## Assignment for Finance 1

1. (Text chapter 3 #6)

2. (Text chapter 3 #10)

3. (Text chapter 3 #15 – the "no-arbitrage price" is simply the fair value, given by the present value of the cash flows)

4. (Text chapter 4 #3)

5. An asset promises to pay you three annual payments of $100 with the first payment to be paid one year from today. The appropriate discount rate with which to value the asset is 8% per year. Using algebra only, find the value of the asset today by summing up the individual values of each promised cash flow.

6. This is the same problem you solved for Question 5, but let's use the financial calculator to value each individual cash flow. An asset promises to pay you three annual payments of $100 with the first payment to be paid one year from today. The appropriate discount rate with which to value the asset is 8% per year. Record your financial calculator input as you would on an exam to value each individual cash flow and then sum at the end to arrive at the value of the asset today.

7. Once again, you will address the same problem you solved for Question 5, but let's use the financial calculator treating this as an annuity. An asset promises to pay you three annual payments of $100 with the first payment to be paid one year from today. The appropriate discount rate with which to value the asset is 8% per year. Record your financial calculator input as you would on an exam to value the asset, treating the cash flow stream as an annuity.

8. Suppose you invest three annual deposits of $100 into an investment account promising you 8% interest per year. Using algebra only, find the accumulated value you expect to have in the account right after the last $100 deposit is made by summing up the individual future values of each deposit.

9. This is the same problem you solved in Question 8, but let's use the financial calculator. Suppose you invest three annual deposits of $100 into an investment account promising you 8% interest per year. Record your financial calculator input as you would on an exam to value each individual cash flow right after the last deposit is made and then sum at the end to arrive at total account value you will have right after the last deposit is made.

10. Once again, this is the same problem you solved in Question 8, but let's use the financial calculator treating this as an annuity. Suppose you invest three annual deposits of $100 into an investment account promising you 8% interest per year. Record your financial calculator input as you would on an exam to value the future value in the account right after the last deposit is made, treating the cash flow stream as an annuity.

11. (Text chapter 4 #6 parts a and b)

12. (Text chapter 4 #10)

13. (Text chapter 4 #8)

14. (Text chapter 4 #12)

15. Nine years ago you opened a new savings account and invested $5000. You made no additional investments and today the balance in the account is $5,666.46. What annual interest rate has the bank paid?

16. Here is a slight tweak of the problem you solved in Question 15. Nine years ago you opened a new savings account and invested $5000. You made no additional investments and today the balance in the account is $5,666.46. What monthly interest rate has the bank paid?

17. If you invest $1000 at an annual interest rate of 4%, in how many years will the investment grow to $1,872.98?

18. In one year you will receive the first $123 payment of a perpetuity. Using a discount rate of 8% per year, what is the present value of this perpetuity?

19. Three years from today you will receive the first payment of a $300 annual annuity with 4 payments total. If the appropriate discount rate is 10% per year, what is the present value today?

20. If the discount rate is 5% per year, what is the present value of a $500 annual perpetuity if the first payment begins 5 years from today?

21. (Text chapter 4 #39)

22. (Text chapter 4 #45)

23. Starting one year from today you will receive an annual payment of $1000 for 30 years, except that the payments 10 and 20 years from today will be skipped. At a discount rate of 5% per year, what is the total present value? (Hint: this is *almost* a standard annuity…it there an adjustment you could make to the cash flows to ease calculations, and then compensate for that adjustment later so you would arrive at the correct PV?)

24. Given an APR of 16%, compounded monthly, what is the monthly periodic rate and effective annual rate?

25. If you take out a $50,000 10-year loan with monthly payments (the first due one month from today) with an APR of 6%, compounded monthly,
a) What will be your monthly payment?
b) What will be the balance on the loan after three years (right after the 36 payment)?

26. A bank account earns 3.6% APR with monthly compounding for as long as you keep the account open. You open up the account and today deposit the first of 8 annual deposits of $1000 (after which you make no further deposits). What will be the balance exactly 10 years from today?

27. Five years ago you invested $5000 in a bank account that paid a fixed monthly rate of interest. Today the account balance is $7158.94. Express the interest that you earned as a monthly periodic rate, an APR, and an APY.

28. (Text chapter 5 #23)

29. Suppose that for valuing an annuity for gift tax purposes, the IRS currently dictates a discount rate of APR =10%, compounded monthly. How should we value a $400,000 annuity with 25 annual payments if the first payment begins 6 months from today?

30. Flaming Fireball Motors has a used car with a stated price of $19,000. They offer you cash back of $1000 for paying in cash, or a 48-month 4.0% APR financing deal (with monthly compounding and monthly payments). Which should you prefer if you can borrow from a bank at an APR of 8% with monthly compounding?

31. You can buy a new car for $24,000 plus 7% sales tax, and your after-tax cost of borrowing is 5%. Alternatively you can lease the car for 36 months for $600 at signing, then $450 per month plus 7% sales tax. The lease has a residual value of $10,000, which is $10,700 with tax included. Your plan is to have the car for three years, either selling it for what you estimate will be $9800, or giving the car back to the dealership when the lease ends. Should you buy the car, or lease it?

