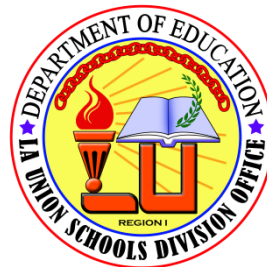


Senior High School



General Mathematics

Module 9:

Simple and Compound Interest



AIRs - LM

GENERAL MATHEMATICS

Module 9: Simple and Compound Interest
Second Edition, 2021

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Region I

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Senior High School

General Mathematics
Module 9:
Simple and Compound Interest



Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



Target

When using a property owned by another person, you sometimes need to pay an amount as a fee. For example, you pay rent for the use of a house. You also pay a toll for the use of a private road. The same is true for the use of money.

If you deposit a sum of money in a bank or if you borrow money from a lending institution, a fee is charged for the money deposited or borrowed. This fee is the rent for the use of another's money, find out as you go through this lesson.

How much do we pay for the use of money?

After going through this module, you are expected to:

1. illustrate simple and compound interests(**M11GM-IIa-1**),
2. distinguish between simple and compound interests(**M11GM-IIa-2**); and
3. compute interest, maturity value, future value, and present value in simple interest and compound interest environment(**M11GM-IIa-b-1**).

Learning Objectives:

1. define simple interest
2. define compound interest
3. define future and present value
4. differentiate simple and compound interest
5. determine the formula to be used in solving simple and compound interest
6. solve problems involving simple and compound interest

Before going on, check how much you know about this topic. Answer the pretest on the next page in a separate sheet of paper

Pretest

Directions: Read each item carefully. Write the letter of the correct answer.

1. What do you call a person or an institution who invests the money or the one who makes the funds available?
A. Borrower B. Creditor C. Debtor D. Pledger
2. Which is technically defined as the price for the privilege of borrowing money?
A. Interest B. Interest Rate C. Maturity value D. Profit
3. If the interest given in the borrowed amount is 5%, how do you express the percent interest to its decimal counterpart?
A. 0.005 B. 0.05 C. 0.5 D. 5.0
4. What is the value of 0.008 when expressed in percent?
A. 0.8% B. 1.8% C. 8% D. 80%
5. A ₱ 2,000,000 house loan was made by Mrs. Dela Cruz in the year 1999. If it has 10% annual interest and has to mature in 2019, how much would be the interest?
A. ₱ 2,000,000 B. ₱ 3,000,000
C. ₱ 4,000,000 D. ₱ 6,000,000
6. Which of the following refers to the standard mode of return for real-world investment?
A. Compound interest B. Maturity Rate
C. Investment Return D. Simple Interest
7. Which of the following formulas represents the maturity value within given time in years?
A. $F = P(1 + r)^t$ B. $F = P(1 + rt)$
C. $F = P(1 + r)^t - P$ D. $F = P(1 + t)^r$
8. In the equation $I = Prt$, what does r represent?
A. Interest rate B. Principal Interest Ratio
C. Maturity value D. Company satisfactory rating
9. If ₱ 10,000 is invested in a savings account that earns 5% annual simple interest for 10 years, what are the values of P , r , and t ?
A. $P = ₱ 10,000$, $r = 0.05$, $t = 10$ B. $P = ₱ 10,000$, $r = 5$, $t = 10$
C. $P = ₱ 10,000$, $r = 0.5$, $t = 10$ D. $P = ₱ 10,000$, $r = 0.05$, $t = 3650$
10. What is being asked in the problem “In order to have ₱ 130,000 in 2 years, how much should you invest if the annual simple interest is 4.5%?”
A. Interest B. Maturity value
C. Interest rate D. Principal

