At the end of this session, the learner should be able to

LO1: find the effective interest rate for a given nominal interest

LO2: calculate the worth of the cash flow as required for different compounding frequency

Suppose you deposit $10,000 in a savings account that pays you at an interest rate of 9% compounded quarterly. Here, 9% represents the nominal interest rate, and the interest rate per quarter is 2.25% (9%/4). The following is an example of how interest is compounded when it is paid quarterly:

End of Period	Base amount	Interest Earned 2.25% × (Base amount)		New Base
First quarter	$10,000.00	2.25% × $10,000.00 =	$225.00	$10,225.00
Second quarter	$10,225.00	2.25% × $10,225.00 =	$230.06	$10,455.06
Third quarter	$10,455.06	2.25% × $10,455.06 =	$235.23	$10,690.30
Fourth quarter	$10,690.30	2.25% × $10,690.30 =	$240.53	$10,930.83

F= P (1+.09)
= 10000 (1.09)
= $10900

9 % per year is equal to 2.25% per quarter

$$F = P(1 + i)^N$$

$$= \$10{,}000(1 + 0.0225)^4$$

$$= \$10{,}930.83.$$

930/10000 = 9.3%

Effective interest rate per payment period

$$i = \left(1 + \frac{r}{M}\right)^C - 1$$

$$= \left(1 + \frac{r}{CK}\right)^C - 1,$$

where

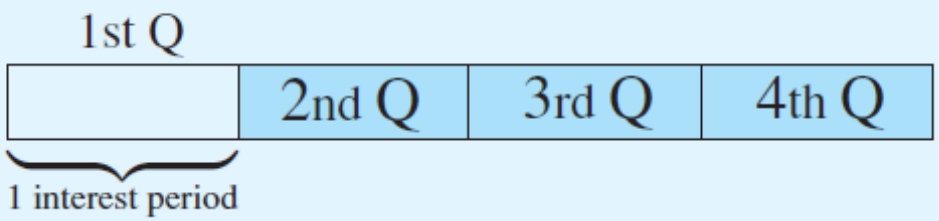
r = Nominal interest rate

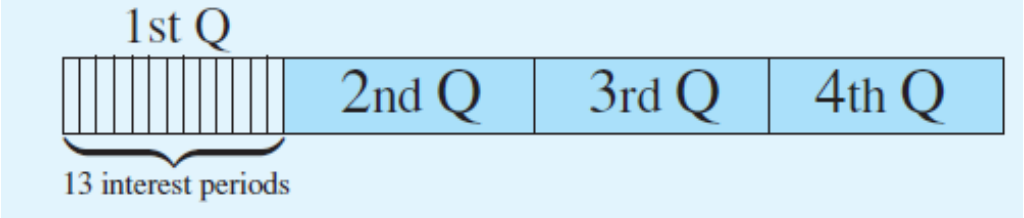
M = the number of interest periods per year,

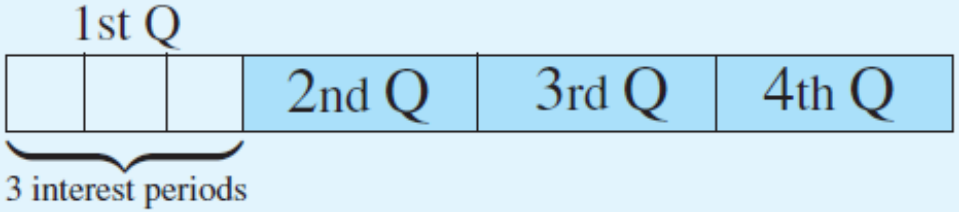
C = the number of interest periods per payment period, and

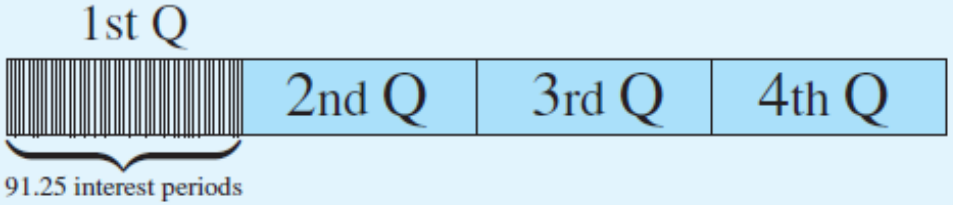
K = the number of payment periods per year.

Find the effective interest rate per *quarter* at a nominal rate of 8% compounded (a) quarterly, (b) monthly, (c) weekly, (d) daily.









What is the present worth of the following series of payments?

(a) $1,500 at the end of each six-month period for 12 years at 8% compounded semiannually.

(b) $2,500 at the end of each quarter for 8 years at 8% compounded quarterly.

(c) $3,800 at the end of each month for 5 years at 9% compounded monthly.

Answers

a) $58,623

b) $58670.75

c) $183058.92

E.g. Suppose you make quarterly deposits of $ 1500 into an account that pays 6% compounded monthly, find the balance at the end of year 2.

Ans: Ieff= 1.507%; $ 12652

E.g. Suppose you make $500 monthly deposits into an account that pays 10% interest compounded quarterly *, compute the balance at the end of 10^{th} year.

Ans: Ieff = 0.826%; *$101907

E.g. Suppose you deposit $2000 in an individual retirement account that pays interest at 6% compounded monthly for the first two years and 9% compounded monthly for the next three years. Determine the balance at the end of five years.

