

# GENERAL MATHEMATICS 11

Name of Learner: \_\_\_\_\_

Grade Level: \_\_\_\_\_

Section: \_\_\_\_\_

Score: \_\_\_\_\_

## LEARNING ACTIVITY SHEET SIMPLE AND COMPOUND INTEREST

### Background Information for Learners

In this activity sheet, you examine and compare the simple and compound methods of calculating interest. This will also help you decide on what investment will pay you most over time or will give you low interest as much as possible when you borrow money.

#### Simple Interest

$$I_s = Prt$$

where,

$I_s$  = simple interest

$P$  = principal

$r$  = rate

$t$  = term or time, in years

#### Maturity (Future) Value

$$F = P + I_s \quad \text{or} \quad F = P(1 + rt)$$

where,

$P$  = maturity (future) value

$I_s$  = simple interest

$r$  = rate

$t$  = term or time, in years

**Example 1.** Find the interest and maturity value if Sara deposits ₱20,000 at a bank for 3 year at an interest rate of 4% per year.

$$\begin{aligned} I_s &= Prt \\ &= (20,000)(0.04)(3) \\ I_s &= 2,400 \end{aligned}$$

$$\begin{aligned}
 F &= P + I_s & \text{or} & \quad F = P(1 + rt) \\
 &= (20,000) + (2,400) & & \quad = (20,000)[(1 + (.04)(3))] \\
 F &= 22,400 & & \quad F = 22,400
 \end{aligned}$$

Thus, after 3 years, the ₱20,000 deposited in the bank will earn an interest of ₱2,400, therefore, the money will grow to ₱22,400.

### 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 or time, in years

### Compound Interest

$$I_c = F - P$$

where,

*P* = Principal or present value  
*F* = maturity (future) value at the end of the term

**Example 2.** Find the maturity value and compound interest if ₱30,000 is invested at 3% compounded annually for 6 years.

$$\begin{aligned}
 F &= P(1 + r)^t \\
 &= 30,000(1 + 0.03)^6 \\
 F &= 35,821.57
 \end{aligned}$$

$$\begin{aligned}
 I_c &= F - P \\
 &= 35,821.57 - 30,000 \\
 I_c &= 5,821.57
 \end{aligned}$$

Thus, ₱30,000 invested at 3% compounded annually for 6 years will earn an interest of ₱5,821.57. Therefore, the money will grow to ₱35,821.57.

### Present Value $P$ at Compound Interest

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

where,

$P$  = Principal or present value

$F$  = maturity (future) value at the end of the term

$r$  = interest rate

$t$  = term or time, in years

**Example 3.** Find the present value of ₱70,000 due in 5 years at 10% compounded annually?

$$\begin{aligned} P &= \frac{F}{(1+r)^t} \\ &= \frac{70,000}{(1+0.10)^5} \\ &= 43,464.49 \end{aligned}$$

Therefore, an amount of ₱43,464.49 was originally invested to earn ₱70,000 in 5 years at 10% compounded annually.

### Maturity Value, Compounding $m$ times a year

$$F = P(1+j)^n$$

where,

$F$  = maturity (future) value

$P$  = principal

$j$  = interest rate per conversion period

$t$  = number of times interest is compounded

$$\begin{aligned} \text{Note: } j &= \frac{(i)^m}{m}; & (i)^m &= \text{nominal interest rate (annual rate)} \\ & & m &= \text{frequency of conversion} \\ n &= mt; & t &= \text{time/term in years} \end{aligned}$$

**Example 4.** Find the maturity value and interest if ₱15,000 is deposited in the bank at 3% compounded quarterly for 5 years.

$$\begin{aligned} F &= P(1+j)^n & j &= \frac{.03}{4} = 0.0075; & n &= mt = 4(5) = 20 \\ &= 15,000(1 + .0075)^{20} \\ &= 17,417.762 \end{aligned}$$

$$\begin{aligned}
 I &= F - P \\
 &= 17,417.762 - 15,000 \\
 &= 2,417.762
 \end{aligned}$$

Hence, ₱15,000 deposited in the bank at 3% compounded quarterly for 5 years will grow to ₱17,417.762. Thus, the interest earned will be ₱2,417.762.

