Basic Types of Questions (Sect 4.2, 4.3, 4.4)

1. Answer both these questions to choose the correct formula:
   
   (a) Is this an Ordinary Annuity or Annuity Due?
   
   (this is a question about the timing of payments)
   
   (b) Is this a Future Value (snigh) or Present Value (annie) question?
   
   (does the big sum of money change hands at the start or end of the time?)

2. Choose the correct formula of the 4:
   (Or just read the formula sheet)

<table>
<thead>
<tr>
<th></th>
<th>Snigh/Future Value</th>
<th>Annie/Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary Annuity</td>
<td>$FV = PMT s_{\pi</td>
<td>i}$</td>
</tr>
<tr>
<td>Annuity Due</td>
<td>$FV = PMT s_{\pi</td>
<td>i}(1 + i)$</td>
</tr>
</tbody>
</table>

3. Identify how often payments are happening (monthly, quarterly, yearly, etc)

4. Identify $n$, $i$, and one of: $PMT$, $PV$ or $FV$

5. Calculate $s_{\pi |i}$ or $a_{\pi |i}$ (depending on your answer to 1b)

6. Plug everything into formula and solve. Make sure to answer the question asked.
‘Add Ons’ to Basic Questions

• **Find total interest earned and/or total interest paid.** (Can be added onto any basic question)

  1. First you need to know both the payment amount (PMT) and either PV or FV
    
    * Finding one of PMT, FV or PV will be a ‘Basic Question’

  2. You will find Total interest with one of these 2 formulas: *(on formula sheet)*
    
    - (For FV/snigh questions) Total Interest Earned = $FV - \frac{PMT \times n}{TotalDeposits}$
    
    - (For PV/annie questions) Total Interest Paid = $\frac{PMT \times n}{TotalPayments} - PV$

• **Down Payments** *(Usually added onto PV questions)*

  One Loans (or Mortgages) you may need to combine a person’s down payment with the total amount they are borrowing from a loan (PV of an annuity) to give you the total amount that person can spend.

  - If you know PMT
    
    * Find PV *(basic question)*
    
    * Then add the downpayment to the PV to get the total amount they can spend on ExpensiveThing

  - If you know ‘The cost of the House/Car/ExpensiveThing’
    
    * Cost of ExpensiveThing minus down payment = total amount to borrow
    
    * Use total amount to borrow as PV and find PMT *(basic question)*

• **Sinking Funds with Loans**

  - First find how much will be owed when the loan is due. You will probably use either the compound interest formula or the simple interest formula.

  - This total amount owed for the loan is the Needed Future Value for the Sinking Fund (Annuity).

    *(Go to ‘Basic Types of Questions’ Section)*

**Special Types of Questions**

• Remaining Balance Questions *(including Consolidation and Refinancing)* *(Sect 4.5)*

• Other ‘Small Questions’

  - Just calculating $s_{n|i}$ or $a_{n|i}$ with no ‘word problem’ around it
  
  - Knowing that speeding up payments (for a fixed interest rate) leads to paying much less in interest
  
    * Section 4.1 questions

There aren’t examples of these below, as they are not hard to identify the type.
Below you will find questions from 4.2, 4.3 and 4.4 all blended together. Make sure to make appropriate choices as you set these up. NOTE: These are not the only types of questions you can expect to see (for example there are no Mortgages), this is just extra practice at determining which formulas to use on similar looking 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?

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?

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?

4. 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?

5. Kitty Sanchez just came into $2,500 (it may or may not be hush-money from her employer). She plans to use this $2,500 as a down payment for a $7150 cosmetic surgery procedure she’s planning on having. Assume that Kitty will borrow the rest and make quarterly payments for the next 3 years at 5.25% interest. How much will Kitty’s payments be?

6. 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?
7. 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?

8. 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?

9. Compare the Lenders in Question 7 and Question 8, which lender is the cheapest for the city of Newport Beach, explain.

10. **There’s always money in the Banana Stand**

George Sr. has been ‘saving’ money by literally hiding it in the walls of the Banana Stand (where it earns no interest). The day the banana stand opened in 1953 George Sr. hid $5000 in the walls. Assume that he did the same each year for the next 50 years (bringing us to 2003, when the ‘Top Banana’ episode of Arrested Development came out)

(a) How much money in total did George Sr. hide in the Banana stand?

(b) If instead of hiding his $5000 per year in the Banana Stand, George Sr. had invested the $5000 per year in an investment that only paid 1.1% interest\(^1\), what would his investment be worth at the end of 50 years?

(c) How much in interest did George Sr. forgo by hiding his money in the banana stand?\(^2\)

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\(^1\)Interest rates on savings accounts in the 1950’s were roughly 1%, interest rates on savings accounts today are near 0.01%, unless you use the online bank Ally, where they are roughly 1%. In the decades between interest rates on savings accounts tended to be higher. And for part of the 80’s they were closer to 9%. So it’s very reasonable to assume George Sr. could have found a safe investment that averaged 1.1% over those 50 years.

\(^2\)It’s possible that George Sr. was hiding the money in the Banana Stand to avoid paying taxes, or to avoid having his illegal activities detected...so maybe he had his reasons.