Chapter

8

Financial Mathematics: Investing Money

LEARNING GOALS

You will be able to develop your number sense in financial applications by

- Understanding and comparing the effects of simple interest and compound interest
- Determining how changes in the variables of an investment affect the return
- Being aware of a variety of different investment instruments
- Comparing different investment strategies

8.1 Simple Interest

term
The contracted duration of an investment or loan.

interest
The amount of money earned on an investment or paid on a loan.

fixed interest rate
An interest rate that is guaranteed not to change during the term of an investment or loan.

principal
The original amount of money invested or loaned.

maturity
The contracted end date of an investment or loan, at the end of the term.

future value
The amount, *A*, that an investment will be worth after a specified period of time.

GOAL

Solve problems that involve simple interest.

simple interest
The amount of interest earned on an investment or paid on a loan based on the original amount (the principal) and the simple interest rate.

Communication *Tip*

Interest rates are communicated as a percent for a time period. Since most often the time period is per year or **per annum** (abbreviated as **/a**), a given percent is assumed to be annual unless otherwise stated. For example, an interest rate of 4% means 4%/a or 4% interest per year.

SIMPLE Interest

Based on the **principal** (original amount) that is invested/borrowed. Interest is a certain percentage per **annum** (year). Often used for personal loans and short-term investments. The length of time for the investment/loan is called the **term**.

$$I = Prt$$

&

$$A = P + I$$

OR

$$A = P + Prt$$

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

Interest = Principal x rate x time

- I - interest earned
- P - principal (original investment/loan)
- r - interest rate as a percent **(change to a decimal)**
- t - is ALWAYS time in **years**

(how long the money is invested/borrowed)

- **A - amount of money including interest**

COMPOUND Interest

Interest is added to the principal periodically throughout the year. New interest may be paid on the principal plus the interest. The interest rate is stated per annum and is divided by the number of **compounding periods**.

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

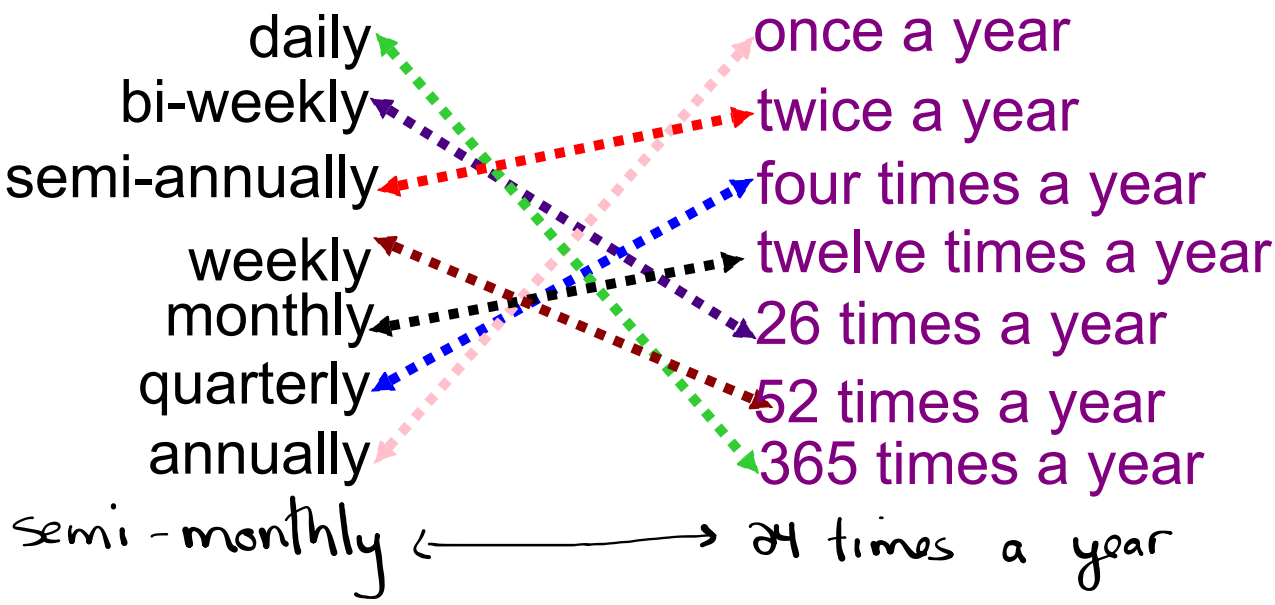
$$I = A - P$$

A = final value of the investment ...(principal + interest)
P = principal
r = annual interest rate
n = number of compounding periods in a year
t = term of the investment or loan in number of years

Terminology Tango

Click on the picture to verify the match.

