Senior High School

Department of Education
National Capital Region
SCHOOLS DIVISION OFFICE
MARIKINA CITY

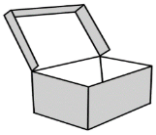
GENERAL MATHEMATICS

Quarter 2: Module 1

Simple and Compound Interest

Writer: JOEL C. HAGOS, (FHS)
Cover Illustrator: Joel J. Estudillo (SNNHS)

City of Good Character
DISCIPLINE • GOOD TASTE • EXCELLENCE



What I Need to Know

Hello Grade 11 learners! In this module, you will learn how to:

illustrates simple and compound interests (**M11GM-IIa-1);**

distinguish between simple and compound interests (**M11GM-IIa -2);** and

computes interest, maturity value, future value, and present value in simple interest and compound interest environment **M11GM-Iia-b-1**.

You can say that you have understood the lesson in this module if you can already:

1. define the different terms on interest;
1. illustrate and distinguish simple and compound interest;
2. compute interest, maturity value and present value in simple interest environment and solve problems involving simple interest; and
3. compute interest, maturity value and present value in compound interest environment.

What I Know

Choose the correct letter that corresponds to the exact answer.

1. A person (institution) who avails the money of the funds from the lender.
   A. Borrower B. Creditor C. Interest D. Principal
2. The amount paid or earned for the use of money.
   A. Borrower B. Creditor C. Interest D. Principal
3. The length of time between the origin and maturity date.
   A. Compound interest C. Time
   B. Maturity Value D. Present value

For item 4 – 5, please refer to the table below.

Simple Interest	**Compound interest**
₱ 500.00 invested with a rate of 5% for 2 years	₱500.00 invested with a rate of 5% for 2 years
Year 1: interest = 500(0.05) = ₱25.00	Year 1: interest = ₱ 500(0.05) = ₱25.00
Year 2: interest = 500(0.05) = ₱25.00	Year 2: interest = ₱ 525(0.05) = ₱26.25

4. What is the total simple interest based from the given problem in the table above?
A. ₱25.00 B. 26.25 C. ₱50.00 D. 51.25

5. In the given problem in the table above, what is the compound interest in year 2?
A. 25 B. 26.25 C. 50 D. 51.25

6. A bank offers 0.40% annual simple interest rate for a particular deposit. How much interest will be earned if 1 million pesos is deposited in this savings account for 2 years?
A. ₱4,000.00 B. ₱6,000.00 C. ₱8,000.00 D. ₱10,000.00

7. In item number 6, 0.40% is equivalent to _____.
A. 0.004 B. 0.04 C. 0.4 D. 40

8. How much money will you have after 3 years if you deposited ₱30,000.00 in a bank that pays 0.6% simple interest?
A. ₱28,450.00 B. ₱29,640.00 C. ₱30,540.00 D. ₱31,640.00

For item 9-10, please refer to the problem below.
₱15,000.00 is compounded annually at an interest rate of 3% in 6 years.

9. Find the maturity value.
A. ₱14,328.63 B. ₱14,645.45 C. ₱16,098.72 D. ₱17,910.78

10. Compute the compound interest.
A. ₱1,910.78 B. ₱2,910.78 C. ₱3,910.78 D. ₱4,910.78

Lesson 1	**Illustrating and Distinguishing Simple and Compound Interest**

What's In

Convert each percent into decimal. Write your answer in the box.

1. 25% =	2. 35% =
3. 12.34% =	4. 0.45% =
5. 0.02% =	6. 125% =

What's New

Study the table below and answer the following questions.

Interest on principal only	**Interest on principal and interest previously earned**
₱ 200.00 invested with a rate of 3% for 2 years Year 1: interest = 200(0.03) = ₱6.00 Year 2: interest = 200(0.03) = ₱6.00 **Total interest** = ₱ 12.00	₱ 200.00 invested with a rate of 3% for 2 years Year 1: interest = ₱ 200(0.03) = ₱6.00 Year 2: interest = ₱ 206(0.03) = ₱6.18 **Total interest** = ₱ 12.18

1. What is the total interest in the given problem that computes the interest on principal only?
2. What is the total interest in the given problem that computes the interest on principal and interest previously earned?
3. What have you noticed on the interest from year 1and year 2 if interest is calculated on the principal only?
4. What can you observe on the interest from year 1 and year 2 if interest is calculated on the principal and interest previously earned?
5. What types of interest are being illustrated above?

