of \$\$\$\$\$ sitting in a bank somewhere, and it’s slowly getting smaller (as Michael makes withdrawals) So this is

\[ \$\$\$\$\$ \rightarrow \$\$\$ \rightarrow \$ \rightarrow 0 \]

PV/$a_{\overline{n}|i}$ Type.

\[ PV = PMT \cdot a_{\overline{n}|i}(1 + i) \]

\[ a_{\overline{24}|0.045/12} = 22.9106561 \]

Michael can afford to pay himself (up to) \$1,516.62 = PMT a month.