

Kingdom Of Bahrain
Ministry Of Education
Shaikh Isa bin Ali Alkhalifa Commercial Secondary School
Financial Department B – (FIN B)

Financial Mathematics III – FIN214

Study Guide

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Student Name

Student Number

Class

UNIT ONE: Compound Interest

CHAPTER ONE:

Compound Amount and Interest

Simple vs. Compound Interest

Simple Interest	Compound Interest
1- Is calculated from the principal at the end of the period.	1- Calculated from the amount at the end of each period.
2- Principal is fixed.	2- Principal is increasing.
3- Interest is fixed.	3- Interest is increasing.

Ex1: A person deposit BD1000 at 5% for 3 years. Find the simple interest and compound interest **at the end of each year?**

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1. Finding the Compound Amount (using calculator):

C.A.	Compound Amount
C.I.	Compound Interest
P	Principal
i	Interest Rate
N	Number of periods

Find Compound Amount by knowing (P,i,N)

$$CA = P \times (1 + i)^N$$

Find the Compound Interest by knowing (CA,P)

$$CI = CA - P \quad \text{or}$$

by knowing (P,i,N)

$$CI = P \times [(1 + i)^N - 1]$$

Ex2: Find the compound amount and interest for BD 2,500 invested at 6% annually for 10 years.

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Ex3: Ahmed invested BD 5,600 at B.B.K for 4 years at 6.5 % annually. Find the compound amount and compound interest for his investment.

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Ex4: Find the compound amount and compound interest if BD 1,000 is invested for 10 years at 7% annually.

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Ex5: Ali invested BD 3,000 at B.B.K for 8 years at $10\frac{1}{2}\%$ annually. Find the compound interest.

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Ex6: Ali borrowed BD 4500 from City Bank for 3 years and 5 month at 4.3% annually. Find the compound amount and compound interest.

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Ex7: Aala deposited BD 4520 at City Bank for 2.75 years at 7.25%. Find the compound amount.

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Ex8: Find the compound interest for a loan of BD 5800 for 5 years and 6 month at 3.75% compound annually.

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Ex9: Salem borrowed from Bahrain National Bank a principal of BD 5200 for 6 years and 9 months. Find the compound interest if the rate is 9 % annually.

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2. Finding the Compound Amount (using interest table):

$$CA = P \times (1+i)^N$$

$(1+i)^N$ From Table #1

Ex10: Find the compound amount of BD 4500 deposited at 6% annually for 5 years (using Table #1).

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Ex11: Ali leant BD 1000 at B.B.K for 56 years at 6% annually. Find the compound amount and compound interest (using Table #1).

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Ex12: Find the compound amount for BD 3000 invested at 8% for 56 years (using Table).

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Ex13: Sara invested BD 5500 at AUB for 8 years at 10.5%. Find the compound interest (using Table #1).

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Ex14: By using interest table, find the value of the followings:

1. $(1.06)^{55}$

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2. $(1.035)^{65}$

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3. $(1.1025)^{120}$

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3. Finding the Number of periods and Interest Rate per period:

- Review the differences between SI & CI
- The CI takes interest on the last period's interest, or in different words: the principal is changing every time we take interest.
- How you can calculate the interest if it occurs more than once a year?

Ex15: A principal of BD 1000 is deposited at 6% annually for 10 years, calculate:

a. Number of periods in a year.

$$\text{Number of Periods by Year} = \frac{12}{\text{Number of Months}}$$

b. Number of periods in total.

$$\# \text{ Periods in } (X) \text{ Years} = \# \text{ periods by year} \times \# \text{ of years}$$

c. Rate per period.

$$\text{Rate per Period} = \frac{\text{Annual Rate}}{\text{Number of Periods by Year}}$$

A. If the interest is compounded annually.

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B. If the interest is compounded / Semiannually/every 6 month/ half years /two time yearly.

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C. If the interest is compounded / quarterly / every 3 month / Four times yearly.