32. Consider the prior problem. To recap, you can buy a new car for $24,000 plus 7% sales tax, and your after-tax cost of borrowing is 5%. Alternatively, you can lease the car for 36 months for $600 at signing, then $450 per month plus 7% sales tax. The lease has a residual value of $10,000, which is $10,700 with tax included. Now your plan is to have the car for 8 years. Should you buy the car, or lease it now and then buy it from the dealership at the end of the lease?

33. Two years from today you will receive the first payment of a $200 annual annuity with 3 payments total. If the appropriate discount rate is 12% per year, what is the present value today, and what is the future value 6 years from today?

34. An account you have just opened today (which is your 26 birthday) with a bank earns 0.10% per month for as long as you have a positive balance in the account. What is the constant monthly amount you need to deposit today and each month thereafter, with the last deposit on your 30th birthday, so that you will have accumulated $10,000 on your 35 birthday?

35. An asset promises to pay you five annual payments of $5,000 with the first payment beginning five years from today. If you value this asset using a discount rate of 14% per year, what is the value you place on the asset?

36. You invested $10,000 in an investment that earned an APR of 2.08%, compounded weekly, and the investment has grown to $13,578.99. How many years ago did you make the initial investment?

37. (Text chapter 5 #4)

38. Today is your 25th birthday, and you are deciding how much money to pay to begin to contribute to your retirement plan. You believe contributions will earn 7% per year, and you plan to retire on your 69th birthday. When you retire you plan to withdraw $125,000 per year, starting at the end of the first year of retirement and ending on your 100th birthday. You will contribute

the same amount to the plan at the end of every year, making the last contribution on your 69th birthday. How much should you contribute each year?

39. Ten years from today you will receive the first payment of a $2000 annual annuity with 10 payments total. If the appropriate discount rate is 10% per year, what is the present value today?

40. A bank savings account compounds monthly, and has an APY of 2.14536%. What is the monthly periodic rate? What is the APR?

41. Gabe’s Motors has a used car with a stated price of $12,500. They offer you cash back of $1000 for paying in cash, or a 3-year 4.0% APR financing deal (with monthly compounding and monthly payments). Which should you prefer if you can borrow from a bank at an APR of 7.5% with monthly compounding?

42. How much should you deposit today in a new bank account, and every month with the last deposit made one year from today, to accumulate $10,000 3 years after you make the last deposit if the bank pays an APR of 3%, compounded monthly?

43. Investment A pays an APR of 10.00% with quarterly compounding. Investment B pays an APR of 9.90% with monthly compounding. Which pays the greater rate of interest?

44. Exactly 20 years ago a great uncle opened a new investment account that paid some fixed APR, compounded quarterly. Your uncle deposited $1,000 when the account was opened, and continued to make annual $1,000 deposits (the last deposit was made this morning). Your uncle has informed you that he is transferring the account to you as a gift, and that the account now has a balance of $35,270.94. What is the APR the account has been paying?

45. Five years ago you took out a 30-year fixed $300,000 mortgage with monthly payments and an APR of 8%, compounded monthly. You have made the normal payments in full, and, this morning, after making a normally scheduled payment, you are paying off the balance by taking out a new 30-year fixed mortgage at a lower APR of 6% (with monthly compounding). How much will each monthly payment be?

**FINANCE 1 ASSIGNMENT - SUGGESTED SOLUTIONS**

(Please note that what you turn in does not have to be as detailed as what follows…this is *extra detailed* in order to better explain solutions to those new to this topic)

1.

a. \$200 today is equivalent to \$208 in one year, because \$200 × 1.04 = \$208.
b. \$200 in one year is equivalent to having \$192.31 today, because \$200 / 1.04 = \$192.31.
c. You should prefer \$200 today to having \$200 in one year, because money today is worth more than money in the future. Note that this is the case even if you do not need the money today—you could invest \$200 for one year, so that you would have more than \$200 one year later.

2.

a. NPV (project A) = -10 + 20/1.10 = \$8.18
NPV (project B) = 5 + 5/1.10 = \$9.55
NPV (project C) = 20 - 10/1.10 = \$10.91
b. Project C is the best if only one can be chosen, because it has the highest NPV.
c. If two projects can be taken, B and C should be selected because together they have an NPV pf \$9.55 + \$10.91 = \$20.46, which exceeds the total NPV of any other of the two project choices.

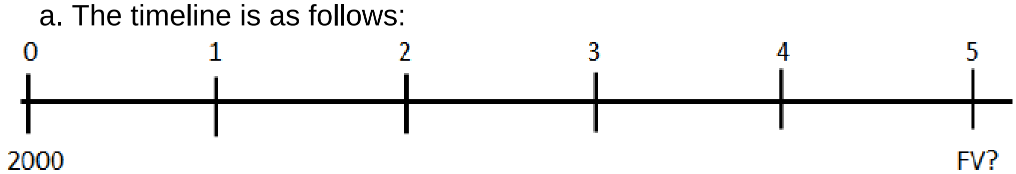
3.

