

## Unit 8: Financial Applications

### Day 3: Compound Interest - Future Value

Today we will....

1. Learn the compound interest formula.
2. Use the formula to solve for future value, interest rate or time in a real-life situation.

MCF3MI:

Unit 8: Financial Applications

Day 3: Compound Interest – Future Value

Some Definitions:

*Compound Interest:* Calculated by adding interest to the principal!  
(this is exponential growth).

*Future Value:* Final Amount

*Compounding Period:*

Each period that the interest is earned.

*Compound interest earnings*

Use simple interest to complete the following Compound Interest Chart.

\$2000 is invested for three years at 8% compounded annually.

Year	Principal for Year (\$)	Interest Earned (\$)	Amount at the end of the Year (\$)
1	2000	$2000(1+0.08)^1$	2160
2	2160	$2160(1+0.08)^1$	2332.80
3	2332.80	$2332.80(1+0.08)^1$	2519.42

*Compound Interest:*

$$A = P(1+i)^n$$

$A$  = Final (Accumulated Value)     
  $P$  = Principal     
 $i$  = interest rate (per compounding period)     
 $n$  = number of compounding periods

Interest may be calculated...

- |   |                                  |
|---|----------------------------------|
| 1. Annually (per Annum or p.a.) - $1/\text{yr}$ | 2. Semi-annually - $2/\text{yr}$ |
| 3. Quarterly - $4/\text{yr}$                    | 4. Monthly - $12/\text{yr}$      |
| 5. Bi-weekly - $26/\text{yr}$                   | 6. Weekly - $52/\text{yr}$       |
| 7. Daily - $365/\text{yr}$                      |                                  |

EX. 1. Calculate the final amount of investment of \$5000 at 3.5% p.a. compounded annually for 5 years.

$$\begin{aligned}
 A &= P(1+i)^n \\
 &= 5000(1+0.035)^5 \\
 &= 5000(1.035)^5 \\
 &= \$5938.43
 \end{aligned}$$

EX. 2. Calculate the amount of an investment of \$1000 at 6% p.a. compounded monthly for 2 years.

How much interest was earned?

$$\begin{aligned}
 A &= P(1+i)^n \\
 &= 1000(1+0.005)^{24} \\
 &= 1000(1.005)^{24} \\
 &= \$127.16
 \end{aligned}$$

$$i = \frac{0.06}{12}$$

$$i = 0.005$$

$$\begin{aligned}
 \text{Interest} &= \$127.16 - 1000 \\
 &= -127.16
 \end{aligned}$$

$n = 2 \times 12 = 24$

EX. 3. If \$500 grows to \$800 in 7 years, what is the annual rate of interest if it is compounded annually?

$$\begin{aligned}
 A &= P(1+i)^n \\
 \frac{800}{500} &= \frac{500}{500}(1+i)^7 \\
 1.6 &= (1+i)^7
 \end{aligned}$$

$$\sqrt[7]{1.6} = 1+i$$

$$1.0694 = 1+i$$

$$1.0694 - 1 = i$$

$$0.0694 = i$$

$\therefore$  the interest rate is 6.94%

EX. 4. How long will it take for a \$100 investment to double if interest is paid at 4% compounded annually?

$$\begin{aligned}
 A &= P(1+i)^n \\
 \frac{200}{100} &= \frac{100}{100}(1+0.04)^n \\
 2 &= (1.04)^n
 \end{aligned}$$

guess check:

$$1.04^2 = 1.08$$

$$1.04^{10} = 1.49 \leftarrow \text{too small}$$

$$1.04^{15} = 1.8$$

$$1.04^{17} = 1.95$$

$$1.04^{18} = 2.03$$

$$1.04^{20} = 2.19 \leftarrow \text{too big}$$

Homework: p. 468 #3-6, 8, 10, 15

$\therefore$  it will take 18 years.