

LEARNING ACTIVITY SHEETS

General Mathematics

S.Y. 2021 – 2022 1st Semester

2nd Quarter Week 1 & 2

Learning Competencies

- The learner...
- M11GM-IIa-1.** illustrates simple and compound interests.
 - M11GM-IIa-2.** distinguishes between simple and compound interests.
 - M11GM-IIa-b-1.** computes interest, maturity value, future value, and present value in simple interest and compound interest environment.
 - M11GM-IIb-2.** solves problems involving simple and compound interests.

SIMPLE INTEREST

Definition of Terms

- Simple Interest (I_s)** – interest that is computed on the principal. The interest remains constant throughout the term.
- Lender or creditor** – person (or institution) who invests the money or makes the funds available.
- Borrower or debtor** – person (or institution) who owes the money or avails of the funds from the lender
- Origin or loan date** – date on which money is received by the borrower.
- Repayment date or 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 the 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 of increase of the investment
- Interest (I)** – amount paid or earned for the use of money.
- Maturity value or future value (F)** –amount after t years that the lender receives from the borrower on the maturity date.

Example

Problem Solving

A working student in one of the biggest fast-food restaurants in Lucena City wants to save for the upcoming school year. He wants to deposit his money into a Filipino owned bank so that even in a simple way he can help his fellow Filipino. Supposed his monthly salary is ₱10,000.00 and it was deposited to an account that earns a simple interest of 2.75% per annum. Find the simple interest after 6 months, one year, and 18 months.

You can solve this problem using the simple interest formula

$$I_s = Prt$$

- where:
- I_s = Simple Interest
 - P = Principal or amount invested or borrowed
 - r = simple interest rate
 - t = term of time in years
- Here are the steps to find the simple interest:

Step 1: Identify the given and the unknown $P = ₱10,000.00$ $r = 2.75\%$ or 0.0275 $t_1 = 0.5$ (6 months) $t_2 = 1$ (1 year) $t_3 = 1.5$ (18 months) $I_s = ?$	Step 2: Substitute the given to the formula. $I_s = Prt$ For 6 months $I_s = (₱10,000.00)(0.0275)(0.5) = ₱137.50$ For 1 year $I_s = (₱10,000.00)(0.0275)(1) = ₱275.00$ For 18 months $I_s = (₱10,000.00) (0.0275) (1.5) = ₱412.50$
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The formula can be manipulated to obtain the following relationships:

The formula for the principal amount

$$P = \frac{I_s}{rt}$$

The formula for rate

$$r = \frac{I_s}{Pt}$$

The formula for time

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

To find the maturity (future) value, you can use either of the following:

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

or

$$F = P + I_s$$

- where:
- F = maturity (future) value
 - I_s = simple interest
 - P = principal or the amount invested or borrowed or present value
 - r = simple interest rate
 - t = time or term in years

Example

1. Given: $P = ₱20,000$, $I_s = ₱4,000$, $t = 4$. Find the rate (r).

$$r = \frac{I_s}{Pt} = \frac{4000}{20000(4)} = 0.05 \text{ or } 5\%$$
2. Given: $P = ₱40,000$, $I_s = ₱700$, $r = 7\%$. Find t .

$$t = \frac{I_s}{Pr} = \frac{700}{40000(0.07)} = 0.25 = \frac{1}{4} \text{ year or } 3 \text{ mos.}$$

3. Given: $P = ₱15,000$, $t = 4 \text{ mos.}$, $r = 2\%$. Find the maturity value F .

$$F = P + Prt$$
$$F = 15000 + (15000) \left(\frac{4}{12} \right) (0.02)$$
$$F = 15000 + 100$$
$$F = 15100$$

Thus, the maturity value is ₱15,100.

COMPOUND INTEREST

Compound interest (I_c) is the interest computed on the principal and also on the accumulated past interest.

To find the compound interest, which is compounded annually the formula to find the maturity value is: $F = P(1 + r)^t$ where: F = maturity (future) value P = principal or present value r = interest rate t = term or time in years	To find the compound interest use the formula $I_c = F - P$ where: I_c = compound interest P = principal or present value F = maturity (future) value
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To find the present value or principal of the maturity value F due in t years the formulas are:

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

 or

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

Example

1. Given: $P = ₱18,500$, $r = 3\%$ and compounded annually for 3 years, find the maturity value (F) and the compound interest (I_c).