What is It

Let us define first the following terms connected to interest.
Definition of Terms:

Lender or creditor	- person (institution) who invests the money or makes the funds available
Borrower or debtor	- person (institution) who owes the money or avails of the funds from the lender
Origin or loan date	- date on which money received by the borrower
Maturity date	- date on which the money borrowed or loan is to be completely repaid
Time or term (t)	- amount of time in years the money is borrowed or invested; length of time between origin and maturity date
Principal (P)	- amount of money borrowed or invested on the origin date

Rate (r)	- annual rate, usually in percent, charged by the lender, or rate increase of the investment
Interest (I)	- amount paid or earned for the use of money
Simple Interest (I_s)	- interest is calculated on the principal only
Compound Interest (I_c)	- interest is computed on the principal and on the accumulated past interests
Maturity Value or Future Value (F)	- amount after t years that the lender receives from the borrower on the maturity date

Let us now illustrate and distinguish between simple interest and compound interest.

Illustrative example:

Mr. Tan decided to invest ₱ 30,000.00 to the bank for 4 years. Bank X offers 4% simple interest rate per year while Bank Z also offers the same rate but compounded annually. Which bank should Mr. Tan choose to invest and why?

Simple Interest:

Time (t)	Principal (P)	Bank X (I_s)		Amount after t years (Maturity Value)
		Solution	Answer	
1	₱30,000.00	(30,000)(0.04)(1)	1,200	30,000 + 1,200 = ₱31,200.00
2		(30,000)(0.04)(2)	2,400	30,000 + 2,400 = ₱32,400.00
3		(30,000)(0.04)(3)	3,600	30,000 + 3,600 = ₱33,600.00
4		(30,000)(0.04)(4)	4,800	30,000 + 4,800 = ₱34,800.00

Interest gained:

Simple Interest: ₱34,800.00 – 30,000.00 = ₱4,800.00

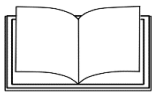
Compound Interest:

Time (t)	Principal (P)	Bank Z (I_c)		Amount after t years (maturity Value)
		Solution	Answer	
1	₱30,000.00	(30,000)(0.04)(1)	1,200	30,000 + 1,200 = ₱31,200.00
2		(31,200)(0.04)(1)	1,248	31,200 + 1,248 = ₱32,448.00
3		(32,448)(0.04)(1)	1,297.92	32,448+ 1,297.92 = ₱33,745.92
4		(33,745.92)(0.04)(1)	1,349.84	33,745.93 + 1,349.84 = ₱35,095.77

Interest gained:

Compound Interest: ₱35,095.77– 30,000.00 = ₱5,095.77

Most likely, Mr. Tan will invest his money in Bank Z that offers the same rate but compounded annually because his investment will grow more. Simple interest remains constant throughout the investment term. In compound interest, the interest from the previous years also earns interest. Thus, the interest grows every year.



What's More

Illustrate and distinguish between simple and compound interest by solving the given problem below.

Suppose you have ₱50,000.00 and you plan to invest it for 6 years. Bank A offers 5% simple interest rate per year, while Bank B offers 5% compounded annually. Which offers will you choose and why?

What I Have Learned

Complete the statement/s. Write your answer on the space provided.

1. _____ is amount of money borrowed or invested on the origin date.
2. _____ person (institution) who owes the money or avails of the funds from the lender.
3. Interest is the amount paid or earned for the use of _____.
4. Simple interest remains _____throughout the investment term.
5. In _____, the interest from the previous years also earns interest. Thus, the interest grows very year.

What I Can Do

Problem:

Mrs. Tolentito wants to invest ₱ 25,000.00 in a bank for 5 years with 6% interest rate per year. Illustrate and distinguish the interest between simple and compound interest and compare the interest gained.

Score	Description
15 points	Complete solutions and correct answer
10 points	Incomplete solutions but correct answer
5 points	Incomplete solutions and incorrect answer
No point earned	No output at all

Additional Activities

Given a problem below, illustrate and distinguish between simple and compound interest.