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D. If the interest is compounded /every 4 months / three times yearly.

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E. If the interest is compounded / every 2 months / $\frac{1}{6}$ a year / six times yearly.

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F. If the interest is compounded /monthly / 12 times yearly / $\frac{1}{12}$ a year.

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Ex16: Find the compound amount and compound interest of BD 2,300 for 8 years at 8% compound quarterly.

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Ex17: Ahmad invested BD 11,000 from BBK for 10 years at 3% every 4 month if the interest compounded three times yearly, find the compound Interest.

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Ex18: Find the compound amount of BD 3,000 invested at 6% compounded semiannually at the end of 10 years and 9 months.

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Ex19: Find the compound amount and interest for BD 3,200 is borrowed for 3 years at 9% converted monthly?

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Ex20: A person deposit BD 7,000 at City Bank if the rate of compound interest was 3.5% each 3 months, find the compound amount and interest after 7.5 years.

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Ex21: Salem borrowed form Bahrain National Bank BD 4300 for 5 years and 6 months, find the compound interest if the interest rate was 8% annually but interest compound semiannually.

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Ex22: Ali invested BD 8,000 at Bahrain National Bank for 4 years at 12% annually. Find the compound Amount (If the interest compounded every 2 month).

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Ex25: How much is the compound amount for BD 1400 invested at 8% annually for 30 years if the interest compounded every half years (using Table #1).

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Ex23: How much is the compound amount for BD 1500 invested at 8% compounded monthly (if the interest compounded twelve times yearly).

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Ex24: Fatima deposited BD 4350 at AUB if the rate of the compound interest was 2.5% each 4 months; find the amount due to Fatima after 2 years and 8 months.

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4. **Amount at Changing Rate**

- ***What will happen if you change the interest rate?***

Ex26: Find the compound amount and interest if BD 2000 is invested for 8 years at 3% annually for the first 2 years and 4.5% annually for the next 3 years and 5.75% annually for the rest years.

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Ex27: A principal of BD 900 earns 6% converted quarterly for 4 years and then 7% converted semiannually for 2 more years. Find the amount.

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Ex28: Find the compound amount and interest if BD 3000 is invested for 10 years at changing rate as following: 5% annually for first three years, 5.5% annually for the forth and fifth year, and 4.75% annually for the remaining years.

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Ex29: A principal of BD 6500 earns 5% annually for 3 years and then 6% compounded semiannually for 4 more years what is the amount at end of 7 years.

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Ex30: Find the compound amount and interest if BD 2000 is invested for 3 years at 3% for first year, 3.5% for second year and 3.75% for the third years.

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Ex31: A person deposit BD 5000 in B.B.K at 5% annually, after 3 years he draw BD1500, calculate his balance after 10 years from beginning deposit.

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5. Compound Amount with a Changeable Principal

- *If you deposit/withdraw amount of money from the fund/account.*

Ex36: Amal invested KD7800 at AUB bank at interest rate of 10.5% annually and after 3 years she added BD8000 to the account at 5.25% compounded semi-annually. Find the compound amount and the compound interest at the end of 8 years from the first deposit?

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Ex38: Jawad deposited BD4000 at a compound interest of 5% annually, after 3 years he added BD1369.5 to his account and the new interest rate become 10% annually. Find the amount at the end of 8 years from the first deposit.

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Ex37: Ali deposited BD14000 at 6% annually, after three years he withdrew BD 10000 from his account and invested the rest at $7\frac{3}{4}\%$ annually. Find the followings:
a- His fund after withdrawal
b- The compound amount for the remaining sum at the end of six years.

Final Exams Questions:

Question #1-1 First Semester 2004/2005

1- Find the value of $(1.045)^{75}$ (using table 1).

Question #1-2 First Semester 2004/2005

What is the compound amount if BD2560 deposited at 4.25% annually for 6 years?

Question #1-4 First Semester 2004/2005

Find the partially rate for compound interest rate 12% annually compounded quarterly?