11. A friend asks to borrow ₱ 3,000 and agrees to repay it in 1 year with 3% interest. How much interest will you earn?
 A. ₱ 9 B. ₱ 19 C. ₱ 29 D. ₱ 90
12. Anthony borrowed ₱150,000 from a lending company where he needs to pay an interest rate of 3% compounded annually in 3 years. Find the maturity value of the loan.
 A. ₱ 159,990.05 B. ₱ 163,909.05 C. ₱ 179,900.05 D. ₱ 199,000.05
13. Maria wanted to invest her ₱ 100,000 to earn more money. A bank offers 6% simple interest rate per year while the cooperative group offers same rate compounded annually. Which will you recommend?
 A. Bank B. Cooperative C. Both D. None
14. Suppose your father deposited in your bank account ₱ 100,000 at an annual interest rate of 0.375% compounded yearly when you graduate from kindergarten and did not get the amount until you finish grade 12. How much will you have in the bank account after 12 years?
 A. ₱ 104 500.00 B. ₱ 104 593. 98
 C. ₱ 105,500.00 D. ₱ 110,500.00

15. Complete the table by finding the unknown (I_c , F).

Principal(P)	rate(r)	time(t)	I_c (compound interest)	Future value(F)
10 000	8%	15		

- A. ₱ 12,000, ₱ 22,000 B. ₱ 21,721.69, ₱ 31,721.69
 C. ₱ 22,000, ₱ 12,000 D. ₱ 31,721.69, ₱ 21,721.69



Jumpstart

*For you to understand the lesson well, do the following activities.
Have fun and good luck!*

Activity 1: Convert, convert!

A. Express each percent to decimal. Write your answer in a separate sheet of paper.

1. 0.3%
2. 12%
3. $8\frac{1}{2}\%$
4. 10.5%
5. 40%

B. Answer the following questions:

1. What percent of 24 is 12?
2. What is 25% of 108?
3. What is 3.5 % of 100 000?
4. 48 is what percent of 60?
5. 30 is 40% of what number?

Activity 2: Analyze Me!

Directions: Analyze the two tables given. Answer the questions below.

Time in years (t)	Principal (P)	Interest Rate (r)	Interest (I)	Amount after t years Maturity/ Future Value (F)
1	5000	5 %	250	5 250
2	5000	5 %	500	5 500
3	5000	5 %	750	5 750
4	5000	5 %	1 000	6 000
5	5000	5 %	1 250	6 250

Table 1

Time in years (t)	Principal (P)	Interest Rate (r)	Interest (I)	Amount after t years Maturity/ Future Value (F)
1	5000	5 %	250	5 250
2	5 250	5 %	262.5	5 512.5
3	5 512.5	5 %	275.63	5 788.13
4	5 788.13	5 %	289.41	6 077.54
5	6 077.53	5 %	303.88	6 381.41

Table 2

Directions: Read each item carefully. Write the letter of the correct answer.

1. Which of the following statements is NOT true about the two tables?
 - A. Both tables show the same value.
 - B. The future value of table 2 in second to fifth year is higher than in table 1.
 - C. Both tables have the same value in the first year but not in the proceeding years.
 - D. The principal amount in table 1 is the same in first to fifth year while the principal amount in table 2 is accumulated.

2. Considering the variables used in the table, which formula is applicable for table 1 in getting the interest?
 A. $I = Prt$ B. $I = P(1 + r)^t$ C. $I = \frac{P}{rt}$ D. $I = \frac{r}{Pt}$
3. Considering the variables used in the table, which formula is applicable for table 2 in getting the interest?
 A. $I = Prt$ B. $I = P(1 + r)^t$ C. $I = F - P$ D. $I = \frac{r}{Pt}$
4. Which table do you think shows simple interest?
 A. Table 1 B. Table 2 C. Both D. None
5. Which table do you think shows compound interest?
 A. Table 1 B. Table 2 C. Both D. None



Discover

Interest is the amount paid or earned for the use of money. An amount of money that is borrowed for a period of time is called **loan**. A person or institution who invests the money or makes the funds available is called **lender** or **creditor** while the person or institution who owes or avails the fund from the lender is called **borrower** or **debtor**.

Let's familiarize ourselves with other terms and variables that we will encounter as we go on with our lesson.

Principal or present value (P) is an amount of money borrowed or invested on the origin date.

Origin or loan date is the date on which money is received by the borrower.