The no-arbitrage price is the present value of the cash flows.
For A, this is \$500 + \$500 /1.05 = \$976.19.
For project B, the no-arbitrage price is \$1000 / 1.05 = \$952.38.
For project C, the no-arbitrage price is \$1000.

Note that the total amount of cash flows paid by each security is \$1000. The reason that C is worth more than A or B is that with those projects, some of the money is received in the future, and money received in the future is worth less than money received today.

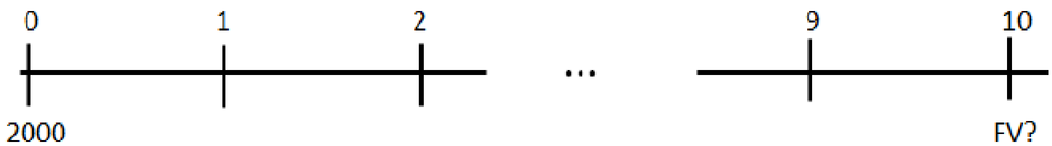
4.

a. The timeline is as follows:



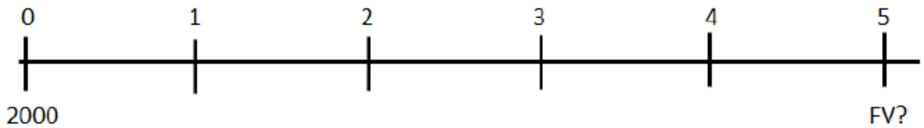

FV = \$2000 $(1.05)^5$ = \$2,552.56

b. The timeline is as follows:




$FV = \$2000\ (1.05)^{10} = \$3,257.79$

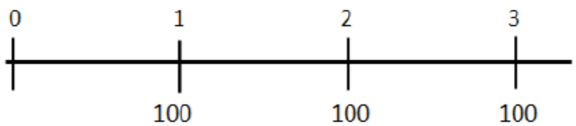
c. The timeline is as follows:




$FV = \$2000\ (1.10)^{5} = \$3,221.02$

d. This is the case because in (b), during the last five years you receive interest on the interest earned in the first five years, as well as interest on the initial $2,000. Basically, due to the longer time period of compounding, there is a larger “interest on interest” component to the total amount of interest you earn.

5.




$$PV = \frac{100}{(1.08)} + \frac{100}{(1.08)^2} + \frac{100}{(1.08)^3}$$

Which = 92.593 + 85.734 + 79.383 = $257.71 (note how we carry out each intermediate calculation to three decimal places, so that when we sum at the end we are sure to be accurate two the penny).

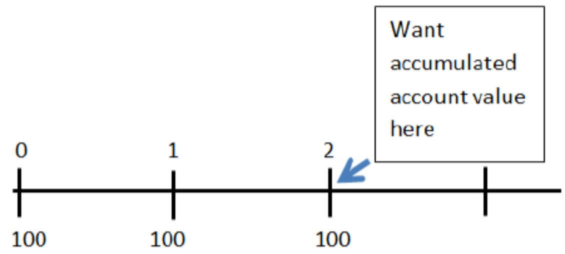
6. PV of the t=1 cash flow: N=1, I = 8, PMT = 0, FV = -100 ➔ PV = 92.593
PV of the t=2 cash flow: N=2, I = 8, PMT = 0, FV = -100 ➔ PV = 85.734
PV of the t=3 cash flow: N=3, I = 8, PMT = 0, FV = -100 ➔ PV = 79.383
Total PV = 92.593 + 85.734 + 79.383 = $257.71

Note in each step it would be okay enter the 100 values as positive and solve for negative PV, but that the final answer MUST be expressed as a positive number because the problem is asking for the present value of three cash flows of positive $100.

7. N = 3, I = 8, PMT = -100, FV = 0 Solve for PV = $257.71
Note that N = 3 has nothing to do with where on the timeline the cash flows occur…instead, with an annuity, N tells the calculator HOW MANY payments there are in

the annuity. Recall that with the PV of an annuity, the calculator gives the PV as of one period before the first payment—this is exactly what we need in this problem. Also note that the input shown is the correct input for exam purposes…using “cash flow keys” (e.g., denoted $CF_j$ on some calculators) would not be accepted, as in this course you are expected to use only the five main financial calculator keys (N, I, PMT, PV, and FV).

8.




We want the combined future value at t = 2, right after the last payment.
FV = $100(1.08)^2 + 100(1.08) + 100$
= 116.640 + 108.000 + 100 = $324.640

9. FV at t = 2 of the t=0 cash flow: N=2, I = 8, PMT = 0, PV = -100 ➔ FV = 116.640
FV at t = 2 of the t=1 cash flow: N=1, I = 8, PMT = 0, PV = -100 ➔ FV = 108.000
FV at t = 2 of the t = 2 cash flow is $100 and does not need to be moved in time. FV = 100.000

Total FV = 116.64000 + 108.000 + 100.000 = $324.64
Note in each step it would be okay to enter the 100 values as positive and solve for negative FV, but that the final answer MUST be expressed as a positive number because the problem is asking for the future value of three cash flows of $100.