Question #2-1 First Semester 2004/2005

Ali invested BD4200.312 at Al-Ahli United Bank for 2 years and 6 months. Find the compound amount if the rate 10% annually compounded semi-annually.

Question #2-2 First Semester 2004/2005

If the compound interest rate is 4% every 4 months for 4 years and 8 months. Find the compound interest for BD 1?

Question #1-1 Second Semester 2004/2005

If the thirdly rate is 1.25%, find the annually rate.

Question #1-2 Second Semester 2004/2005

Ali borrowed BD 2,500 from BHS for 62 years at 3% find the compound interest at the end of period?

Question #1-A1 First Semester 2005/2006

Choose the correct answer from the following (Show all calculation):
If BD 1 invested at 12% annually compounded thirdly, the partial rate is:

- a- 4%
- b- 3%
- c- 6%
- d- 12%

Question #1-C Second Semester 2005/2006

Find the partial rate of 18% annually compounded quarterly.

Question #3-2 Second Semester 2005/2006

A deposit of BD 6000 was made for 7 years at changeable interest rate as follows: 5% for the first year, 6% for the following 3 years and 6.5% for the rest, find the compound amount and the interest.

Question #1-4 Reset Exam 2005/2006

Find the value of $(1.05)^{150}$ using table only?

Question #1-2 Reset Exam 2005/2006

Rana deposited BD7000 in HSBC, which gives an interest rate of 5% every 4 months. Find her fund after 8 years and 6 months?

Question #2-1 Reset Exam 2005/2006

Find the compound amount and the compound interest for BD 6000 invested for 7 years, if the interest rate was 2% for the first year, 3% for the following 3 years and 4% for the rest?

Question #2-2 Reset Exam 2005/2006

A man deposited BD1000 at 5% annually. After 3 years he added BD659.904 at 6% annually find the compound amount at the end of 9 years?

Question #1-A First Semester 2006/2007

Find the compound amount for BD 1000 invested at 2% every month at end of 5 years (using interest table only)?

CHAPTER TWO: Compound Interest Factors

Finding the Principal (P):

Find the principle by knowing the **Amount:**

Ex1: If the amount is BD4000 for a principal invested for 4 years at 5% annually, find the principle.

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Ex2: How much must be deposit in investment fund paying 8% compounded quarterly to give an amount of BD2228.850 in 5 years period of time.

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Ex3: How much principal is needed so that the compound amount will become BD3600.596 if it invested at 3.5% compound annually for 5 years?

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Ex4: Find the principal invested for 5 years becomes BD8100.182 at rate of 4.5% annually.

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Ex5: How much must be invested at 3% every 4 months if invested compounded three times yearly to amount BD2268.9 in 4 years and 8 months?

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Find the principal if know interest:

Ex6: If the interest is BD1036.8 is invested for 9 years at 4.7% annually, find the principal.

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Ex7: If the interest is BD1944.4 is invested for 2 years at 4.5% every 2 months. Find the principal.

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Finding the Interest Rate (i):

Ex8: What is the rate of compound interest that will make BD1000 in 7 years amount to BD1713.800?

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Ex9: If BD5000 amounts to BD7429.500 in 5 years with interest compounded quarterly what is the rate of interest?

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Ex10: If an investment of BD5000 amount to BD7765 in 5 years, what is the rate of interest if interest compounded semiannually?

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Ex11: If the amount of BD6500 invested for 5 years becomes BD8100.182 find the rate?

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Finding the Time/Number of Periods (N):

Ex12: How long will it take an investment BD 4000 to amount BD5610.4 at 7% annually?

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Ex13: How long will it take BD 1600 to amount BD 3447.97 at 10.5% compounded semiannually?

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Ex14: How long will it take BD6000 to amount BD 8261.4 at 3.5 % every 6 month?

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Ex15: How long will it take the money to double it self at 8 % annually?

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Ex16: How long will it take the money to triple it self at 10.5 % annually?