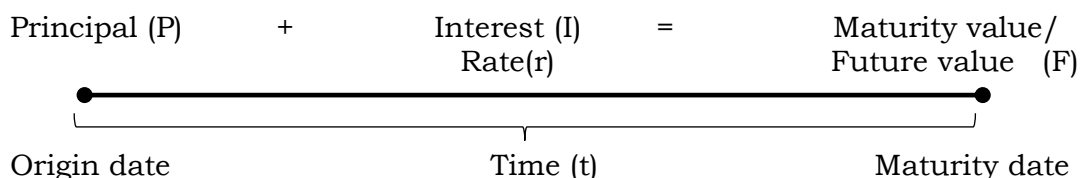
Repayment date or maturity date is the date on which the money borrowed or loan is to be completely repaid.

Time or term (t) is the length of time between the origin and maturity dates

Rate (r) is annual rate usually in percent, charged by the lender.

Maturity value or future value (F) is the amount after t years that the lender receives from the borrower on the maturity date.

To understand more about the terms let's consider the diagram below:



Note: Rate is the charged amount for the use of money over a certain period usually in percent.

Interest has two types, simple interest and compound interest. **Simple interest** is an interest that is computed on the principal and then added to it while **compound interest** is an interest on the principal amount and also on the accumulated past interest. Let's consider below example as simple interest and compound interest is being illustrated.

Example: Suppose you won Php 5 000 and you plan you invest it for 5 years. A cooperative group offers 5 % simple interest rate per year. A bank offers 5 % compounded annually. Which will you choose and why?

Solution:

Investment 1: **Simple Interest**

Time in years (t)	Principal (P)	Interest Rate (r)	Simple Interest		Amount after t years Maturity/ Future Value (F)
			Solution	Interest (I)	
1	5000	5 %	$5\,000(0.05) (1)$	250	$5\,000 + 250 = 5\,250$
2	5000	5 %	$5\,000(0.05) (2)$	500	$5\,000 + 500 = 5\,500$
3	5000	5 %	$5\,000(0.05) (3)$	750	$5\,000 + 750 = 5\,750$
4	5000	5 %	$5\,000(0.05) (4)$	1 000	$5\,000 + 1\,000 = 6\,000$
5	5000	5 %	$5\,000(0.05) (5)$	1 250	$5\,000 + 1\,250 = 6\,250$

Investment 2: **Compound Interest** (Annual)

Time in years (t)	Principal (P)	Interest Rate (r)	Compound Interest		Amount after t years Maturity/ Future Value (F)
			Solution	Answer	
1	5000	5 %	$5\,000 (0.05) (1)$	250	$5000 + 250 = 5\,250$
2	5 250	5 %	$5\,250 (0.05) (1)$	262.5	$5250 + 262.5 = 5\,512.5$
3	5 512.5	5 %	$5\,512.5(0.05) (1)$	275.63	$5512.5 + 275.63 = 5\,788.13$
4	5 788.13	5 %	$5\,788.13(0.05) (1)$	289.41	$5788.13 + 289.41 = 6\,077.54$
5	6 077.53	5 %	$6\,077.53(0.05) (1)$	303.88	$6077.53 + 303.88 = 6\,381.41$

Simple interest remains constant throughout the investment term. In compound interest, the interest from the previous year earns interest. Thus, the interest grows every year.

While both types of interest will grow your money over time, there is a big difference between the two. Specifically, simple interest is only paid on principal, while compound interest is paid on the principal plus all of the interest that has previously been earned.

As an investor or depositor, you definitely want to earn compound interest, as it adds up greater over time.

In the real world, simple interest is rarely used. When you deposit money into an interest-bearing account, or take out a line of credit, the interest that accumulates is added to the principal, and the next interest calculation is done on both the principal and the interest.

To understand more about simple and compound interest let's consider the following information.

Problems related to **simple interest** may require solving for any of the variables involved: interest, principal, rate, or time or the number of periods.

I represent the interest, **P** is the principal, **r** is the rate, and **t** is the time.

The triangle below will help you derive the formula use to solve for the principal, rate, time, or interest. You simply cover the variable representing what is needed, and the remaining variables give you a clue to form the formula needed to solve for the unknown.

(**Note:** The operations involve are multiplication and division. Multiplication for the variables found in the same level and division for the variables found in upper and lower part of the triangle).