Suppose you won ₱18,000.00 and you plan to invest it for 6 years. A cooperative group offers 3% simple interest rate per year. A bank offers 3% compounded annually. Which will you choose and why?

Lesson 2	**Computation of Interest, Maturity Value, and Present Value of Simple and Compound Interest**

What's In

Answer the following statement/s and questions by choosing the terms on the word bank below.

1. In simple interest, interest for all years is _____.
2. In compound interest, interest for all years is _____.
3. Simple interest is _____ than compound interest.
4. Compound interest is _____ than simple interest.
5. What do you call the amount of money borrowed or invested on the origin date?
6. What do you call the amount after *t* years that the lender receives from the borrower on the maturity date?

same/constant	different	larger
Time or term(t)	smaller	Maturity value (F)
Principal(P)	Compound interest	Lender or creditor

What's New

Let us study these tables and answer the questions that follow.

Table 1: Simple Interest

Time (t)	Principal (P)	Bank A Solution	Amount after t years (Maturity Value)
1	₱5,000.00	(5,000)(0.02)(1)	5,000 + 100 = ₱5,100.00
2		(5,000)(0.02)(2)	5,000 + 200 = ₱5,200.00
3		(5,000)(0.02)(3)	5,000 + 300 = ₱5,300.00
4		(5,000)(0.02)(4)	5,000 + 400 = ₱5,400.00

Table 2: Compound Interest

Time (t)	Principal (P)	Bank B Solution	Amount after t years (maturity Value)
1	₱5,000.00	$5,000(1+0.02)^1$	₱5,100.00
2		$5,000(1+0.2)^2$	₱5,202.00
3		$5,000(1+0.02)^3$	₱5,306.40
4		$5,000(1+0.02)^4$	₱5,412.16

1. Give the values of the following based from the two tables above:
   a. P = _____
   b. t = _____
   c. r = _____
2. What inferences can you give on the maturity values of the two tables?
3. Based from the solution on the two tables above, can you give the formula in finding the simple interest, compound interest and maturity value of simple and compound interest?

What is It

In the previous lesson, you have learned how to illustrate and distinguish between simple and compound interest. Lesson 2 focuses on the computations of interest, maturity value and present value of simple and compound interest.

Simple Interest

Annual Simple Interest

$$I_s = Prt$$

Where:
I_s = simple interest
P = principal amount or the amount invested or borrowed
r = simple interest rate
t = term or time in years

Illustrative examples:

1. A bank offers 0.30% annual simple interest rate for a particular deposit. How much interest will be earned if ₱500,000.00 is deposited in this savings account for 3 years?

Given: P = 500,000.00 r = 0.30% = 0.003 t = 3 years
Find: Simple interest (I_s)

Solution:

$$I_s = Prt$$
$$I_s = (500{,}000)(0.003)(3)$$
$$I_s = 4{,}500$$

Thus, the interest earned is ₱4,500.00.

2. When invested at an annual interest rate of 7%, the amount earned is ₱11,200.00 of simple interest in two years. How much money was originally invested?

Given: r = 7% = 0.07 t = 2 years I_s = 11,200.00

Find: Amount invested or principal (P)

Solution:

$$P = \frac{I_s}{rt}$$
$$P = \frac{11{,}200}{(0.07)(2)}$$
$$P = 80{,}000$$

Thus, the amount invested or the principal amount is ₱80,000.00.

3. If an entrepreneur applies for a loan amounting to ₱300,000.00 in a bank, the simple interest of which is ₱60,000.00 for 3 years. What interest rate is being charged?

Given: P = 300,000 I_s = 60,000 t = 3 years

Find: interest rate

Solution:

$$r = \frac{I_s}{Pt}$$
$$r = \frac{60{,}000}{(300000)(3)}$$
$$r = 0.067$$

Thus, the interest rate is 0.067 or 6.7%.

4. How long will a principal earn an interest equal to half of it at 5% simple interest?

Given: P r = 5% = 0.05 $I_s = \frac{1}{2}P = 0.5P$

Find: Term or time

Solution:

$$t = \frac{I_s}{Pr}$$
$$t = \frac{0.5P}{(P)(0.05)}$$
$$t = 10$$

Thus, it will take 10 years for a principal to earn half of its value at 5% simple annual interest rate.