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Final Exams Questions:

Question #1-3 First Semester 2004/2005

How long will it take the money to double of self at 5.25% annually?

Question #3 First Semester 2004/2005

Eman deposited an amount of money in a bank at 4% every 4 months. After 3 years she added BD 1160.500 to her account at a new rate of 5% annually. After another 2 years her account was BD 6954.636 - Find the principal?

Question #3 Second Semester 2004/2005

Sara invested BD 6200 in her bank after 7 years her balance reached BD 9019.140 – What was the rate used?

Question #1-A First Semester 2005/2006

Choose the correct answer from the following (Show all calculation):

If the compound amount is KD 9339.630 and the compound interest is KD6000.630 - the principal is equal:

- a- 9993 b- 3999 c- 9333 d- 3339

Question #1-B First Semester 2005/2006

If BD3000 amount to BD5418.300 in 20 years, find the annually rate.

Question #2 Second Semester 2004/2005

Mr. Ahmed invested in a bank BD3500 at 5% annually .After 3 years he drew sum of money then he invested the reminder at 4.5% annually for 2 years to give an amount of BD 2730.150 .Find the money which was drawn?

Question #3 First Semester 2006/2007

A trader borrowed BD 3000. After 4 years he paid BD 3543.300. Find the compound amount that should be paid by another trader borrowed BD 2000 for 7 years at the same interest rate of the first trader?

UNIT TWO: Discounting Debts

Part One: Present Value

Kinds and Types of Discounts

- 1) Bankers Discount: الخصم المصرفي أو التجاري
- 2) True Discount: الخصم الحقيقي أو الصحيح

Discount Factors:

- 1) Face value (F.V.) القيمة الاسمية
- 2) Present Value (P.V.) القيمة الحالية
- 3) Discount Rate (i) معدل الخصم
- 4) Number of period (N) المدة/ عدد الفترات

$Present\ Value.(PV) = FV \times (1+i)^{-N}$ Using Table (2)

$Present\ Value.(PV) = \frac{FV}{(1+i)^N}$ Using Table (1)

$Compound\ Discount.(CD) = FV - PV$

$Future\ Value.(FV) = PV + CD$

Ex1: Find the present value of BD 5000 due in 4 years if money is worth 8% compound semiannually.

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Ex2: Find the present value to compound discount Face value BD 6000 due in 3 years if money is worth 18 % compound monthly.

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Ex3: What is the present value at 5¾% compounded semiannually of BD 3000 due in 5years?

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Ex4: Find the present value and compound discount of BD 4500 due in 2½ years if money is worth 8% compounded semiannually.

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Final Exams Questions:

Question #4-1 First Semester 2004/2005

Find the present value of BD4010.600 due in 4 years, if money is worth 11% annually compounded quarterly.

Question #4-2 First Semester 2004/2005

A note will mature after 4 years from today is sold to a bank that uses 10% annually. If the present value is BD 2049.039 - Find the future value?

Question #3 First Semester 2005/2006

A debtor with following loans:

- a- BD 2500 due 2 years
- b- BD 4000 due 5 years

If he replaced them with a new due in 7 years. Find the face value for the new note if you know that the discount for the old notes was 4.5% annually and the new notes money worth 5% annually.

Question #4 Second Semester 2005/2006

A debtor with following loans:

- a- BD 1000 due before 3 years
- b- BD 2000 due 5 years

If he replaced them with a new due in 12 years. Find the face value for the new note if you know that the rate for the old notes was 4% annually and the new notes money worth 7% every quarter.

Question #3 Reset Exam 2005/2006

A debtor with following loans:

- a- BD 1500 due after 2 years.
- b- BD 4600 due after 4 years.

If he replaced them with a new note due in 12 years. Find the face value for the new note if you know that the discount rate for the old notes was 4% annually and the new notes money worth 4.5% annually?