### Present Value P at Compound Interest

$$P = \frac{F}{(1 + j)^n}$$

where,

$F$  = maturity (future) value

$P$  = principal

$j$  = interest rate per conversion period

$t$  = number of times interest is compounded

Example 5.

Find the present value if ₱50,000 due in 5 years if money is invested at 9% compounded semi-annually.

$$\begin{aligned}
 P &= \frac{F}{(1+j)^n} & j &= \frac{.09}{2} = 0.045; & n &= mt = 2(5) = 10 \\
 &= \frac{50,000}{(1+0.045)^{10}} \\
 &= 32,196.38
 \end{aligned}$$

Therefore, an amount of ₱32,196.38 was invested at 9% compounded semi-annually due in 5 years.

### Learning Competency

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

### Exercise 1.

#### Simple Interest

Complete the table by finding the unknown. (2 points each)

<i>Principal (P)</i>	<i>Rate (r)</i>	<i>Time (t)</i>	<i>Interest (I)</i>	<i>Maturity Value (F)</i>
25,000	(1.)	5	10,000	35,000
(2.)	5%	2	9,000	(3.)
36,000	(4.)	6.5	7,020	43,020
40,000	4.5%	(5.)	9,000	49,000
(6.)	10%	8	120,000	(7.)
65,000	6%	3	(8)	(9.)
250,000	3.5%	(10.)	131,250	381,250

### Exercise 2.1.

#### Compound Interest

Complete the table by finding the unknown. (2 points each)

<i>Principal (P)</i>	<i>Rate (r)</i>	<i>Time (t)</i>	<i>Interest (I)</i>	<i>Maturity Value (F)</i>
10,000	9%	5	(1.)	(2.)
25,000	3%	4	(3.)	(4.)
85,000	3.5%	7	(5.)	(6.)
(7.)	5%	10	(8.)	200,000
(9.)	4.5%	15	(10.)	1,000,000

### Exercise 2.2.

Complete the table by finding the unknown. (2 points each)

Principal (P)	Nominal Rate (r)	Frequency of Conversion (m)	Interest rate per period	Time in Years (t)	Total number of conversions (n)	Compound Interest (I)	Compound Amount (F)
5,000	12%	12	(1.)	5	(2.)	(3.)	(4.)
(5.)	10%	6	2.5%	4	(6.)	(7.)	27,130.89
50,000	8%	2	(8.)	8	(9.)	(10.)	(11.)
(12.)	5%	365	(13.)	1	(14.)	(15.)	105,242.44

### Exercise 3.

Solve the following problems. (3 points each)

1. Ian is investing ₱14,000 for 2 years. The interest rate is 5%. How much interest will Ian earn after 2 years?

2. Michelle deposits ₱10,000 in an account that earns 8% simple interest. How long will it take for the total amount in her account to reach ₱12,000?
3. At what simple interest rate will ₱5,000 amount to ₱6,050 in 3 years?
4. Mark invested a certain amount at 5% simple interest per year. After 10 years, he received an interest of ₱50,000. How much did he invest?
5. Matt is saving for a new car. He invests ₱70,000 into an account that pays 3% interest compounded annually. How much will he have after 5 years?
6. Karla borrowed ₱80,000 in a bank at 8% compounded annually, how much will she pay after 3 years?
7. How much money would you need to deposit today at 15% annual interest compounded annually to have ₱1,500,000 in the account after 9 years?
8. Calculate the present value of ₱100,000 payable in 25 years at 2.4% interest compounded monthly.
9. In order to have ₱2,000,000 in the bank account after 20 years. How much would a person have to invest if the money will earn 8% interest compounded semi-annually?
10. Find the future value if ₱50,000 is deposited in a bank at 4% interest compounded quarterly in 1 year.

