

## 14.3: Solutions to CH 3 Exercises

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### Question 1

\$1 received today is worth more than \$1 received one year today because as soon as we have the money we can start making it work for us earning a positive rate of return. If I earn 5% interest, then having the \$1 today means I get an extra 5 cents. The earlier I get the money, the more time I have to make it work in my favor.

### Question 2

An annuity refers to an equal periodic cash flow stream. While the equal cash flows arrive at the END of each period for an annuity, they arrive at the BEGINNING of each period for an annuity due.

### Question 3

Present Value and Future values are just flip sides of the same coin. Present value tells us what the cash flow is worth to us today while future value tells us what the cash flow will grow to over time. Once we have one, we can find the other.

### Question 4

The appropriate discount rate to use when finding present value is the rate of return we can earn on other investments of similar risk. The idea of present value is that it tells us how much a future cash flow is worth to us today. The value of this future cash flow is exactly equal to what we would have to invest today to duplicate it. However, we need to control for risk. Riskier cash flows should be discounted at a higher rate because they are worth less to us. Note that the appropriate discount may change over time as market rates of interest change over time. This will play a large part in our valuation chapters starting with Chapter 6 on bond valuation.

### Question 5

Compounding on a monthly basis is better than annual because it allows us to start earning interest on interest sooner. Not only does the principle work for us, but so does the interest.

**Reminder for calculation exercises: When using the 5-key approach with the TI-BAII+ , you must press CPT and then what you want to solve – for instance in Problem 1a, your last step would be CPT FV. With the HP, you just press what you want to solve – for instance in Problem 1a, your last step would be FV. With the TI-83/84 move the cursor to highlight the variable you want to find and then press SOLVE.**

### Problem 1

#### Part 1a

Step 1: 10 N  
Step 2: 11 I/Y  
Step 3: 2500 PV  
Step 4: 0 PMT  
Step 5: FV⇒ \$7,098.55

#### Part 1b

Step 1: 30 N  
Step 2: 11 I/Y  
Step 3: 2500 PV  
Step 4: 0 PMT  
Step 5: FV⇒ \$57,230.74

### Part 1c

Step 1: 10 N  
Step 2: 5 I/Y  
Step 3: 6000 FV  
Step 4: 0 PMT  
Step 5: PV  $\Rightarrow$  \$3,683.48

### Part 1d

Step 1: 10 N  
Step 2: 10 I/Y  
Step 3: 6000 FV  
Step 4: 0 PMT  
Step 5: PV  $\Rightarrow$  \$2,313.26

### Part 1e

Step 1: 30 N  
Step 2: 6 I/Y  
Step 3: 0 PV  
Step 4: 3000 PMT  
Step 5: FV  $\Rightarrow$  \$237,174.56

### Part 1f

Step 1: 30 N  
Step 2: 12 I/Y  
Step 3: 0 PV  
Step 4: 3000 PMT  
Step 5: FV  $\Rightarrow$  \$723,998.05

### Part 1g

Step 1: 20 N  
Step 2: 15 I/Y  
Step 3: 4000 PMT  
Step 4: 0 FV  
Step 5: PV  $\Rightarrow$  \$25,037.33

### Part 1h

Step 1: 40 N  
Step 2: 15 I/Y  
Step 3: 4000 PMT  
Step 4: 0 FV  
Step 5: PV  $\Rightarrow$  \$26,567.11

## Problem 2

### Part 2a

Step 1: 5 N  
Step 2: 2114 FV  
Step 3: -1500 PV  
Step 4: 0 PMT  
Step 5: I/Y  $\Rightarrow$  7.10%

## Part 2b

Step 1: 4 N  
Step 2: 0 FV  
Step 3: -500 PV  
Step 4: 193.50 PMT  
Step 5: I/Y  $\Rightarrow$  20.10%

## Problem 3

### Part 3a

Step 1: 15 N  
Step 2: 12 I/Y  
Step 3: 2000 PV  
Step 4: 0 PMT  
Step 5: FV  $\Rightarrow$  \$10,947.13

### Part 3b

Step 1: Set P/YR to 4  
Step 2: 60 N  
Step 3: 12 I/Y  
Step 4: 2000 PV  
Step 5: 0 PMT  
Step 6: FV  $\Rightarrow$  \$11,783.21

### Part 3c

Step 1: Set P/YR to 12  
Step 2: 180 N  
Step 3: 12 I/Y  
Step 4: 2000 PV  
Step 5: 0 PMT  
Step 6: FV  $\Rightarrow$  \$11,991.60

### Part 3d

Step 1: Set P/YR to 365  
Step 2: 5475 N  
Step 3: 12 I/Y  
Step 4: 2000 PV  
Step 5: 0 PMT  
Step 6: FV  $\Rightarrow$  \$12,095.72  
Remember to Set P/YR back to 1.