10. N = 3, I = 8, PMT = -100, PV = 0 and solve for FV = $324.64.
Notice that we used N = 3 because with an annuity in the calculator, N is the number of payments being valued. And recall that with the future value of an annuity, the calculator gives the future value right after the last payment (which is exactly when we need it for this problem). Also note that the input shown is the correct input for exam purposes…using “cash flow keys” (e.g., denoted $CF_j$ on some calculators) would not be accepted, as in this course you are expected to use only the five main financial calculator keys (N, I, PMT, PV, and FV).

11.

a. PV(i) = $100 / 1.10 = $90.91
PV(ii) = $200 / $(1.10)^5$ = $124.18
PV(iii) = $300 / $(1.10)^{10}$ = $115.66
Option (ii) is the most valuable, followed by option (iii) and then option (i).

b. PV(i) = $100 / 1.05 = $95.24
PV(ii) = $200 / $(1.05)^5$ = $156.71
PV(iii) = $300 / $(1.05)^{10}$ = $184.17
Option (iii) is the most valuable, followed by option (ii) and then option (i).

Note how the rank order of preferences can differ due to the magnitude of the discount rate used!

12.

a. Here a timeline may help, showing age and also years from age 18:


$FV = \$3,996\,(1.08)^7 = \$6,848.44$

b.


$FV = \$3,996\,(1.08)^{47} = \$148,779.12$

c.

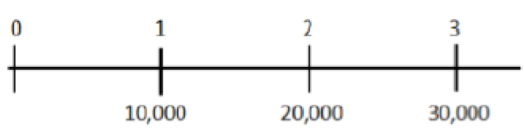

$PV = 3996 / (1.08)^{18} = \$1000.00$

13.

$PV = 100,000 / (1.03)^{10} = \$74,409.39$
Or, alternatively you could use your financial calculator: N=10, I=3, PMT=0, FV = -100,000 and solve for PV. Just make sure to show all of your calculator input if you use your calculator to solve a problem on an exam.

14.

a.

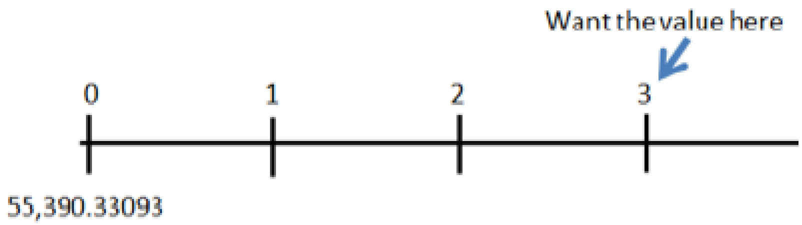



$$PV = \frac{10,000}{(1.035)} + \frac{20,000}{(1.035)^2} + \frac{30,000}{(1.035)^3} = \$55,390.33093 \textit{ rounds to } \$55,390.33.$$

b. Method 1: Calculate future value of each cash flow and then sum.
$10{,}000(1.035)^2 + 20{,}000(1.035) + 30{,}000 = \$61{,}412.25$

Method 2: work from the PV: $55{,}390.33093(1.035)^3 = \$61{,}412.25$

You should well understand both methods. A graphic for method 2 is as follows:



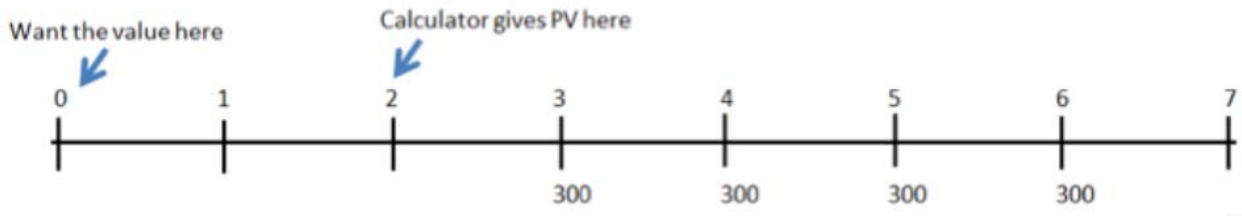

15. PV = -5000, N = 9, PMT = 0, FV = 5666.46 ➔ I = 1.40% per year.
Alternatively, solve for $5000(1+r)^9 = 5666.46$ for r.

16. PV = -5000, N = 108, PMT = 0, FV = 5666.46 ➔ I = 0.11593% per month
Did this seem like the same question to you? Did you catch that the way the interest rate is asked is different? With finance problems, it is extremely important to read very carefully. Note N = 108 (which is 9 x 12). Also, we need to enter PV and FV with opposite signs due to the calculator sign convention.