So, if interest or I is unknown, then the formula to be used is $I = Prt$. If the principal or P is unknown, then the formula to be used is $P = \frac{I}{rt}$. If the rate or r is unknown, then the formula to be used is $r = \frac{I}{Pt}$. And if time or t is unknown, then the formula to be used is $t = \frac{I}{Pr}$.

So, here are the steps in solving problems related to simple interest.

Step 1: Identify what is asked.

Step 2: Identify what are given.

Step 3: Identify which formula to be used.

Step 4: Substitute the given values to the formula.

Step 5: Solve the problem.

Example 1: A bank offers 0.25% 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 1 year?

Given: $P = \text{₱ } 1,000,000$

$r = 0.25\% = 0.0025$

$t = 1$

Find: Simple Interest (I_s)

Solution: $I_s = Prt$

$I_s = (1,000,000) (0.0025) (1)$

$I_s = 2,500$

Answer: The interest earned is **₱ 2,500**

Example 2: When invested at an annual interest rate of 7.5%, the amount earned ₱ 15,400 of simple interest in two years. How much money was originally invested?

Given: $I = ₱15,400$

$$r = 7.5\% = 0.075$$

$$t = 2$$

Find: Principal(P)

Solution: $P = \frac{I}{rt}$

$$P = \frac{15,400}{(0.075)(2)}$$

$$P = 102,666.67$$

Answer: The amount invested is **₱ 102, 666.67**

Suppose the problem asks the maturity or future value. How will you solve it? **Maturity value** or **amount** refers to the sum of the principal and interest. It is the **future value** of the principal amount expressed given the formula:

$$F = P + I_s$$

where: F is the maturity value or future value

P is the principal

I is the simple interest.

By expanding the basic simple interest formula, the maturity value may be computed using the following alternative formula:

$$F = P + I_s \quad \text{Definition of maturity value}$$

$$F = P + (Prt) \quad \text{Substitution of } I = Prt$$

$$F = P(1 + rt) \quad \text{Distributive property}$$

Example 3: Anthony borrowed ₱150 000 from a lending company where he needs to pay an interest rate of 3% annually. Find the a.) simple interest for 2 years. b.) maturity value of the loan.

a. Given: $P = ₱150\,000$

$$r = 3\% = 0.03$$

$$t = 2 \text{ years}$$

Find: Interest (I_s)

Solution: $I_s = Prt$

$$I_s = (150\,000) (0.03) (2)$$

$$I_s = 9000$$

Therefore, the simple interest after two years is **₱ 9,000.00**

b. **Given:** $P = ₱150\,000$

$$r = 3\% = 0.03$$

$$t = 2 \text{ years}$$

Find: Maturity value of the loan (F)

Solution:

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

$$\text{or} \quad F = P + I$$

$$F = 150\,000[1+(0.03) (2)]$$

$$F = 150\,000 + 9000$$

$$F = 159\,000$$

$$F = 159\,000$$

Therefore, the maturity value of the loan after two years is **₱159,000.00**

TIPS: Do not be confused between interest and maturity value. Interest is the product of the principal, the rate, and the time. Maturity value is the sum of the present value and the interest.

Now, let's proceed to compound interest. **Compound interest** is calculated as the difference between the compound amount and the original or principal amount. It is calculated as:

$$I_c = F - P$$

where: F is the maturity value or future value

P is the principal or present value

I_c is the compound interest.

If the maturity/future value is unknown, we use the formula:

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

but if the present value is unknown, we use the formula:

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

where: F is the maturity value or future value

P is the principal or present value

r is the interest rate

t is the term in years

Example 4: If ₱ 20,000 is deposited in a savings account at an annual rate of 5%, what will be the amount in the account at the end of 3 years if the interest is compounded annually?

Given: $P = ₱ 20,000$

$$r = 5\% = 0.05$$

$$t = 3$$

Find: Maturity value (F)

Solution:

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

$$F = 20000(1+0.05)^3$$

$$F = 20000(1.05)^3$$

$$F = 20000(1.1576)$$

$$F = 23,152.00$$

Answer: The amount after 3 years if the interest is compounded annually is **₱ 23,152.00**; therefore, the compound interest earned is ₱ 3,152.00

Example 5: Find the maturity value and the compound interest if ₱ 20, 500 is compounded annually at an interest rate of 3% in 7 years.

