Unit 8: Financial Applications

Day 6: Regular Annuities - Future Value

Today we will...

1. Learn how to use a timeline to visualize an annuity.

2. Learn how to use a formula to calculate the future value of a simple, ordinary annuity.

MCF3MI: 2016-17 **Unit 8: Financial Applications** **Day 6: Regular Annuities – Future Value**

Some Definitions:

Annuity:

A series of equal deposits or payments made at regular intervals.

Simple Annuity:

Ordinary Annuity:

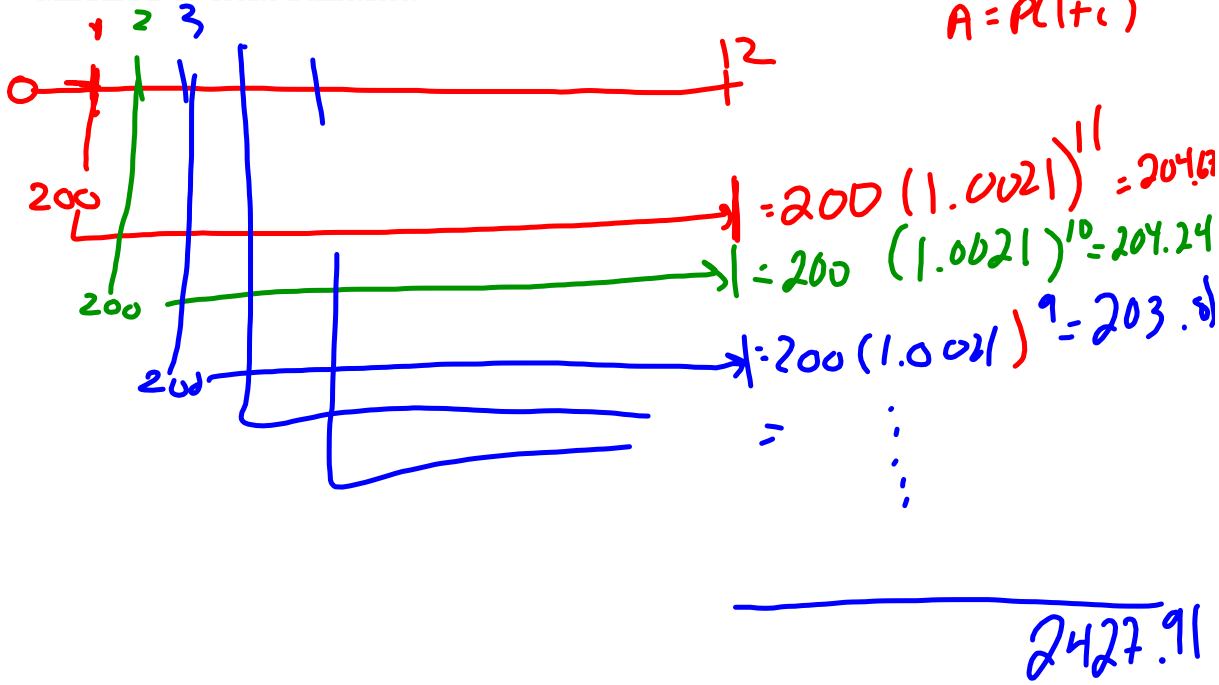
In this course, we will assume a simple, ordinary annuity unless otherwise stated.

EX. Kristine has a part time job and is able to save ~~$200 per month~~. If her bank account pays ~~2.5%~~ p.a. compounded monthly, how much will she have in her account at the end of one year?

$\frac{0.025}{12} = 0.0021$

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

METHOD 1: Create a timetable.



METHOD 2: The Annuity Formula
There is a formula for this calculation…

Amount of an Annuity:

$$A = \frac{R[(1+i)^n - 1]}{i}$$

$A =$ Accumulated Value $R =$ Regular Payment $i =$ interest rate per comp period. $n =$ number of compound periods.

Consider the same example as before…

EX. 1. Kristine has a part time job and is able to save $200 per month. If her bank account pays 2.5% p.a. compounded monthly, how much will she have in her account at the end of one year?

R

$A = \frac{R[(1+i)^n - 1]}{i}$

$= \frac{200[(1.0021)^{12} - 1]}{0.0021}$

$= 2427.91$

$i = \frac{0.025}{12} = 0.0021$

$n = 12$

$R = 200$

∴ she will have $2427.91

EX. 2. a) A person finishes college at age 21, debt free and starts an RRSP with monthly contributions of $50. How much will she have saved by age 50 in an account that pays 3% p.a. compounded monthly?

$A = \frac{R[(1+i)^n - 1]}{i}$

$= \frac{50[(1.0025)^{348} - 1]}{.0025}$

$= 27\,686.42$

$i = \frac{.03}{12}$

$= .0025$

$n = 12 \times 29$

$= 348$

b) How much interest has she earned in her RRSP?

Payments $= 50 \times 348$

$= 17\,400$

∴ Interest $= 27\,686.42 - 17\,400$

$= \$10\,286.42$

EX. 3. You want to retire in 30 years with $1,000,000 in savings. Your current investments are earning, on average, 11% p.a. compounding annually.

a) What annual deposit must you make to reach your savings goal?

$A = \frac{R[(1+i)^n - 1]}{i}$

$1\,000\,000 = \frac{R[(1.11)^{30} - 1]}{0.11}$

$i = 0.11$

$n = 30$

$1\,000\,000 = \frac{R(21.8922957)}{0.11}$

$1\,000\,000 = R(199.0209779)$

$\$5024.60 = R$

b) Of the final $1,000,000, how much is interest?

Homework: p. 498 #3-7, 10, 14

$5024.60 \times 30 = 150\,738$

∴ Interest is $1\,000\,000 - 150\,738$

$= \$849\,262$