17. PV = -1000, I = 4, PMT = 0, FV = 1872.98 ➔ N = 16 years.

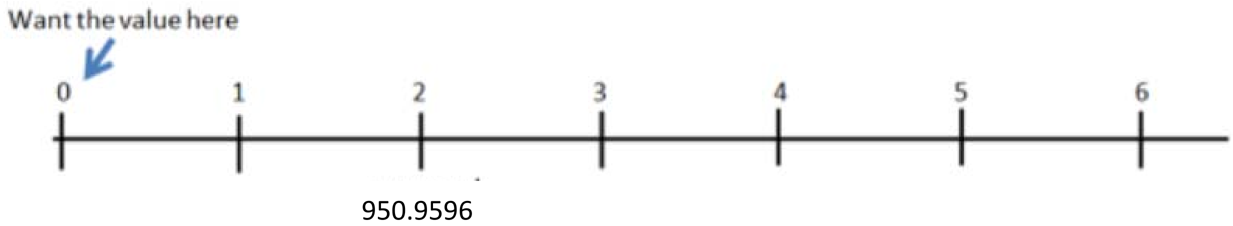
18. PV = 123 / 0.08 = $1537.50. One could also treat this as an annuity in the calculator using a very large number of payments such as 99,999 because the present value of payment very far out in time approaches zero. N = 99999, I = 8, FV = 0, PMT = -123 ➔ PV = $1537.50.

19.




Step 1: N = 4, PMT = 300, I = 10, FV = 0 ➔ PV = 950.9596.
This is valued as of t = 2, because the calculator gives the PV one period before the first payment. We carry out the answer several decimal places because this is only an intermediate step and at the end we wish to be accurate to the penny. Essentially we

now have a new problem…moving the single lump sum value we have at t = 2 back to t = 0.




PV at t = 0 is 950.9596 / $(1.10)^2$ = \$785.92.

20. PV = 500 / 0.05 = \$10,000.00. This is valued as of t = 4 (one period before first payment).

PV at t = 0: 10,000 / $(1.05)^4$ = \$8227.02

21. a. N = 30 x 12= 360, PV = -600,000, I = 0.50, FV = 0 ➔ PMT = \$3597.30
b. N = 15 x 12= 180, PV = -600,000, I = 0.40, FV = 0 ➔ PMT = \$4682.49

22. First, find the PV as of your 65 birthday of the \$100,000 annual annuity that will be withdrawn on your 66 birthday (the end of the first ear of retirement) through your 100th. This annuity has 100 – 66 + 1 = 35 total payments (need to count the endpoints!). Recall that the PV of annuity in the calculator is given one payment before the first payment…since the first withdrawal is at age 66, the PV will be at age 65 as needed.

N = 35, I = 7, PMT = -100,000, FV = 0 ➔ PV = \$1,294,767.23. This is the total accumulated value you will need at age 65.

Now, recall the FV of annuity in the calculator is given at the time (immediately after) the last payment. You make your first payment when you turn 31 (you are 30 now and the problem states you will make your first deposit one year from now) and the last at age 65, for a total of 65 – 31 + 1 = 35 deposits. This is set up perfectly for a FV of annuity in the financial calculator and you simply need to solve for the payment that will result in a FV of \$1,294,767.23.

N = 35, I = 7, PV = 0, FV = 1,294,767.23 ➔ PMT = \$9,366.29.

23. First, recognize this is "almost" a standard annuity. If there were not skipped payments, the PV today would be found as: N = 30, I = 5, PMT = 1000, FV =0 ➔ PV = \$15,372.4510. Now recognize that this value is too high, because it includes receiving \$1000 at t = 10 and t = 20 instead of skipping them. So, let's find the total PV of a payment of \$1000 at t = 10 and t = 20 so we can subtract it out.

PV of the two \$1000 payments we need to subtract is: $1000/(1.05)^{10} + 1000/(1.05)^{20}$ = \$990.8027.Thus the total PV of the payments you will actually receive is: \$15,372.4510 - \$990.8027 = \$14,381.65.

24. The monthly periodic rate is 0.16 / 12 = 0.0133333 or 1.33333%
The EAR is $(1.0133333)^{12} - 1 = 0.1722708$ or 17.22708%

25. a. N = 10 x 12 = 120, I = 6/12 = 0.50, PV = -50,000, FV = 0 ➔ PMT = $555.10
b. The balance will be the PV of the remaining payments:
N = 7 x 12 = 84, I = 6/12 = 0.50, PMT = -555.10 ➔ PV = $37,998.28

26. You will make annual payments, so to value the future value of an annual annuity we need an annual effective interest rate (i.e., the APY = EAR).
Monthly periodic rate is 0.036 / 12 = 0.00300 or 0.300%.
APY = EAR = $(1.003)^{12} - 1 = 0.03659998 = 3.659998\%$
FV of the annuity: N = 8, I = 3.659998, PMT = -1000, PV = 0 ➔ FV = 9,103.349011.

Remember that the calculator gives the FV of an annuity immediately after the last payment, so be careful to note this FV we have solved for is at t = 7! (The first payment is today at t = 0, the second is at t = 1 year from today... the 8 and final payment is at t = 7 years from today).

Thus we need to move the value of 9,103.349011 from t = 7 years from today to t = 10 years from today. 9,103.349011 $(1.03659998)^3$ = $10,139.93.
(Note we could also use the monthly rate to compound, i.e., 9,103.349011 $(1.003)^{36}$ ).