## Problem 4

### Part 4a

Step 1: 3 FV  
Step 2: 5 I/Y  
Step 3: -1 PV  
Step 4: 0 PMT  
Step 5: N  $\Rightarrow$  22.52 years

### Part 4b

Step 1: 3 FV  
Step 2: 10 I/Y  
Step 3: -1 PV  
Step 4: 0 PMT  
Step 5:  $N \Rightarrow 11.53$  years

### Part 4c

Step 1: 3 FV  
Step 2: 15 I/Y  
Step 3: -1 PV  
Step 4: 0 PMT  
Step 5:  $N \Rightarrow 7.86$  years

## Problem 5

### Part 5a

$PV = PMT/k$   
 $PV = \$5000/.10$   
 $PV = \$50,000$

### Part 5b

Now, the first payment is in year 6, so when we solve for the perpetuity we get the amount we need to have at the end of year 5  $\Rightarrow$  \$50,000. In order to find out how much we need to invest now to have \$50,000 at the end of year 5, we solve for PV

Step 1: 5 N  
Step 2: 10 I/Y  
Step 3: 50000 FV  
Step 4: 0 PMT  
Step 5:  $PV \Rightarrow \$31,046.07$

## Problem 6

Solution: \$34,833.37. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 4000 CFj Step 4: 10 Nj Step 5: 6000 CFj Step 6: 5 Nj Step 7: 8000 CFj Step 8: 5 Nj Step 9: 12 I/YR Step 10: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 4000 Enter ↓ Step 4: 10 Enter ↓ Step 5: 6000 Enter ↓ Step 6: 5 Enter ↓ Step 7: 8000 Enter ↓ Step 8: 5 Enter Step 9: NPV 12 Enter ↓ Step 10: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv( Step 2: Enter the given information in the following format: $\text{npv}(\text{InterestRate}, \text{CF0}, \{\text{CF Stream}\}, \{\text{CF Frequencies}\})$ $\text{npv}(12,0,\{4000,6000,8000\},\{10,5,5\})$ Step 3: Press the SOLVE key

## Problem 7

Solution: \$77,129.07. Calculator steps are below.

HP10BII+	TI-BAII+	TI-83/84
Step 1: Clear All Step 2: 0 CFj Step 3: 3000 CFj Step 4: 5 Nj Step 5: 7500 CFj Step 6: 9000 CFj Step 7: 9 Nj Step 8: 12,000 CFj Step 9: 15 Nj Step 10: 8.75 I/YR Step 11: NPV	Step 1: CF CLR Work Step 2: 0 Enter ↓ Step 3: 3000 Enter ↓ Step 4: 5 Enter ↓ Step 5: 7500 Enter ↓↓ Step 6: 9000 Enter ↓ Step 7: 9 Enter ↓ Step 8: 12,000 Enter ↓ Step 9: 15 Enter Step 10: NPV 8.75 Enter ↓ Step 11: CPT	Go to APPS⇒Finance⇒ Step 1: Select npv( Step 2: Enter the given information in the following format: $\text{npv}(\text{InterestRate}, \text{CF0}, \{\text{CF Stream}\}, \{\text{CF Frequencies}\})$ $\text{npv}(8.75,0,\{3000,7500,9000,12000\},\{5,1,9,15\})$ Step 3: Press the SOLVE key

Second, solve for FV using 5-key approach:

Step 1: 30 N  
 Step 2: 8.75 I/Y  
 Step 3: 77,129.07 PV  
 Step 4: 0 PMT  
 Step 5: FV⇒ \$955,203.85

## Problem 8

### Part 8a

$k_{\text{eff}}=9.00\%$

### Part 8b

Solution: 9.31%

Formula:  $k_{\text{eff}}=[1+(.09/4)]^4-1=9.31\%$  or

Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 4 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 4 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF( Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,4) Step 3: Press SOLVE

### Part 8c

Solution: 9.38%

Formula:  $k_{\text{eff}}=[1+(.09/12)]^{12}-1=9.38\%$  or

Calculator:

HP10BII+	TI-BAII+	TI-83/84
Step 1: 12 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I Conv Step 2: 9 Enter ↓↓ Step 3: 12 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF( Step 2: Enter the given information in the following format: EFF(NOMINAL RATE,COMPOUNDING PERIODS PER YEAR) EFF(9,12) Step 3: Press SOLVE

### Part 8d

Solution: 9.42%

Formula:  $k_{\text{eff}}=[1+(.09/365)]^{365}-1=9.42\%$  or

Calculator:

HP10BII+	TI-BAII+	TI-83/84

HP10BII+	TI-BAII+	TI-83/84
Step 1: 365 SHIFT P/YR Step 2: 9 SHIFT NOM% Step 3: SHIFT EFF%	Step 1: 2nd I ConvI Step 2: 9 Enter ↓↓ Step 3: 365 Enter ↑ Step 4: Press the CPT key	Go to APPS⇒Finance⇒ Step 1: Select EFF( Step 2: Enter the given information in the following format: EFF(NOMINAL RATE, COMPOUNDING PERIODS PER YEAR) EFF(9,365) Step 3: Press SOLVE

Note: If you are using the HP, be sure to set P/YR back to 1 after finishing 8d.