Maturity (Future) Value

$$F = P + I_s$$

Where: F = maturity (future) value
P = principal amount
I_s = simple interest

Substitute I_s by Prt gives F = P + Prt or F = P(1 + rt).

Maturity (Future) Value

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

Where: F = maturity (future) value
P = principal amount
r = interest rate
t = term/time in years

6. Find the maturity value if 1million pesos is deposited in a bank at annual simple interest rate of 0.025% after: a) 1 year b) 5 years

Given: P = 1,000,000 r = 0.25% = 0.0025

Find: a) maturity value (F) after 1 year
b) maturity value (F) after 5 years

Solution:

a) maturity value(F) after 1 year
F = P(1 + rt)
F = (1,000,000)[1 + 0.0025(1)]
F = 1,002,500.00

Thus, the future value after 1 year is ₱1.002, 500.00.

b) maturity value(F) after 5 years
F = P(1 + rt)
F = (1,000,000)[1 + 0.0025(5)]
F = 1,012,500.00

Thus, the future value after 5 years is ₱1.012, 500.00.

Compound Interest

Maturity (Future) Value and Compound Interest

$$F = P(1 + r)^t$$

Where: P = principal or present value
F = maturity(future) value at the end of the term
r = interest rate
t = term/time in years

The compound interest $\mathbf{I_c}$ is given by

$$I_c = F - P$$

Illustrative examples:

1. Find the maturity value and the compound interest if ₱ 10,000.00 is compounded annually at an interest rate of 2% in 5 years.

Given: P = 10,000 r = 2% = 0.02 t = 5 years

Find: a) maturity value (F)

b) compound interest (I_c)

Solution:

a) $\mathbf{F = P(1 + r)^t}$

$F = 10{,}000(1 + 0.02)^5$

$F = 11{,}040.081$

b) $\mathbf{I_c = F - P}$

$I_c = 11{,}040.081 - 10{,}000$

$I_c = 1{,}040.081$

Thus, the future value (F) is ₱11,040.081 and the compound interest is ₱1,040.081.

Present Value (P) at Compound Interest

$$\mathbf{P = \frac{F}{(1+r)^t}} \quad \textbf{or} \quad \mathbf{P = F(1 + r)^{-t}}$$

Where: P = principal or present value
F = maturity(future) value at the end of the term
r = interest rate
t = term/time in years

2. What is the present value of ₱ 50,000.00 due in 7 years if the money is worth 10% compounded annually?

Given: F = 50,000.00 r = 10% = 0.1 t = 7 years

Find: P

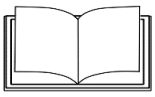
Solution:

$\mathbf{P = F(1 + r)^{-t}}$

$P = 50{,}000(1+0.1)^{-7}$

$P = 25{,}657.91$

Thus, the present value is ₱ 25,657.91.



What's More

Solve the following problems.

A. Simple Interest:

1. Find the unknown principal (P), rate (r), time (t) and simple interest (Is) by completing the table.

Principal (P)	Rate (r)	Time (t)	Simple Interest (I_s
₱2,000.00	5%	3 years	a.)
b.)	12%	5 years	₱20,000.00
₱88,000.00	c.)	4 years	₱8,000.00

2. What are the amounts of interest and maturity value of a loan for ₱30,000.00 at 10% simple interest for 5 years?

B. Compound Interest:

1. Mr. Cruz invested ₱ 120,000.00 at 12% compounded annually. He plans to get this amount after 6 years for his son's college education. How much will he get?

2. Mrs. Bautista aims to have her investment grow to ₱600,000.00 in 3 years. How much should she invest in an account that pays 6% compounded annually?

What I Have Learned

Answer the following questions. Write your answer on the space provided.

1. What is the formula in calculating simple interest (I_s)?
   Answer: _____
2. In simple interest, if P is unknown, what is the formula for P?
   Answer: _____
3. In simple interest, if t is unknown, what is the formula for t?
   Answer: _____
4. What does F means in the formula $F = P(1+r)^t$
   Answer: _____
5. Give the formula in calculating the present value at compound interest.
   Answer: _____

I Can Do

Solve the following problems.