27. Solve for the monthly periodic rate: N = 5 x 12 = 60, PV = -5000, FV = 7158.94, PMT = 0
➔ I = 0.600 so that the monthly periodic rate is 0.60%.
(Remember with the calculator inputs that the PV and FV must have opposite signs).
The APR = 0.60% x 12 = 7.20%
The APY = $(1.006)^{12} - 1 = 0.0744242$ or 7.44242%.

28. a. The balance on the old load is the PV of remaining payments (under its APR and payments). N = 25 x 12 = 300, I = 10/12 = 0.83333, PMT = -1402, FV = 0 ➔ PV = 154,286.22

This is the amount you will refinance. Find the new payments as follows (the interest rate is 6% + 5/8% = 6.625% APR, which we divide by 12 when plugging in):
PV = - 154,286.22, N = 30 x 12= 360, I = 6.625/12 = 0.55208333 , FV = 0 ➔ PMT = $987.91.

b. Now we simply use 25 years (300 months): PV = - 154,286.22, N = 25 x 12= 300, I = 6.625/12 = 0.55208333 , FV = 0 ➔ PMT = $1053.83.

c. So, this means you will pay a bit more ($65.92) than the required 987.91 each month.
PV = - 154,286.22, I = 6.625/12 = 0.55208333, PMT = $1402, FV = 0 ➔ N = 169.9 (so, 170 months)

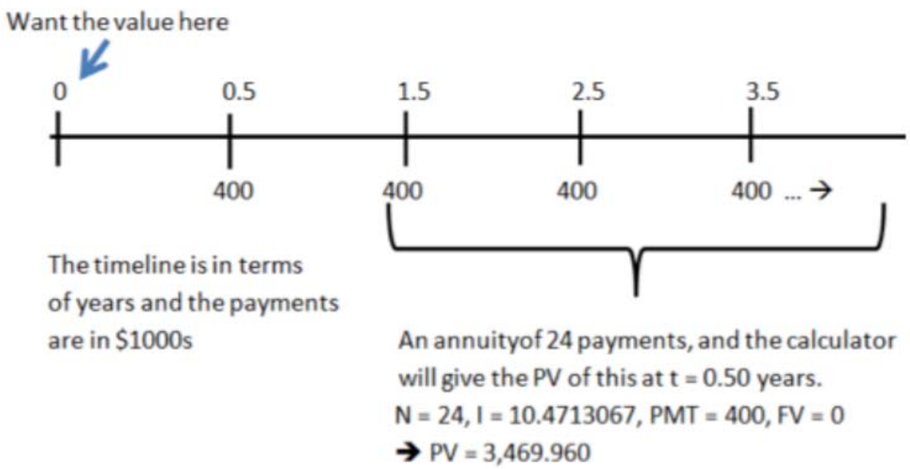
d. N = 25 x 12= 300, I = 6.625/12 = 0.55208333, PMT = -1402, FV = 0 ➔ PV = $205,259.23

The balance on the old loan you must pay off was $154,286.22. Thus, you can borrow an additional $205,259.23 - $154,286.22 = $50,973.01 more than needed to pay off the old loan. Time for a new kitchen perhaps?

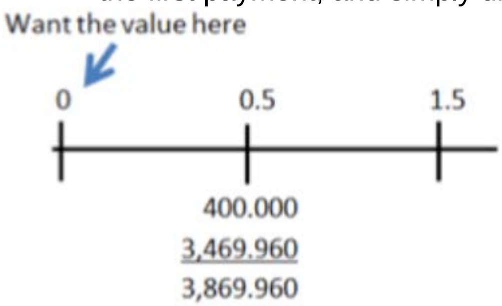
29. For an annual annuity, we need an annual effective interest rate. EAR = $(1 + 0.10/12)^{12}$ - 1 = 0.104713067 or 10.4713067%.If we value all 25 payments in an annuity calculation in the calculator, we will have a present value that is one year before the first payment (i.e., at t = - 6 months ago) and then we can move it forward to t = 0 years.

The value at t = -6 months: N= 25, I= 10.4713067, PMT= 400, FV=0➔ PV = 3503.13586
Value at t = 0 (we compound forward one-half year): 3503.13586 x $(1.104713067)^{0.5}$ = $3681.98255. So the final answer (because that was in $1000s) is $3,681,982.55.

Another approach, which avoids having any values given prior to today (which may have seemed a bit strange to you) is to treat the first payment and the remaining 24 separately. Thus we can attack it as follows:




Now we can combine the value of the last 24 payments (valued as of t = 0.50 years) with the first payment, and simply discount back one-half year to today.




'13067) = $3681.983 and so given that we worked with $1000s remember the final answer is $3,681,982.55.

Yet another approach is to begin by calculating the FUTURE VALUE of the annuity. You would need to carefully figure out the timing of the annuity's last payment, which will be at t = 24.5. (If the payments were timed normally they would be at t = 1 through t = 25....but in this problem they always occur one-half year earlier, so they are at t = 0.50 through t = 24.5. So let's first solve for the future value of an annuity with 25 payments: n = 25, i = 10.4713067, pmt = 400 and PV = 0 ==> FV = 42,237.1160 and you need to recall that the calculator gives the FUTURE value of an annuity exactly where the last payment occurs. Thus, this 42,237.1160 is valued as of t = 24.5 years (because the last payment is at 24.5 years).