## Problem 9

Company Plan	Do-it-Yourself Plan
Step 1: 25 N Step 2: 9 I/Y Step 3: 0 PV Step 4: 4500 PMT Step 5: FV⇒ \$381,154.03	Step 1: 25 N Step 2: 12 I/Y Step 3: 0 PV Step 4: 3000 PMT Step 5: FV⇒ \$400,001.61

## Problem 10

Step 1 ⇒ How much will Jen have saved immediately before purchasing vacation home?

15 N  
 9 I/Y  
 -15000 PV  
 -6000 PMT  
 FV⇒ \$230,802.73

Note that I made both the 15,000 and the 6000 negative. That is because Jen's 15,000 that she has already saved is equivalent to a cash outflow (set aside today so it can compound) and the \$6000 she is saving at the end of each year are also effectively outflows (set aside so they can compound until 15 years from now). After 15 years, we will have \$230,802.73 available for us to withdraw (equivalent to a cash inflow). While I made the \$15,000 and \$6000 negative, you could also leave them both positive...just make sure the both are the same sign.

Step 2 ⇒ How much will Jen have immediately after withdrawing \$100,000 for the purchase of a vacation home?

$$\$230,802.73 - \$100,000 = \$130,802.73$$

Step 3 ⇒ How much will Jen have to save at the end of each year for the remaining years (17) to accumulate \$750,000?

17 N  
 9 I/Y  
 -130,802.73 PV  
 750,000 FV  
 PMT ⇒ \$4,974.72

Note that it is 17 years (not 16) as we have the initial 15 + the subsequent 17 to give us 32 years (the full time horizon). Also, note that the PV needs to be negative (we are setting aside the 130,802.73 at the start of the last 17 years) and the FV positive (so we can get \$750,000 at the end of our time horizon). While I didn't put a negative sign in front of it, you should note that your PMT is also negative as you are giving up the \$4974.72 per year (along with the \$130,802.73) in order to get the \$750,000 at the end.

## Problem 11

Step 1 ⇒ How much will you have at the end of year 15?

15 N  
9.5 I/Y  
0 PV  
2000 PMT  
FV  $\Rightarrow$  61,080.46

Step 2  $\Rightarrow$  How much will this \$61,080.46 grow to over the remaining 20 years?

20 N  
9.5 I/Y  
61,080.46 PV  
0 PMT  
FV 375,132.49

Step 3  $\Rightarrow$  Since your brother will save nothing for the first 10 years, he will start at the end of year 10 with nothing and have 25 years to accumulate \$375,132.49. How much must he save each year to accomplish this?

25 N  
9.5 I/Y  
0 PV  
375,132.49 FV  
PMT  $\Rightarrow$  \$4,111.22

## Problem 12

### Part 12a

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12	Set P/YR to 12
Step 1: 180 N	Step 1: 360 N
Step 2: 6.25 I/Y	Step 2: 6.5 I/Y
Step 3: 108,000 PV	Step 3: 108,000 PV
Step 4: 0 FV	Step 4: 0 FV
Step 5: PMT $\Rightarrow$ \$926.02	Step 5: PMT $\Rightarrow$ \$682.63

### Part 12b

15-Year Mortgage  $\Rightarrow$   $\$926.02 \times 180 = \$166,683.60$

30-Year Mortgage  $\Rightarrow$   $\$682.63 \times 360 = \$245,746.80$

### Part 12c

15-Year Mortgage	30-Year Mortgage
Set P/YR to 12	Set P/YR to 12
Step 1: 168 N	Step 1: 348 N
Step 2: 6.25 I/Y	Step 2: 6.5 I/Y
Step 3: 926.02 PMT	Step 3: 682.63 PMT
Step 4: 0 FV	Step 4: 0 FV
Step 5: PV $\Rightarrow$ \$103,511.02	Step 5: PV $\Rightarrow$ \$106,792.31

### Part 12d

#### 15-Year Mortgage

Total First Year Payments (15-Year) =  $\$926.02 \times 12 = \$11,112.24$

Principal Paid (15-Year) =  $\$108,000 - \$103,511.02 = \$4488.98$

Interest Paid (15-Year) =  $\$11,112.24 - \$4488.98 = \$6623.26$



### 30-Year Mortgage

Total First Year Payments (30-Year) =  $\$682.63 \times 12 = \$8191.56$

Principal Paid (30-Year) =  $\$108,000 - \$106,792.31 = \$1207.69$

Interest Paid (30-Year) =  $\$8191.56 - \$1207.69 = \$6983.87$

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