#### Exercise 4.

Solve the following problems completely. (5 points each)

1. Lorraine wants to lend ₱200,000 to Marie at the simple interest rate of 10% for 2 years and the same amount to James at 10% compounded annually for 2 years. Find the amount of money that Marie and James will return to Lorraine after 2 years to repay the loan. Who will pay more and by how much?
2. Calculate and compare the effective rates of interest for saving accounts paying:
  - (a.) a nominal rate of 3.65%; compounded quarterly
  - (b.) a nominal rate of 3.5%; compounded monthly
3. Rachel is planning to borrow ₱300,00 in a bank. Bank A is offering 4% compounded semi-annually while Bank B is offering 3.5% compounded monthly and Bank C is offering 5% compounded quarterly. If she plans to borrow the money for 4 years. Which bank should she borrow the money?
- 4.

#### Reflection

What meaningful lessons have you learned from this topic??

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#### Reference for Learners

Verzosa, D.B, et.al (2016). General Mathematics. Quezon City, Manila

## Answer Key

Exercise 1.

<i>Principal (P)</i>	<i>Rate (r)</i>	<i>Time (t)</i>	<i>Interest (I)</i>	<i>Maturity Value (F)</i>
25,000	<b>(1.) 8%</b>	5	10,000	35,000
<b>(2.) 90,000</b>	5%	2	9,000	<b>(3.) 99,000</b>
36,000	<b>(4.) 3%</b>	6.5	7,020	43,020
40,000	4.5%	<b>(5.) 5</b>	9,000	49,000
<b>(6.) 150,000</b>	10%	8	120,000	<b>(7.) 270,000</b>
65,000	6%	3	<b>(8.) 11,700</b>	<b>(9.) 76,700</b>
250,000	3.5%	<b>(10.) 15</b>	131,250	381,250

Exercise 2.1.

<i>Principal (P)</i>	<i>Rate (r)</i>	<i>Time (t)</i>	<i>Interest (I)</i>	<i>Maturity Value (F)</i>
10,000	9%	5	<b>(1.) 5,386.24</b>	<b>(2.) 15,386.24</b>
25,000	3%	4	<b>(3.) 3,137.72</b>	<b>(4.) 28,137.72</b>
85,000	3.5%	7	<b>(5.) 23,143.74</b>	<b>(6.) 108,143.74</b>
<b>(7.) 122,782.65</b>	5%	10	<b>(8.) 77,217.35</b>	200,000
<b>(9.) 516,720.44</b>	4.5%	15	<b>(10.) 483,279.56</b>	1,000,000

Exercise 2.2.

Principal (P)	Nominal Rate (r)	Frequency of Conversion (m)	Interest rate per period	Time in Years (t)	Total number of conversions (n)	Compound Interest (I)	Compound Amount (F)
5,000	12%	12	1%	5	60	4,083.48	9,083.48
15,000	10%	6	2.5%	4	24	12,130.89	27,130.89
50,000	8%	2	4%	8	16	43,649.06	93,649.06
100,000	5%	365	0.014%	1	365	5,242.44	105,242.44

Exercise 3.

- |                  |                  |
|------------------|------------------|
| 1. I= 1,400      | 6. P= 426,393.62 |
| 2. 2.5 years     | 7. P=87,753.34   |
| 3. 0.07 or 7%    | 8. P= 54,914.058 |
| 4. P=30,695.66   | 9. P= 416,578.09 |
| 5. P= 287,945.87 | 10. F=52,030.20  |

## Exercise 4

1. Marie (Simple Interest)

$$P = 200,000$$

$$r = 10\%$$

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

$$I = Prt$$

$$= (200,000)(.10)(2)$$

$$= 40,000$$

$$F = I + P$$

$$= 40,000 + 200,000$$

$$= 240,000$$

Therefore, Marie will repay ₱240,000 to Lorraine after 2 years.

James (Compound Interest)

$$P = 200,000$$

$$r = 10\%$$

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

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

$$= 200,000(1+.10)^2$$

$$= 242,000$$

Therefore, James will repay ₱242,000.

Now, ₱242,000 > ₱240,000, so James will pay more. He will pay 2,000 more than Marie.

2. (a.) 3.65% compounded quarterly

3. Future value

Bank A 4%; semi-annually	Bank B 3.5%; monthly	Bank C 4.5%; quarterly
₱351,497.81	₱345,011.83	₱358,804.44

Since Rachel will borrow the money, she should choose Bank B with the lowest interest after 4 years.