Next we take the present value of that all the way back to t = 0...you can do this by algebra: 42,237.1160 / [ 1.104713067^24.5] = 3,681.98. Or you can use your calculator: n = 24.5, fv = 42,237.1160, i = 10.4713067, pmt = 0 and solve for PV (and multiply by $1000).

30. Monthly payments if you borrow from the bank to pay in cash:
N = 48, I = 8/12 = 0.666667, PV = -18,000, FV = 0 ➔ PMT = $439.43
Monthly payments financing the car through Grove Motors:
N = 48, I = 4/12= 0.333333, PV = -19,000, FV = 0 ➔ PMT = $429.00
You are better off financing through Flaming Fireball Motors.

31. Your monthly after-tax cost of capital is 5% / 12 = 0.4166667%.
The net cost of buying the car is what you pay (with taxes) minus the PV of the future price for which you expect to sell it.
This is (24,000)(1.07) – [ $9800/(1.0041666677)^{36}$] = 17,242.43.
Cost of the lease in today's dollars is what you put down today ($600) + the PV of the lease payments (using the 0.4166667% to value them…this is your cost of capital and noting the after-tax lease payment is 450(1.07) = $481.50).

PV of the lease payments: N = 36, I = 0.4166667, PMT = 481.50, FV = 0 ➔ PV = 16,065.59
Total cost of lease in today's dollars is $600 + $16,065.59 = $16,665.59.
Leasing is cheaper than buying and reselling later.

32. Either way you will have outright ownership of the car after three years, so it makes no difference whether you plan to have it for 8 years, 10 years etc. – the only thing we must analyze is the best way to end up owning the car after three year years.

Total cost of the lease route is what you put down today plus the PV of the payments plus the PV of the residual you pay the dealership when the lease ends to keep the car.
PV of the lease payments: N = 36, I = 0.4166667, PMT = 481.50, FV = 0 ➔ PV = 16,065.59
Total cost is $600 + $16,065.59 + [$10,700/ $(1.004166667)^{36}$ ]= $25,878.03
Total cost of buying (24,000)(1.07) = $25,680. It is cheaper to buy.

33.


First find a lump sum value of the annuity. N=3, i=12, PMT = -200, FV=0 ➔ PV = 480.3663
This is valued as of t=1 (i.e., one period before the first payment). Thus PV as of t = 0 = 480.3663 / 1.12 = 428.8984 (rounds to $428.90).

To obtain the value at t = 6, we can simply take the future value of the t = 0 value.
PV = -428.8984, n = 6, pmt = 0, I = 12 ➔ FV = $846.57 (note pmt = 0 because the $428 value at t=0 *replaces* the payments). Or with algebra: 428.8984 $(1.12)^6$ = $846.57.

34. If you will need $10,000 on your 35th birthday, then you will need ___??___ on your 30th birthday immediately after you make the last deposit. This is found as follows:

10,000 / (1.0010) = $9,417.9277 (recognizing that 5 years = 60 months)

If you make the first monthly deposit today on your 26th birthday, then the deposit on your 27 birthday will be the 13 deposit, the deposit on your $28^{th}$ birthday will be the 25 deposit, etc. and the last deposit on your 30 birthday will be the 49 deposit. (A timeline may help you see this). We need the FV of an annuity with 49 payments to be $9417.9277.
FV = -9417.9277, N = 49, I = 0.10, PV = 0 ➔ PMT = $187.63.

35. First find a PV of the annuity: N = 5, I = 14, PMT = -5000, FV = 0 ➔ PV = 17,165.40484 and recognize this is given as of t = 4 (because the first payment begins at t = 5 and the calculator provides the PV of an annuity one period before the first payment. Now we discount back four period to find the PV as of t = 0: 17,165.40484 / $(1.14)^4$ = $10,163.30.

36. Weekly periodic rate is 2.08% / 52 = 0.0400%.
I = 0.040, PV = -10,000, PMT = 0, FV = 13,578.99 ➔ N = 765 weeks which is 765/52 = 14.71 years. (Note PV and FV must be opposite signs).
Also note the EAR = (1.0004) – 1 = 0.021013581 so that you could do the following:
I = 2.1013581%, PV = -10,000, PMT = 0, FV = 13,578.99 ➔ N = 14.71 years.

37. If you invest $1 invested in an account that pays 10% APR with monthly compounding, at the end of the year it will accumulate to: $1 $[ 1 + (0.10/12)]^{12}$ = $1.10471.
(Note the monthly periodic rate is 0.10/12 = 0.00833333 and then we can use $1$(1.00833333)^{12}$ = $1.10471). The EAR is thus 0.10471 or 10.471%.

With annual compounding, the $1 will grow to $1(1 + 0.10) = $1.10 and thus the EAR is 10%.

