

King Saud University

Department of Mathematics

Tutorial 1 - Semester 461

ACTU 371 – Financial Mathematics

Exercise 1.

- (a) Find the effective rate of interest over the interval $[3,4]$ if interest is accumulating at a 5% annual rate of:
- Compound interest
 - Simple interest
- (b) Given $i^{(4)} = 0.08$, find $i^{(2)} + d^{(2)} + \delta$.
- (c) Let $a(t) = (t + 1)^3$. Find $\delta(t)$
- (d) Let $\delta(t) = \frac{4}{t+3}$. Find $a(t)$.

Exercise 2

- (a) You deposit 1,800 into an account earning a force of interest of 0.05. How long will it take for the account balance to reach 2,700.
- (b) You make an investment where you pay 10,500 now and receive 12,500 in 3 years. What nominal rate of interest convertible monthly did you earn.

Exercise 3

You deposit 1,500 into an account that earns a nominal annual rate of 6% convertible monthly for the first year, then a nominal rate of 8% convertible quarterly for the next two years.

- What is the account balance at the end of 3 years?
- What is the equivalent level nominal rate convertible semi-annually for this account over the 3-year period.

Exercise 4

At time 0, an amount X is deposited into an account that earns 8% simple interest. Also at time 0, an amount $X/2$ is deposited into an account that accumulates at a constant force of interest δ . The total amount of interest earned in each account as of time 10 years is the same. Find δ .

Exercise 5

A woman deposits 1,000 into a bank account. The bank credits interest at a nominal annual rate of i convertible quarterly for the first 8 years, and a nominal annual rate of $1.5i$ convertible bimonthly (every two months) thereafter. The amount of the account at the end of 5 years is 1,516.

What is the amount in her account at the end of 10 years.

Exercise 6

You can receive one of the following two payment streams:

- (i) 100 at time 0, 200 at time n , and 300 at time $2n$.
- (ii) 600 at time 10.

At an annual effective interest rate of i , the present values of the two streams are equal. Given $v^n = 0.76$, determine i .

Exercise 7

At a nominal interest of i convertible semi-annually, an investment of 1,000 immediately and 1500 at the end of the first year will accumulate to 2,600 at the end of the second year. Calculate i .

Exercise 8

Eric deposits 100 into a saving account at time 0, which pays interest at a nominal rate of i compounded semi-annually.

Mike deposits 200 into a different savings account at time 0, which pays simple interest at an annual rate of i .

Eric and Mike earn the same amount of interest during the last 6 months of the 8th year. Calculate i .

Exercise 9

A bank offers the following choices for certificates of deposit:

Terms (in years)	Nominal annual interest rate convertible quarterly
1	4%
3	5%
5	5.65%

The certificates mature at the end of the term. The bank does not permit early withdrawals. During the next 6 years the bank will continue to offer certificates of deposit with the same terms and interest rates.

An investor initially deposits 10,000 in the bank and withdraws both principle and interest at the end of 6 years. Calculate the maximum annual effective rate of interest the investor can earn over the 6-year period.

Exercise 10

You deposit 5,000 at $t=0$ into an account that earns interest at an annual effective rate of 5% for two years, and earns continuously compounded interest at a varying force of interest $\delta(t) = \frac{2}{t+1}$ in all subsequent years. What is the account balance at the end of 5 years.