

M118 SECTION 3.1 – SIMPLE INTEREST
SECTION 3.2 – COMPOUND INTEREST

1) Simple Interest is usually used for time periods of a year or less

$$\mathbf{I = Prt}$$

I = Interest : fee charged for use of principal

P = principal : original amount of money invested

r = interest rate per year in decimal $8\% = .08$ or $7\frac{1}{2}\% = .075$

t = time in years

Example: What is the interest earned on a loan of \$900 at 10% for 6 months?

Amount Accrued (A) after t years

$$\mathbf{A = P + I = P + Prt = P(1 + rt)}$$

Example: Find the total amount due on a loan of \$8000 at 12% for 18 months.

Example : # 40 A check for \$3,097.50 was used to retire a 5-month \$3000 loan. What annual rate of interest was charged?

Example :#48 What is the purchase price of a 26-week T-bill with a maturity value of \$1000 that earns an annual interest rate of 4.903%?

Example: #50 To complete the sale of a house, the seller accepts a 180-day note for \$10,000 at 7% simple interest. (Both interest and principal will be repaid at the end of 180 days). Wishing to be able to use the money sooner, the seller sells the note to a third party for \$10,124 after 60 days. What annual rate will the third party receive for the investment?

Section 3.2 – Compound Interest

Interest paid on interest reinvested is called compound interest.

Example : Suppose you deposit \$1000 in a bank that pays 8% compounded quarterly (interest paid 4 times a year). How much will be in the bank after 1 year?

Compound Interest

$$A = P(1 + rt)$$

1st quarter $1000(1 + .08(.25)) = 1000(1.02) = 1020$

2nd quarter $(1000(1.02))(1.02) = 1000(1.02)^2 = 1040.40$

3rd quarter $[1000(1.02^2)](1.02) = 1000(1.02)^3 = 1061.21$

4th quarter $[1000(1.02)^3](1.02) = 1000(1.02)^4 = 1082.43$

so in general

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

I = Interest : fee charged for use of principal

P = principal : original amount of money invested

r = interest rate per year in decimal $8\% = .08$ or $7\frac{1}{2}\% = .075$

n = number of compounding periods per year

annually	n = 1	quarterly	n = 4
semiannually	n = 2	monthly	n = 12

t = time in years

Example: Find the total amount accrued on \$1000 at 6% over 8 years compounded

a) annually \$1593.85 c) quarterly \$1610.32

b) semiannually \$1604.71 d) monthly \$ 1614.14

TVM SOLVER - HANDOUT

PRESENT VALUE: How much should you invest now at 8% compounded semiannually to have \$80,000 in 17 years?

EFFECTIVE RATE or ANNUAL PERCENTAGE YIELD: The effective rate of a named compound interest rate is the equivalent simple interest rate. (Also called annual percentage yield -APY)

To find the effective interest rate : $r_e = (1 + \frac{r}{n})^n - 1$

Which is the better investment?

10% compounded monthly or

10.2% compounded semiannually

$$r_e = (1 + .10/12)^{12} - 1 = 10.47\%$$

$$r_e = (1 + .102/2)^2 - 1 = 10.46\%$$

So 10% compounded monthly is the better investment because it has the larger effective interest rate.

TVM Solver - $EFF(\text{Interest rate per year, number of compounding periods per year}) = EFF(r,n)$

Find the nominal interest rate given the effective rate-

What is the annual nominal rate compounded quarterly for a bond with an effective rate of 8.8%?

$$r_e = (1 + \frac{r}{n})^n - 1$$

$$.088 = (1 + r/4)^4 - 1$$

$$1.088 = (1 + r/4)^4$$

$$1.088^{1/4} = 1 + r/4$$

$$1.088^{1/4} - 1 = r/4$$

$$4(1.088^{1/4} - 1) = r$$

$$r = .08524 = 8.524\%$$

TVM Solver - NOM(Interest rate per year, number of compounding periods per year) = NOM(r,n)

GROWTH and TIME: How long will it take \$10,000 to grow to \$25000 at 18% compounded quarterly?

$$\begin{aligned} A &= P(1 + r/n)^{nt} \\ 25000 &= 10000(1 + .18/4)^{4t} \\ 2.5 &= (1.045)^{4t} \\ \ln 2.5 &= \ln (1.045)^{4t} \\ \ln 2.5 &= 4t(\ln 1.045) \\ t &= \frac{\ln 2.5}{4 \ln 1.045} = 5.2 \text{ years} \end{aligned}$$

or TVM SOLVER = 20.82 quarters = 5.2 years

#42 If \$2000 is invested in an account that earns 8.25% compounded annually for 5 years, find the interest earned during each year and the amount in the account at the end of each year. Organize your results in a table.

	Interest	Amount
1	\$165.00	\$2165
2	\$178.61	\$2343.61
3	\$193.35	\$2536.96
4	\$209.30	\$2746.26
5	\$226.57	\$2972.83