Ans: $ 2950

Visteon, a spin-off company of Ford Motor Company, supplies major automobile components to auto manufacturers worldwide and is Ford's largest supplier. An engineer is on a Visteon committee to evaluate bids for new-generation coordinate-measuring machinery to be directly linked to the automated manufacturing of high-precision components. Three vendor bids include the interest rates. Visteon will make payments on a semi-annual basis only. The engineer is confused about the effective interest rates. What they are annually and over the payment period (PP) of 6-months.

Bid 1: 9% per year, compounded quarterly

Bid 2: 3% per quarter, compounded quarterly

Bid 3: 8.8% per year, compounded monthly

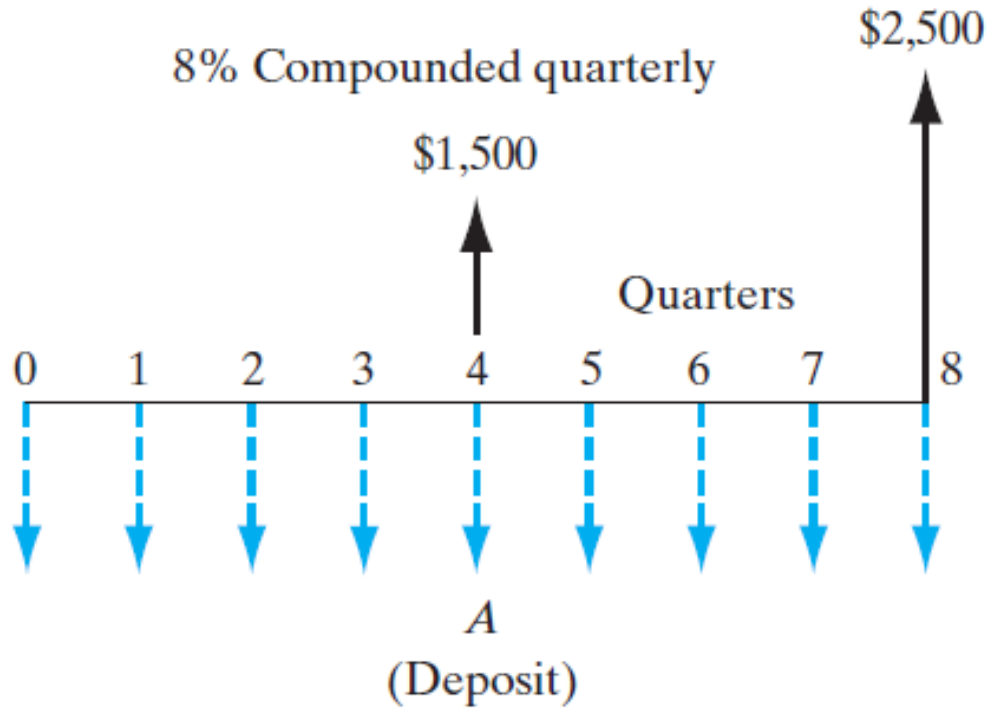
i) Determine the effective rate for each bid on the basis of semi-annual payments

ii) What are the effective annual rates? These are to be a part of the final bid selection.

iii) Which bid has the lowest effective annual rate?

Ans: i) 4.55%, 6.09%, 4.48% (ii) 9.3%, 12.55%, 9.16% (iii) Bid 3

What is the amount of the quarterly deposits A such that you will be able to withdraw the amounts shown in the cash flow diagram if the interest rate is 8% compounded quarterly?



Ans: A= $422.73

1) A couple would like to determine what amount they must deposit in a savings account bearing 12% interest rate so that they will get Rs.5000/- at the end of 10th year and will get an increase of Rs.1000/- each year for the next 10 years. Draw the cash flow diagram.

i) Determine the present amount.

ii) If the interest rate is compounded quarterly what is the present amount?

Ans: i) 19046
ii) 17704

Georgi Rostov deposits $15,000 in a savings account that pays 6% interest compounded monthly. Three years later, he deposits $14,000. Two years after the $14,000 deposit, he makes another deposit in the amount of $12,500. Four years after the $12,500 deposit, half of the accumulated funds is transferred to a fund that pays 8% interest compounded quarterly. How much money will be in each account six years after the transfer?

Ans: 44132; 49568

You borrowed $15,000 for buying a new car from a bank at an interest rate of 12% compounded monthly. This loan will be repaid in 48 equal monthly installments over four years. Immediately after the 20th payment, you desire to pay the remainder of the loan in a single payment. Compute this lump-sum amount at that time.

Ans: $9592

1) A company is planning to invest Rs. 6000 once in 6 months; the investment is made at the end of every 6th month, for next 5 years. The company is planning to utilize this amount accumulated at the end of 5^{th} year for buying an asset. Identify the amount accumulated at the end of 5^{th} year under following cases:

i) If interest is 12% compounded semi-annually. (Ans- 79084.7)

ii) If interest is 12% compounded annually. (Ans-)

iii) If interest is 12% compounded quarterly. (Ans- 79419.83)

1) Suppose that you have a savings plan covering the next ten years, according to which you put aside $600 today, $800 at the end of every year for the next five years, and $2000 at the end of each year for the remaining five years. As part of this plan, you expect to withdraw $300 at the end of every year for the first 3 years, and $350 at the end of every year thereafter till the 10^{th} year. In addition to this you are expected to withdraw an amount of $50 at the end of every 2 years till 15^{th} year. Assume interest to be 12%.

i) Draw your cash flow diagram.

ii) Find the amount accumulated in the saving account at the end of 15th year.

(Answer- Amount in saving account is Rs. 30450)