∩ =



1. Complete the following chart.

Principal	Rate/a	Time	Compounded	Formula	Amount	Interest
$1200	12%	5 a	Semi-annually	$A = 1200\left(1+\frac{0.12}{2}\right)^{10}$	$2149.02	$949.02
$480	6%	3 a	Quarterly	$A = 480\left(1+\frac{0.06}{4}\right)^{12}$	$573.90	$93.90
$10000	8%	12 a	Annually	$A = 10000\left(1+\frac{0.08}{1}\right)^{12}$	$25 181.70	$15181.70
$5600	$7\frac{1}{4}\%$	10 a	Semi-annually	$A = 5600\left(1+\frac{0.0725}{2}\right)^{20}$	$11 415.08	$5815.08
$80	$10\frac{1}{2}\%$	20 a	Monthly	$A = 80\left(1+\frac{0.105}{12}\right)^{240}$	$647.35	$567.35
$1 200 000	5%	7 a	Quarterly	$A = 1200000\left(1+\frac{0.05}{4}\right)^{28}$	$1 699 190.76	$499 190.76

2. Examine how varying interest rates and compounding intervals affects the following investment.

Principal	Rate/a	Time	Compounded	Formula	Amount	Interest
$12 000	8%	15 a	Annually	$A = 12000\left(1+\frac{0.08}{1}\right)^{15}$	$38 066.03	$26 066.03
$12 000	8%	15 a	Semi-Annually	$A = 12000\left(1+\frac{0.08}{2}\right)^{30}$	$38 920.77	$26 920.77
$12 000	8%	15 a	Quarterly	$A = 12000\left(1+\frac{0.08}{4}\right)^{60}$	$39 370.37	$27 370.37
$12 000	8%	15 a	Monthly	$A = 12000\left(1+\frac{0.08}{12}\right)^{180}$	$39 683.06	$27 683.06
$12 000	8%	15 a	Daily	$A = 12000\left(1+\frac{0.08}{365}\right)^{5475}$	$39 836.16	$27 836.16
$12 000	8%	15 a	Simple Interest	$A = 12000 + 12000(0.08)(15)$	$26400.00	$14400.00

$12 000	8%	15 a	Semi-Annually	$A = 12000\left(1+\frac{0.08}{2}\right)^{30}$	$38 920.77	$26 920.77
$12 000	8%	15 a	Quarterly	$A = 12000\left(1+\frac{0.08}{4}\right)^{60}$	$39 372.37	$27 372.37
$12 000	8%	15 a	Monthly	$A = 12000\left(1+\frac{0.08}{12}\right)^{180}$	$39 683.06	$27 683.06
$12 000	8%	15 a	Daily	$A = 12000\left(1+\frac{0.08}{365}\right)^{5475}$	$39 836.16	$27 836.16
$12 000	8%	15 a	Simple Interest	$A = 12000 + 12000(0.08)(15)$	$26 400.00	$14 400.00

3. Which of the following investments would be worth the most money after 20 years?

$5000 at 8%/a compounded semi-annually	$7000 at 6%/a compounded daily	$17000 at 2%/a compounded monthly
$A = 5000\left(1+\frac{0.08}{2}\right)^{40}$ $A = \$24005.10$	$A = 7000\left(1+\frac{0.06}{365}\right)^{7300}$ $A = \$23\,238.53$	$A = 17000\left(1+\frac{0.02}{12}\right)^{240}$ $A = \$25\,352.58$

Attachments

Worksheet - Introduction to Compound Interest.doc