

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

? What do you think it means to be financially literate, and how will being financially literate help you achieve your goals?

+



The video player shows a man in a suit (Tom Hamza) sitting at a table with another man (Steve Paikin) in a studio setting. A screen in the background displays 'THE AGENDA WITH STEVE PAIKIN'. The video player interface includes a progress bar at 00:13 / 13:15, a volume icon, a settings gear, and a 'tvo' logo on the chair.

Tom Hamza: Financial Literacy 101

The Agenda with Steve Paikin · 2,638 videos

Subscribe 10,128

2,865

18 1

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

ex: 5%
0.05

ex 8 months
↓
8/12 years

APPLY the Math p. 446

EXAMPLE 1 Solving a simple interest problem

Marty invested in a \$2500 guaranteed investment certificate (GIC) at 2.5% simple interest paid annually with a term of 10 years.

- a) How much interest will accumulate over the term of Marty's investment?
- b) What is the future value of his investment at maturity?

Paid Annually

NOTE:

Means that interest is paid only in yearly increments.

Amount ↑

a) $I = P \cdot r \cdot t$
 $I = 2500(0.025)(10)$
 $I = \$625$

b) $A = P + I$
 $A = 2500 + 625$
 $A = \$3125$

EXAMPLE #2:

Betty-Ann's bank offers a simple interest rate of 4% per annum. How much interest would Betty-Ann earn on her investment of \$4000 after 8 months.

$$I = Prt$$

$$I = 4000 (0.04) (8/12)$$

$$I = \$106.67$$



Time

Rearranging...

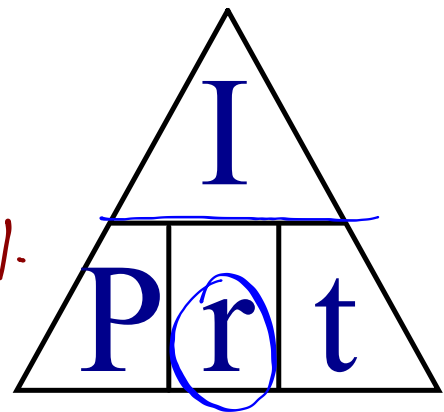
You earned \$107.42 simple interest on a \$671.37 investment over four years.

What was the interest rate?

$$I = \frac{P \cdot r \cdot t}{P \cdot t} = r$$

$$r = \frac{I}{P \cdot t} = \frac{107.42}{671.37(4)} \times 100\%$$

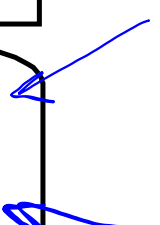
$$r = 4\%$$



rate of return

The ratio of money earned (or lost) on an investment relative to the amount of money invested, usually expressed as a decimal or a percent.

$$ROR = \frac{\text{earn / lost}}{\text{invested}}$$

$$\frac{I}{P}$$


EXAMPLE 3
p. 448

Determining the duration of a simple interest investment

Ingrid invested her summer earnings of \$5000 at 8% simple interest, paid annually. She intends to use the money in a few years to take a holiday with a girlfriend.

$$I = A - P$$

$$= 8000 - 5000$$

$$= 3000$$

$$\frac{I}{Prt}$$

$$t = \frac{I}{Pr}$$

$$t = \frac{3000}{5000 \times 0.08}$$

$$t = 7.5 \text{ years}$$

* paid annual → 8 years

a) How long will it take for the future value of the investment to grow to \$8000?

b) What is Ingrid's rate of return?

Ingrid's Solution

$$ROR = \frac{\$ \text{earn}}{\$ \text{invest}}$$

$$= \frac{3200}{5000} \times 100\%$$

$$= 64\%$$

$$I = 5000 (0.08) (8)$$

$$I = \$3200$$

EXAMPLE 3
p. 448

Determining the duration of a simple interest investment

$$\frac{I}{Prt}$$

Ingrid invested her summer earnings of \$5000 at 8% simple interest, paid annually. She intends to use the money in a few years to take a holiday with a girlfriend.

$$I = A - P$$

$$= 8000 - 5000$$

$$= 3000$$

$$t = \frac{I}{Pr}$$

$$t = \frac{3000}{5000 \times 0.08}$$

$$t = 7.5 \text{ years}$$

x paid annual → 8 years

- a) How long will it take for the future value of the investment to grow to \$8000? **A**
- b) What is Ingrid's **rate of return**?

Ingrid's Solution

a) $A = P + Prt$

P is \$5000.
 r is 8%, or 0.08.
 A is \$8000.

$$8000 = 5000 + (5000)(0.08)t$$

$$3000 = 400t$$

$$7.5 = t$$

I knew P , r , and A . I determined t by substituting these known values into the formula $A = P + Prt$ and solving for t .

Because I needed to isolate t , I knew that the $A = P + Prt$ form of the equation would have fewer solution steps than the $A = P(1 + rt)$ form would.

It will take 8 years for the future value of the investment to be at least \$8000.

I knew 7.5 years would not work because the interest is paid annually. This meant that I had to round up to the next whole year. It also meant that, at 8 years, the future value would be more than \$8000.

b) After 8 years:

$$A = P + Prt$$

$$A = 5000 + (5000)(0.08)(8)$$

$$A = 8200$$

At 8 years, the future value will be \$8200.

I determined the interest earned by subtracting the principal from the future value.

Interest earned:
 $\$8200 - \$5000 = \$3200$

$$\text{Rate of return} = \frac{3200}{5000}$$

I compared the interest earned with the principal to determine the rate of return.

$$\text{Rate of return} = 0.64$$

The rate of return is 64% over 8 years.

HOMework...

p. 452: #1 - 6, 10, 11

$$I = Prt$$

&

$$A = P + I$$

OR

$$A = P + Prt$$

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

$$ROR = \frac{\$ \text{earn}}{\$ \text{invest}}$$

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

Attachments

Worksheet - Rearranging Simple Interest.pdf