Given: $P = ₱ 20,500$

$$r = 3\% = 0.03$$

$$t = 7$$

Find: a. Maturity value (F)

b. Compound interest (I_c)

Solution:

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

$$F = 20\,500(1+0.03)^7$$

$$F = 20\,500(1.03)^7$$

$$F = 20\,500(1.2299)$$

$$F = 25\,212.95$$

(b) $I_c = F - P$

$$I_c = 25\,212.95 - 20\,500$$

$$I_c = 4\,712.95$$

Answer: The maturity value is **₱ 25 212.95** and the compound interest is **₱ 4 712.95**.

Example 6: What amount must be deposited by a student in the bank that pays 2% compounded annually so that after 12 years he will have ₱ 100 000?

Given: $F = ₱ 100\,000$

$$r = 2\% = 0.02$$

$$t = 12$$

Find: Present value or Principal (P)

Solution:

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

$$P = \frac{100\,000}{(1+0.02)^{12}}$$

$$P = \frac{100000}{1.2682}$$

$$P = 78\,851.92$$

Answer: The student must deposit **₱ 78 851.92** to have an amount of ₱100 000 after 12 years.



Explore

Activity 1: Which is which?

Directions: Use an arrow in connecting the statement/statements to which they belong. Connect the dot to the arrowhead using lines.

Simple Interest is dependent on: •	<ul style="list-style-type: none"> ➤ Accrual is linear ➤ Accrual is exponential ➤ Interest earns interest ➤ Principal ➤ Principal remains the same at the beginning of all the periods
Compound Interest is dependent on: •	<ul style="list-style-type: none"> ➤ Principal increases by the interest amount at the end of each period ➤ Rate of Interest ➤ Time Period

Activity 2: Compare and Contrast

Directions: Study the given table, note the differences and similarities you can have as you compare them if 0.4% is the rate used for an amount of ₱ 30,000 invested for 8 years. You can write on additional sheet of paper if space is not enough.

Simple Interest			Compound Interest		
Year	Principal	Interest	Year	Principal	Interest
1	30,000	120	1	30,000	120
2	30,000	120	2	30,120	120.48
3	30,000	120	3	30,240.48	120.96
4	30,000	120	4	30,361.44	121.45
5	30,000	120	5	30,482.89	121.93
6	30,000	120	6	30,604.82	122.42
7	30,000	120	7	30,727.24	122.91
8	30,000	120	8	30,860.15	123.40
Total		960	Total		973.55

Similarities: _____

Differences: _____

Activity 3: Test Your Knowledge

Directions: Answer the following problems on simple and compound interest by following the step by step procedure as shown in the examples.

1. Find the simple interest on a loan of ₱ 95,000 if the loan is given at a rate of 15% and is due in 3 years.
2. Find the future value and the compound interest if ₱ 50,000 is compounded annually at an interest rate of 2 % in 5 years
3. Peter borrowed ₱ 100,000 at 8% compounded annually. How much will he be paying after 2 years?
4. The simple interest of an investment is ₱ 4,500. Find the present value if the interest rate is 5% annually for 5 years
5. Lorna will receive ₱ 21,500 from her investment after 10 years at 12% compounded annually. Find the present value.



Deepen

Now that you can identify simple interest and compound interest, you are ready to perform the next activity.

Show Me your Interest: Ask the help of a family member or a neighbor who experience borrowing or investing any amount which earns or yields an interest. Borrow and photocopy any proof or documents showing their cases. Paste the photocopy in the box below. Make an explanation regarding the document to identify if it is a simple interest case or compound interest case.

Rubrics for scoring the output

Evaluation Method	3 points	2 points	1 point	Score
Picture Focus	Students demonstrate full understanding of the picture	Students demonstrate partial understanding of the picture	Students demonstrate unclear and inaccurate understanding of the picture	
Text Focus	Students provide a complete and accurate description of the key subject matter and elements seen in the photocopy.	Students provide a partial but mostly accurate description of the key subject matter and elements seen in the photocopy.	Students provide an incomplete, unclear and inaccurate description of the key subject matter and elements seen in the photocopy.	
TOTAL POINTS				



Gauge

Directions: Read each item carefully. Write the letter of the correct answer in a separate sheet of paper.