1. How much money will you have after 4 years if you deposited ₱8,000.00 in a bank that pays 0.6%simple interest?

2. Solve for the maturity value and interest if ₱70,000.00 is invested at 4% compounded annually for 6 years.

Rubrics for problem solving

Score	Description
15 points	Complete solutions and correct answer
10 points	Incomplete solutions and correct answer
5 points	Incomplete solutions and incorrect answers but the student showed effort in computing/searching for the answer
No point earned	No output at all

Additional Activities

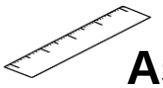
Solve the following problems.

A. Simple Interest:

Principal (P)	Rate (r)	Time (t)	Simple Interest (I_s
₱5,000.00	12.5%	2 years	a.)
₱100,000.00	b.)	6 years	₱6,500.00

B. Compound Interest

Principal (P)	Rate (r)	Time (t)	Compound Interest (I_c)	Maturity Value (F)
₱6,000.00	5%	6 years	a.)	b.)
c.)	2%	4 years	d.)	₱30,000.00



Assessment

Choose the letter that corresponds to the exact answer.

1. What do you call a date on which money is received by the borrower?
   A. Future date B. Loan date C. Maturity date D. None of the above

2. An interest calculated on principal only.
   A. Simple interest C. Future interest
   B. Compound interest D. none of the above

3. An interest calculated on the sum of principal plus accrued interest.
   A. Simple interest C. Future interest
   B. Compound interest D. none of the above

For item 4 – 5, please refer to the tables on the next page.

Simple Interest

Time (t)	Principal (P)	Bank A (I_s)		Amount after t years (Maturity Value)
		Solution	Answer	
1	₱30,000.00	(30,000)(0.04)(1)	1,200	30,000 + 1,200 = ₱31,200.00
2		(30,000)(0.04)(2)	2,400	30,000 + 2,400 = ₱32,400.00
3		(30,000)(0.04)(3)	3,600	30,000 + 3,600 = ₱33,600.00
4		(30,000)(0.04)(4)	4,800	30,000 + 4,800 = ₱34,800.00

Compound Interest:

Time (t)	Principal (P)	Bank B (I_c)		Amount after t years (maturity Value)
		Solution	Answer	
1	₱30,000.00	(30,000)(0.04)(1)	1,200	30,000 + 1,200 = ₱31,200.00
2		(31,200)(0.04)(1)	1,248	31,200 + 1,248 = ₱32,448.00
3		(32,448)(0.04)(1)	1,297.92	32,448+ 1,297.92 = ₱33,745.92
4		(33,745.92)(0.04)(1)	1,349.84	33,745.93 + 1,349.84 = ₱35,095.77

4. In the first table, how much is the total interest gained?
   A. ₱4,800.00 B. ₱5,800.00 C. ₱6,800.00 D. ₱7,800.00

5. In the second table, what is the total maturity value on the 4th year?
   A. ₱31,200.00 B. ₱32,448.00 C. ₱33,600.00 D. ₱35,095.77

6. Lito deposited ₱30,000.00 in a bank with 0.3% simple interest. How much will be the money of Lito after 3 years?
   A. ₱30,170.00 B. ₱30,270.00 C. ₱30,370.00 D. ₱30,470.00

7. When invested at an annual interest rate of 5%, the amount earned is ₱12,300.00 of simple interest in two years. How much money was originally invested?
   A. ₱112,000.00 B. ₱186,000.00 C. ₱123,000.00 D. ₱126,000.00

8. How much money will you have after 5 years if you deposited ₱60,000.00 in a bank that pays 0.7% simple interest?
   A. ₱42,450.00 B. ₱52,640.00 C. ₱62,100.00 D. ₱72,640.00

For item 9-10, please refer to the problem below.

₱18,000.00 is compounded annually at an interest rate of 8% in 4 years.

9. Find the maturity value.
   A. ₱24,488.80 B. ₱34,645.45 C. ₱46,098.72 D. ₱87,910.78

10. Compute the compound interest.
   A. ₱4,687.05 B. ₱4,810.68 C. ₱5,660.03 D. ₱6,488.80

References

General Mathematics Leaner's Materials: Published by Department of Education

Answer Key

What I Know:

1. A 2. C 3. C 4. C 5. B 6. C 7. A 8. C 9. D 10. B

Lesson 1:

What's In

1. 0.25 2. 0.35 3. 0.1234 4. 0.0045 5. 0.000026. 1.25

What's More

Problem: Suppose you have ₱50,000.00 and you plan to invest it for 6 years. Bank A offers 5% simple interest rate per year, while Bank B offers 5% compounded annually. Which offers will you choose and why?