Question #4 First Semester 2006/2007

A debtor with the following loans:

- a- BD 1500 due before 2 years
- b- BD 3000 due today
- c- BD 5000 due after 3 years

Replace them with a new note due after 5 years, if:

- The discount rate for the old notes was 5% annually.
- The compound interest rate for the new note is 5.5% annually.
- The creditor accepts BD 2000 cash

now.

Find the face value for the new note.

UNIT THREE: Equal Annuities

Chapter1: Amount and Interest of Annuities

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	Annuities due	Ordinary Annuities
Using Calculator	$S_n = \frac{R \times [(1+i)^N - 1] \times (1+i)}{i}$	$S_n = \frac{R \times [(1+i)^N - 1]}{i}$
Using Table #3	$S_n = R \times [(N + 1 \text{ and } i) - 1]$	$S_n = R \times (N \text{ and } i)$

1) Ordinary Annuities

- Payment paid at the end of each period.

Ex1: Ali will invest BD 100 every 4 months in B.B.K at a compound interest rate of 0.5% every 4 months for 7 years. Find the amount of an ordinary annuity.

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Ex2: Ahmed paid BD 50 to ALECO at the end of each 4 months by compound interest rate for a profit of 7.5% the interest compounded every 4 months. Find the amount at end of 10 years.

Ex3: Ali will invest BD 100 every 2 months with City Bank by compound interest rate of 2% every 2 months for 3 years. Find the amount of an ordinary annuity.

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Ex4: Find the amount for a payment of BD 75 will be deposit at the end of each year in a bank by compound rate of 6% for 5 years.

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2) Annuities due

- Investment deposit at the beginning of each period.

Ex5: Ali invested BD150 at the beginning of each quarter in a bank for 6 years by compound interest rate of 9% annually compound quarterly, find the amount.

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Ex6: Asharf deposited BD200 in saving account at the beginning each semiannually by compound rate of 5% semiannually. How much will be the amount at the end of 12 years.

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Ex7: Find the amount for an Annuity due at the end 15 years to a payment of BD20 at each 2 month.

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Ex8: Ali invested BD150 at the beginning each quarter in a bank for 6 years by compound interest rate of 9% annually, the interest compounded quarterly. How much the amount will be at the end?

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Ex9: Ali has two accounts in B.B.K, in the first he has BD5500 as a fixed deposit at a compound interest rate of 4% semi-annually, and in the second he is saving BD75 at the beginning of each 3 months at compound interest rate of 1.5% quarterly. Find the total amount that he will get at the end of 5 years.

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Ex10: Ahmad will deposit BD 25 at the end of each quarter in a saving fund that earns interest at the rate of 3% compounded quarterly. How much will he have in the fund at end of 10 years if:

1- He has nothing in the account today.
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2- He has BD1000 in the fund at the present.
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Ex11: Which is better for Mohammed, to deposit BD1500 for 20 years at 1.25% each 4 months, or to buy an insurance policy of BD 75 monthly premium for 5 years at 1.5% quarterly.

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Ex12: A person deposited at the beginning of each month BD125 for 3 years. Find the amount at the end of 10 years if you know that the rate was 6% annually.

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Chapter2: Finding Factors of Annuities

Finding the Annuity Value (R):

Ex1: How much was a deposit made at the end of each semiannually will accumulate to BD2977.810 at 8% compounded semiannually for 10 years?

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Ex2: A man deposited money each year by compound interest rate 5% for 6 yeas to accumulate BD 680.190, find the ordinary annuity.

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Ex3: How much is the payment required at the end of each month for 3 years to repay a lone of BD1353.465 at 1.25% monthly?

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Ex4: How much is the quarterly deposit that will accumulate to BD2697.350 for 6 years at 4% compounded quarterly?

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Ex5: Ali invested a payment at the beginning of each year by a compound rate of 4% for 12 years to amount BD601.032, how much is the payment he invested it?

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Ex6: Find the annuity due payment to accumulate BD2733.808 at the end of 7 years by compound interest rate of 3% semiannually.

