U7D2 Simple and Compound Interest

Friday, December 15, 2017 5:43 PM

U7D2_T - Simple an...

U7D2

Financial Applications: Unit Overview

1. Budgeting
2. Simple Interest
3. Compound Interest
    - Future Value
    - Present Value
4. Annuities
    - Future Value
    - Present Value
    - Applications
        - Mortgages
        - Vehicle Purchases

Definitions

Principal (P): The original amount invested or borrowed

Interest Rate (r): The percent (converted to decimal form) used to calculate the interest earned

Time (t): The length of time the money is invested/borrowed for.
(The time units for t and r MUST MATCH)

Amount (A): The *total value* of the investment or loan *including the interest.*

Interest (I): The fee for the use of money… interest is extra money you earn by investing or the extra you must pay if you borrow

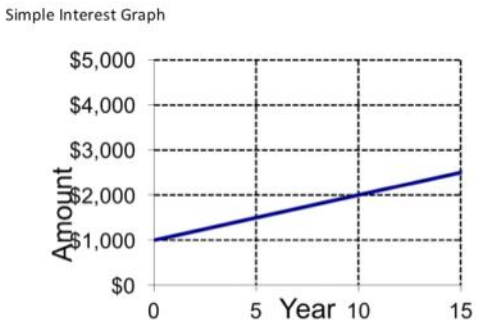
/a or per annum: Latin for **per year**

Term: the length of time of an investment or loan with a guaranteed interest rate.

Simple Interest Formula

$I=Prt$

$A=P+I$



Linear Graph

Example

John borrows $1000 from his parents and they charge him 6%/a simple interest. How much does he owe after 5 months?

$A = ?$ $I = ?$ $P = \$1000$ $r = 0.06$ $t = \frac{5}{12}$

$I = Prt$

$= 1000(0.06)\left(\frac{5}{12}\right)$

$= 25$

$A = P + I$

$A = 1000 + 25$

$A = 1025$

$\therefore$ he will owe $1025.

U7D2

More Definitions for Compound Interest

i = interest rate per compounding period

(interest rate ÷ 100 ÷ number of times per year interest is calculated)

n = number of periods

(number of years x number of times per year interest is calculated)

P = Principal (Original amount invested or borrowed) This is sometimes referred to as Present Value or PV

A= Final Amount (includes interest and principal)

Typical Compounding periods

Compounding Period	Number of Times per year interest is compounded
Annually	1
Semi-annually	2
Quarterly	4
Bi-monthly	6
Monthly	12
Bi-weekly	26
Weekly	52
Daily	365

Example 1: If the interest rate is 12%/a compounded monthly for 2 years, how many compounding periods are there and what is the interest rate per period.

$i = 12 \div 100 \div 12$

$i = 0.01$

$n = 2 \times 12$

$= 24$

U7D2

$$A = \frac{P(1+i)^n}{(1+i)^n}$$

Compound Interest Formula

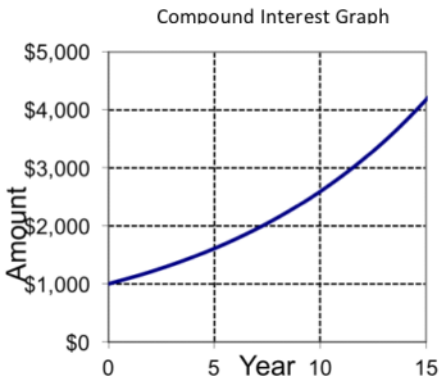
$A = P(1+i)^n$ - future value

or

$P = A(1+i)^{-n}$ - present value

note: negative sign

Exponential Growth Graph



Examples

1. *Find the future amount of an investment of $2200 for 5 years at 3.4% per annum compounded monthly.*

$i = \frac{0.034}{12}$ $n = 5 \times 12 = 60$ $A = ?$ $P = 2200$

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

$A = 2200(1 + 0.034 \div 12)^{60}$

$A = 2607.04$

Therefore, the investment will be worth $2607.04 after 5 years.

U7D2

2. *Rich wants to have $25 000 in 5 years for a down payment on a house. How much should he invest <u>today</u> at 6.25% per annum, compounded quarterly?*

$i = \frac{0.0625}{4}$ $n = 5 \times 4 = 20$ $A = \$25\,000$ $P = ?$

$P = A(1+i)^{-n}$ *Notice the negative exponent*

$P = 25000(1 + 0.0625 \div 4)^{-20}$

$P \doteq 18\,334.64$

Therefore, he should invest $ $18\,334.64$ *today.*

Try these yourself!

Ex. 1. Joe has some money to invest. He buys a 2 year term investment that pays simple interest at 3.35%/a. Calculate the interest earned on a $50 000 investment.

$I = Prt$

$= 50000(0.0335)(2)$

$= 3350$

∴ he earns $3350 in interest.

Ex. 2. Mary invested $1200 for 2 years in a mutual fund that paid 3.6% interest per year with interest compounded annually.

a) Determine the final amount of Mary's investment.

b) Calculate the total interest that Mary earned on her investment.

a) $A = 1200(1+0.036)^2$

$A \doteq 1287.96$

b) $I = A - P$

$= 1287.96 - 1200$

$= 87.96$

∴ Mary's investment is worth $1287.96 including interest of $87.96.

U7D2

Ex. 3. Mark borrows $3000 at an interest rate of 4.75% per annum compounded monthly. How much will he owe in 5 years?

$n = 5 \times 12$
$n = 60$

$A = 3000(1 + 0.0475 \div 12)^{60}$

$A = 3802.44$

∴ Mark will owe $3802.44

Ex. 4. Diana invests$10 000 in a GIC with an interest rate of 3.4%/a compounded semi-annually. If she is in grade 9 today how much will she have when she graduates ?

NOTE: when she finishes school at the end of gr. 12 the 8th 6-month cycle is not complete so she only gains interest for 7 six-month periods.

$A = 10\,000(1 + 0.034 \div 2)^{7}$

$A = 11\,252.44$

∴ she will have $11 252.44.

Answers: 1) $3350 2a) $1287.96 b) $87.96 3) $3802.44 4) $11 252.44