- Which is the difference between simple and compound interest?
 - Simple interest yields a lot money
 - Simple interest is easier to compute
 - Compound interest keeps computing interest
 - Simple interest is interest computed on the original principal only
- Which is the difference between simple and compound interest?
 - Bank always use simple interest
 - Compound interest will yield more money
 - Bank uses compound interest when the money invested is substantial
 - Simple interest will yield less money, but the computation is easier with compound interest
- How much is the simple interest if you invest 1000 pesos for 3 years and get 10% interest?
 - ₱ 200
 - ₱ 300
 - ₱ 350
 - ₱ 400
- How much is the compound interest if you invest 1000 pesos for 3 years and get 10% interest compounded at the end of each year?
 - ₱ 249
 - ₱ 331
 - ₱ 449
 - ₱ 559
- Which of the following is TRUE about the interest under compound interest? Interest earned yearly is _____.
 - constant
 - falling
 - rising
 - unpredictable
- Which of the following functions is used to solve for the maturity value under compound interest?
 - $F = P(1 + r)^t$
 - $F = P(1 + rt)$
 - $F = P(1 + r)^t - P$
 - $F = P(1 + t)^r$
- Which of the following equation will solve the problem below?

How much money would you need to deposit today at 9% compounded annually to have ₱12,000 in the account after 5 years?

 - $P = \frac{12000}{(1+0.09)^{(5)}}$
 - $P = 12000(1 + 0.09)^{(5)} - 12000$
 - $P = 12000(1 + 0.09)^{(5)}$
 - $P = \frac{12000}{(1+0.09)^{(5)}} - 1$
- In the equation $I = Prt$, what does r represent?
 - Interest rate
 - Principal Interest Ratio
 - Maturity value
 - Company satisfactory rating
- If ₱10,000 is invested in a savings account that earns 5% annual simple interest for 10 years, what are the values of P , r , and t ?
 - $P = ₱10,000$ $r = 0.05$ $t = 10$
 - $P = ₱10,000$ $r = 5$ $t = 10$
 - $P = ₱10,000$ $r = 0.5$ $t = 10$
 - $P = ₱10,000$ $r = 0.05$ $t = 3650$

10. What is being asked in the following problem? In order to have ₱130,000 in 2 years, how much should you invest if the annual simple interest is 4.5%?
- A. Interest
B. Maturity value
C. Interest rate
D. Principal
11. A friend asks to borrow ₱ 3,000 and agrees to repay it in 1 year with 3% interest. How much interest will you earn?
- A. ₱ 9
B. ₱ 19
C. ₱ 29
D. ₱ 90
12. Anthony borrowed ₱150,000 from a lending company where he needs to pay an interest rate of 3% compounded annually in 3 years. Find the maturity value of the loan.
- A. ₱ 159,990
B. ₱ 163,909
C. ₱179,900
D. ₱199,000
13. Maria wanted to invest her ₱ 100,000 to earn more money. A bank offers 6% simple interest rate per year while the cooperative group offers same rate compounded annually. Which will you recommend?
- A. Bank
B. Cooperative
C. Both
D. None
14. Suppose your father deposited in your bank account ₱ 100,000 at an annual interest rate of 0.375% compounded yearly when you graduate from kindergarten and did not get the amount until you finish grade 12. How much will you have in the bank account after 12 years?
- A. ₱ 104,500.00
B. ₱ 104,593. 98
C. ₱ 105,500.00
D. ₱ 110,500.00

15. Complete the table by finding the unknown (I_c , F).

Principal(P)	rate(r)	time(t)	I_c (compound interest)	Future value(F)
10 000	8%	15		

- A. ₱ 12,000, ₱ 22,000
B. ₱ 21,721.69, ₱ 31,721.69
C. ₱ 22,000, ₱ 12,000
D. ₱ 31,721.69, ₱ 21,721.69

Great job! You made it. Congratulations!

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