$F = P(1 + r)^t$
 $F = 18500(1 + 0.03)^3$
 $F = ₱20215.45$

$I_c = F - P$
 $I_c = 20215.45 - 18500$
 $I_c = 1715.45$

2. Given $F = ₱15,000$, $r = 2\%$ compounded annually for 4 years, find the present value (P).

$$P = \frac{F}{(1 + r)^t}$$
$$P = \frac{15000}{(1 + 0.02)^4}$$
$$P = ₱13,857.68$$

Therefore, the present value is ₱13,857.68

Compounding More Than Once a Year

In the examples above the interest are compounded annually, however, there are cases that interest is compounded more than once a year so in this case additional terms must be clarified such as:

Frequency of conversion (m) - number of conversion period in one year

Conversion or interest period – time between successive conversions of interest

Total number of conversion periods (n)

$$n = mt = (frequency\ of\ conversion)(time\ in\ years)$$

Nominal rate ($i^{(m)}$) - annual rate of interest or interest rate per year

Rate (j) of interest for each conversion period

$$j = \frac{i^{(m)}}{m} = \frac{annual\ rate\ of\ interest}{frequency\ of\ conversion}$$

Study the table below.

Situations	m	N	i^m	j
2% compounded annually for 3 years	Annually m = 1	m = 1, t = 3 n = (1)(3)=3	$i^1 = 0.02$	$j = \frac{i^m}{m}$ $j = \frac{0.02}{1} = 0.02$
2% compounded semi – annually for 3 years	Semi – annually m = 2	m = 2, t = 3 n = (2)(3)=6	$i^2 = 0.02$	$j = \frac{0.02}{2} = 0.01$
2% compounded quarterly for 3 years	Quarterly m = 4	m = 4, t = 3 n =(4) (3)=12	$i^4 = 0.02$	$j = \frac{0.02}{4} = 0.005$
2% compounded monthly for 3 years	Monthly m = 12	m = 12, t = 3 n = (12)(3) = 36	$i^{12} = 0.02$	$j = \frac{0.02}{12}$ $= 0.001\bar{6}$
2% compounded daily for 3 years	Daily m = 365	m = 365, t = 3 n = (365)(3) =1095	$i^{365} = 0.02$	$j = \frac{0.02}{365}$

Since the rate for each conversion period is represented by j, then in t years, interest is compounded mt times. Thus, the formula of Maturity Value for interest compounding m times a year is: $F = P(1 + j)^n$ where: $F = \text{maturity value}$ $P = \text{present value}$ $j = \frac{i^{(m)}}{m}$ $n = mt$	Meanwhile, the formula in finding the present value given the maturity value is: $P = \frac{F}{(1 + j)^n}$
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Example

1. Find the compound interest and maturity value if $P = \text{₱}43,000$, with a rate of 5% is compounded semi-annually for 6 years.

$m = 2$
 $n = tm = 6 \cdot 2 = 12$
 $j = \frac{i^{(m)}}{m} = \frac{0.05}{2} = 0.025$

$F = P(1 + j)^n$
 $F = 43000(1 + 0.025)^{12}$
 $F = \text{₱}57830.22$

$I_c = F - P$
 $I_c = 57830.22 - 43000$
 $I_c = \text{₱}14830.22$

Hence, the compound interest and maturity value are $\text{₱}14830.22$ and $\text{₱}57830.22$ respectively.

2. Find the compound interest and present value if $F = \text{₱}105,000$ with a rate of 2.5% is compounded quarterly for 3 years.

$m = 4$
 $n = tm = 3 \cdot 4 = 12$
 $j = \frac{i^{(m)}}{m} = \frac{0.025}{4} = 0.00625$

$P = \frac{F}{(1 + j)^n}$
 $P = \frac{105,000}{(1 + 0.00625)^{12}}$
 $P = \text{₱}97,435.81$

$I_c = F - P$
 $I_c = 105,000 - 97,435.81$
 $I_c = \text{₱}7,564.19$

Hence, the compound interest and present value are $\text{₱}7,564.19$ and $\text{₱}97,435.81$ respectively.

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Exercise (Note: Show your solution.)

Part 1

Complete the table.

A.

Principal	Rate	Time	Interest	Maturity Value
₱60,000	4%	3.5 years		
	2.2%	5 years	₱345	
₱125,000	2%			₱135,000

B.

Present Value	Nominal rate (i ^(m))	Interest compounded	Interest per conversion period (j)	Time in years	Total number of conversions (n)	Compound Interest	Maturity Value
₱80,000	2.1%	quarterly		4			
	2%	monthly		6			₱70,000

Part 2

Solve the ff. problems

1. Marinel received ₱ 1,450,500.00 as her inheritance from her parents. She deposited the said amount in a time deposit with 1% simple interest rate per annum, how much money will be accumulated after 7 years?
2. Jenny is planning to deposit ₱17,000.00 Quezon Metropolitan Bank is offering 7.5% compounded semi-annually for 5 years while Quezon Premier Bank is offering 7% compounded monthly for 5 years. Which bank should she deposit her money? Justify your answer by computing and comparing the maturity value for each bank.