Simple Interest:

Time (t)	Principal (P)	Bank X (I_s)		Amount after t years (Maturity Value)
		Solution	Answer	
1	₱50,000.00	(50,000)(0.05)(1)	2,500	50,000 + 2,500 = ₱52,500.00
2		(50,000)(0.05)(2)	5,000	50,000 + 5,000 = ₱55,000.00
3		(50,000)(0.05)(3)	7,500	50,000 + 7,500 = ₱57,500.00
4		(50,000)(0.05)(4)	10,000	50,000 + 10,000 = ₱60,000.00
5		(50,000)(0.05)(5)	12,500	50,000 + 12,500 = ₱62,500.00
6		(50,000)(0.05)(6)	15,000	50,000 + 15,000 = ₱65,000.00

Interest gained:

Simple Interest : ₱65,000 – 50,000 = ₱15,000.00

Compound Interest:

Time (t)	Principal (P)	Bank Z (I_c)		Amount after t years (maturity Value)
		Solution	Answer	
1	₱50,000.00	(50,000)(0.05)(1)	2,500	50,000 + 2,500 = ₱52,500.00
2		(52,500)(0.05)(1)	2,625	52,500 + 2,625 = ₱55,125.00
3		(55,125)(0.05)(1)	2,756.25	55,125 + 2,756.25 = ₱57,881.25
4		(57,881.25)(0.05)(1)	2,894.06	57,881.25 + 2,894.06 = ₱60,775.31
5		(60,775.31)(0.05)(1)	3,038.77	60,775.31 + 3,038.77 = ₱63,814.08
6		(63,814.08)(0.05)(1)	3,190.70	63,814.08 + 3,190.70 = ₱67,004.78

Interest gained:

Compound interest: ₱67,004.78 – ₱50,000.00 = ₱17,004.78

What I Have Learned

1. Principal 2. Borrower 3. Money4. Constant 5. Compound interest

Lesson 2:

What's In

1. same/constant 2. Different 3. Smaller 4. Largers. Principal 6. Maturity value

What's More

A. 1 a.) 300 b.) 33.333.33 c.) 2.3%

2. I_s = 15,000 F = 45,000

What I Have Learned

1. I_s = Prt 2. $P = \frac{I_s}{rt}$ 3. $t = \frac{I_s}{Pr}$ 4. Maturity Value 5. $P = F(1+r)^{-t}$

What I can do

1. 8193.73 2. F = 88,572.33 I_c = 18,572.33

Additional Activity

A. a. 1,250 b. 1.08%

B. a. ₱2,040.57 b. ₱8,040.57 c. ₱27,715.36 d. ₱2,284.64

Assessment

1. B 2. A 3. B 4. A 5. D

6. B 7. C 8. C 9. A 10. D

Development Team of the Module

Writer: Joel C. Hagos, Master Teacher I (FHS)

Editors: Freddie D. Viernes, Public School District Supervisor

Olive R. Lomibao, Head Teacher III (SEHS)

Language Editor: Cyril P. Santos, Master Teacher I (SEHS)

Internal Reviewer: Dominador J. Villafria EPS-Mathematics

Freddie Viernes - PSDS

Cover Illustrator: Joel J. Estudillo, Teacher I (SNNHS)

Management Team:

Sheryll T. Gayola

Assistant Schools Division Superintendent

OIC, Office of the Schools Division Superintendent

Elisa O. Cerveza

Chief, CID

OIC, Office of the Assistant Schools Division Superintendent

Dominador J. Villafria

Education Program Supervisor-Mathematics

Ivy Coney A. Gamatero

Education Program Supervisor– LRMS

For inquiries or feedback, please write or call:

Schools Division Office- Marikina City

Email Address: sdo.marikina@deped.gov.ph

191 Shoe Ave., Sta. Elena, Marikina City, 1800, Philippines

Telefax: (02) 682-2472 / 682-3989