With daily compounding, at the end of the year the accumulated value will be
$1 $[ 1 + (0.10/365)]^{365}$ = $1.09416. (Note the daily periodic rate is 0.10/365 = 0.0002739726 and then we can use $1$(1.0002739726)^{365}$ = $1.09416).
Thus the EAR = 0.09416 or 9.416%.

38. First, find the PV as of your 69th birthday of the $125,000 annual annuity that will be withdrawn on your 70th birthday (the end of the first ear of retirement) through your 100th birthday. This annuity has 100 – 70 + 1 = 31 total payments (need to count the endpoints!). Recall that the PV of annuity in the calculator is given one payment before the first payment…since the first withdrawal is at age 70, the PV will be at age 69 as needed.

N = 31, I = 7, PMT = -125,000, FV = 0 ➔ PV = $1,566,476.77. This is the total accumulated value you will need at age 69.

Now, recall the FV of annuity in the calculator is given at the time (immediately after) the last payment. You make your first payment when you turn 26 (you are 25 now and the problem states you will make your first deposit one year from now) and the last at age 69, for a total of 69 – 26 + 1 = 44 deposits. This is set up perfectly for a FV of annuity in the financial calculator and you simply need to solve for the payment that will result in a FV of $1,566,476.77.

N = 44, I = 7, PV = 0, FV = $1,566,476.77 ➔ PMT = $5,886.34.

39. Step 1: N = 10, PMT = 2000, I = 10, FV = 0 ➔ PV = 12,289.1342.

This is valued as of t = 9, because the calculator gives the PV one period before the first payment. Step 2: Now we move the 12,289.1342 back to t = 0.
PV at t = 0 is $12,289.1342 / (1.10)^9 = \$5211.79$.

40. For monthly periodic rate we solve $0.0214536 = (1+r)^{12} – 1$ for r = 0.001770458 or 0.1770458%. The APR is thus 12 x 0.1770458% = 2.12455%.

41. Monthly payments if you borrow from the bank to pay in cash:

N = 36, I = 7.5/12 = 0.625, PV = -11,500, FV = 0 ➔ PMT = $357.72
Monthly payments financing the car through Gabe's Motors:

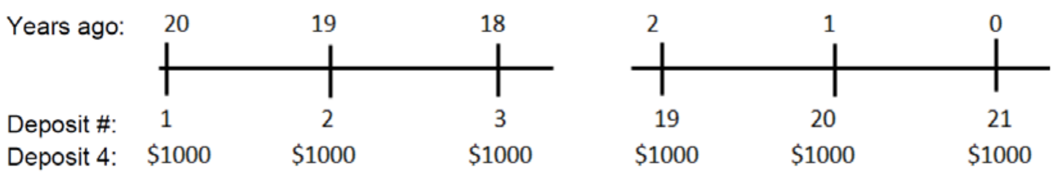
N = 36, I = 4/12= 0.333333, PV = -12,500, FV = 0 ➔ PMT = $369.05

So, you are better off borrowing from the bank to pay in cash.

42. First find the amount you will have needed to accumulate right after the last deposit, so that that amount will grow to $10,000 thirty-six months later at 3% / 12 = 0.25% per month. $PV = 10,000 / (1.0025)^{36} = 9,140.33837$. If you make one deposit today (t = 0) and make the last one year from today, then this is 13 deposits total. The FV of an annuity in the financial calculator is given right after the last payment, so now you can simply solve N=13, I = 0.25, PV = 0, FV = 9,140.33837 ➔ PMT = $692.62 (rounded to the nearest penny).

43. Find the EAR for both.
$EAR(A) = (1 + 0.10/4)^4 – 1 = 10.381289\%$.
$EAR(B) = (1 + 0.099/12)^{12} – 1 = 10.361798\%$. Thus, A pays a higher rate of interest.

44. The balance of $35,270.94 is immediately after the 21st deposit. This is something to be careful about and perhaps the timeline below helps (notice the sum of the "years ago" and "deposit number" always equal 21…this helps with labelling the latter part of the timeline).




The financial calculator gives the FV of annuity right after the last payment. We can solve for the *annual* interest rate (view this as an EAR): N = 21, PMT = 1000, PV = 0, FV = -35,270.94 ➔ 4.88709344. The quarterly periodic rate that results in this EAR is found by solving $(1 + r_{pq})^4 – 1 = 0.0488709344$ ➔ $r_{pq} = (1.0488709327)^{1/4} – 1 = 0.01200$ and thus the APR = 4 x 0.01200 = 4.80%.

45. Monthly payments on the old mortgage: PV = 300,000, FV = 0, I = 8/12, N = 30 x 12 ➔ PMT = $2,201.29. Now, the remaining balance on the loan (which is the amount you will refinance) is the PV of the remaining payments if you had continued with the old mortgage: PMT = 2,201.29, N = 25 x 12, FV = 0, I = 8/12 ➔PV = $285,209.08. Now, find the payments of the new mortgage (which, recall, is a 30-year fixed at a 6% APR): PV = -285,209.08, N = 30 x 12, FV = 0, I = 6/12 ➔ PMT = $1,709.97.