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Ex7: How much is required at the beginning of each 4 months for 2 years by 6% compound interest every 4 months to accumulate BD 3154.050 at the end of time?

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Ex10: Find the rate of BD80 paid at beginning of each 3 month for 8 years if you know that the amount accumulated was BD3303.889 and interest compounded 4 times a years.

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Finding the Compound Interest Rate
(i):

Ex8: A man saving BD200 at the end of each month to start his business after 4 years which cost an amount of BD 37605.080, find the rate.

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Ex11: A man saving BD45 at the end of each 4 months to start his business after 9 years which amount cost of BD 1706.040 - Find the rate.

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Ex9: Adel invested BD600 at the beginning of each year to accumulate BD2649.780 after 4 years – How much is the interest rate?

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Finding the Number of Periods/ Time (N):

Ex12: How long will it take BD300 paid at the end of each year to accumulate BD 13728.6 by compound interest rate of 8% annually?

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Ex13: How many payments of BD 400 will be paid at the beginning quarterly to accumulate BD 9318.960 by compound interest rate of 8% compounded quarterly?

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Ex14: How long is needed to invest BD 900 at the end of each 2 months to amount BD 15536.8 by compound interest rate of 1% every 2 months?

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Ex15: How long will it takes BD950 pays at the beginning of each year to accumulate BD 12546.46 by compound interest rate of 5%?

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Final Exams Questions:

Question #5 First Semester 2004/2005

Amar deposited at the end of each half year BD260 in a fund that earns interest at 9% annually compounded semi-annually. How much will he have at the end of 7 years if:

A) He has nothing in account today?

B) He has BD 850 in the fund at the present?

Question #5 Second Semester 2004/2005

Noof deposited at the beginning of every year BD 550 in a saving fund that earns interest rate of 3.5% annually. How much will the fund contain at end of 9 years?

Question #6 Second Semester 2004/2005

What quarterly deposit will accumulate to BD 8853.300 in 6 years at 7% annually compounded quarterly?

Question #4-1 First Semester 2005/2006

Ali deposited BD100 at the beginning of each 3 months in a bank, if the interest rate was 4% every 3 months. Find the following:

a- his balance in a bank after 6 years.

b- Compound interest at the end of the period?

Question #4-2 First Semester 2005/2006

How long will it take BD 50 paid at the end of each year to be 1764.290 at the rate of 2.75% annually?

Question #5-1 Second Semester 2005/2006

Marwa deposited BD30 each quarter in a saving fund that earns interest at 8% annually compounded quarterly. How much will she has in the fund after 12 years if the deposit made at the beginning of each quarter.

Marks Distribution

Title / Date	Subjects Included	Marks 100%	Marks 30%	Yours		Balance 30%	Loses 30%	Max 30%	Remarks
				100%	30%				
First Exam	<u>Unit One – Chapter One</u> <u>Pages 14 – 38</u> Simple vs. Compound Interest Compound Interest & Amount changeable compound interest rate Compound amount for more than 50 period Compound amount for Years and Months Compounded interest more than once in a year Annual interest rate Partial interest rate Compound amount if the principal changes	20	6						
	Exercises			10	3				
Second Exam	<u>Unit One – Chapter Two</u> <u>Pages 40 - 50</u> Finding Principal Finding the Time Number of Periods Finding the Interest Rate	20	6						
	<i>Total Marks</i>			50	15				
Exam	The Present Value The Net Present Value and the Total discounts	10	3						
Exercise	Equations of equivalence	10	3						
<i>Total Marks</i>		20	6						
Exercise	The meaning of annuities & Types of Annuities Compound Amount Annuities Compound Amount of Payment Annuities Compound Amount of Investment Annuities Amount of annuities with a fixed principal Finding the value of annuity	10	3						
Exam	Finding the interest rate of Annuities Finding Time/Number of Annuities	20	6						
	<i>Total Marks</i>			30	9				
		100	30						