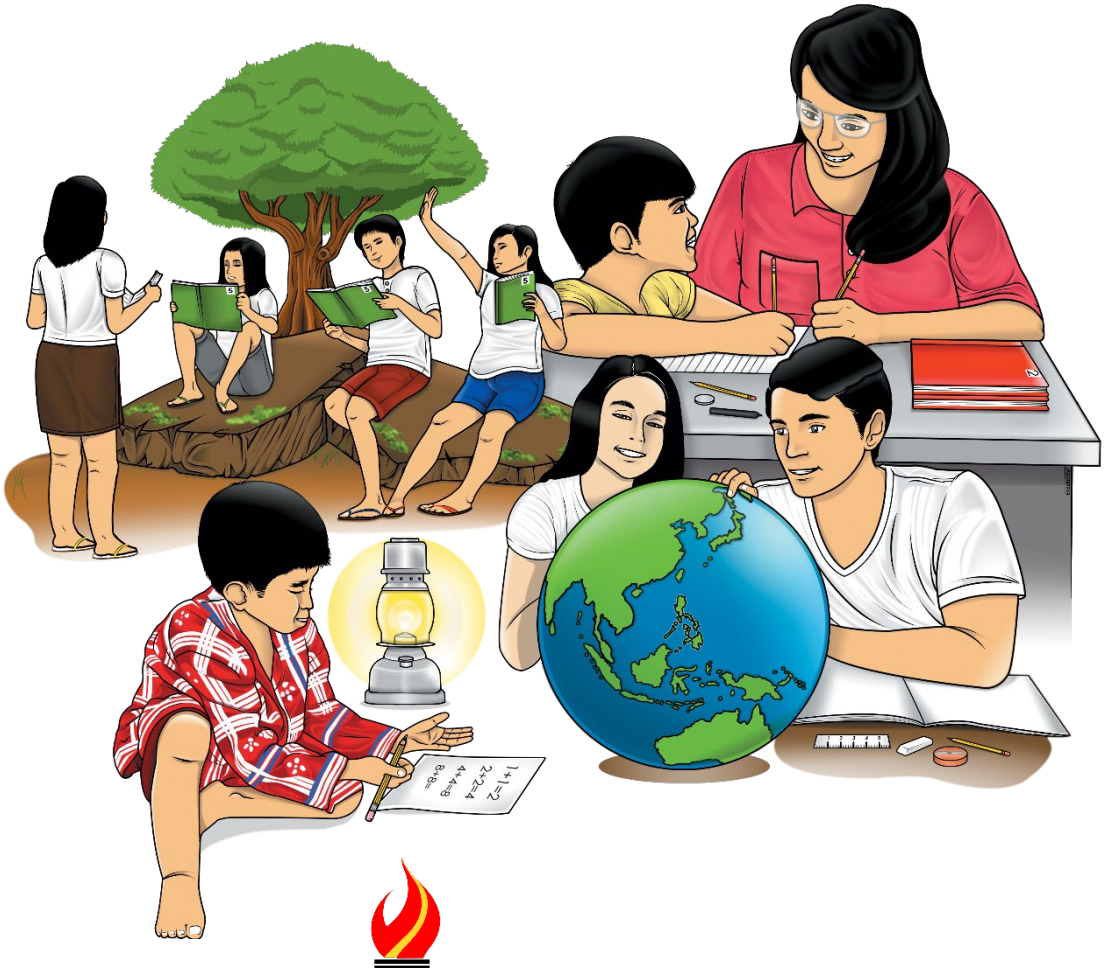
Senior High School

DepED
DEPARTMENT OF EDUCATION

General Mathematics

Quarter 2 – Module 5:
Future and Present Values of Simple and General Annuities



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Senior High School

General Mathematics

Quarter 2 – Module 5:
Future and Present Values of Simple and General Annuities

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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.

What I Need to Know

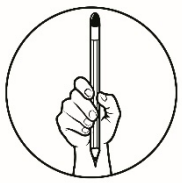
This module was designed and written with you in mind. It is here to help you compute the future and present value of simple and general annuities. The scope of this module permits it to be used in many different learning situations. This modules aims to help you on how to be practical specifically in spending for your needs whether be it in cash or in installment basis. It is important that you apply the skills you will learn here in real life situations. Good luck!

This module is composed of two lessons namely:

Lesson 1 - Future and Present Values of Simple Annuity
Lesson 2 - Future and Present Vlaues of General Annuity

After going through this module, you are expected to:

1. identify the given facts and choose the proper formula to be used in computing for the future and present value of simple and general annuities; and
2. compute the future value and present value of simple and general annuities.



What I Know

Let's find out how far you might already know about this topic! Please take this challenge! Have Fun!

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What do you call a sequence of payments made at equal time periods?
   a. Annuity
   b. Simple Interest
   c. Principal
   d. Compound Interest

2. What is a type of annuity where the payment interval is the same as the interest period?
   a. General Annuity
   b. Simple Annuity
   c. Simple Interest
   d. Compound Interest

3. What is the type of annuity in which the payment interval is not the same as the interest period?
   a. General Annuity
   b. Simple Annuity
   c. Simple Interest
   d. Compound Interest

4. What is equal to the down payment (if there is any) plus the present value of the installment payments?
   a. Downpayment
   b. Cash Price
   c. Markup
   d. Markdown

5. Installment payment for an appliance at the end of each month with interest compounded monthly is an example of what type of annuity?
   a. General Annuity
   b. Simple Annuity
   c. Ordinary Annuity
   d. Annuity Due

6. Installment payment for an appliance at the beginning of each month with interest compounded monthly is an example of what type of annuity?
    a. General Annuity
    b. Simple Annuity
    c. Ordinary Annuity
    d. Annuity Due

7. Which is NOT an example of Annuity?
    a. House and Lot payment
    b. Tuition Fee
    c. Life Insurance
    d. Installment basis of paying a car

8. What is the sum of present values of all the payments to be made during the entire term of the annuity?
    a. Present Value of an Annuity
    b. Future Value of an Annuity
    c. Periodic Payment
    d. Term of an Annuity

9. What is the time between the first payment interval and last payment interval?
    a. Periodic Payment
    b. Term of an Annuity
    c. Payment Interval
    d. Present Value of an Annuity

10. What is the amount of each payment?
    a. Future Value of an Annuity
    b. Periodic Payment
    c. Present Value of an Annuity
    d. Term of an Annuity

11. What is the sum of future values of all the payments to be made during the entire term of the annuity?
    a. Periodic Payment
    b. Payment Interval
    c. Present Value of an Annuity
    d. Future Value of an Annuity

12. What is the time between successive payments ?
    a. Periodic Payment
    b. Term of an Annuity
    c. Time
    d. Payment interval

13. Which is NOT an example of Installment basis purchase?
    a. Pension
    b. Car
    c. House
    d. Cellphone

For item numbers 14-15, refer to the following:
Suppose you would like to save ₱ 1,500 at the end of each month, for a year, in a bank that gives 2.5% compounded monthly.

14. What type of annuity is present in the situation above?
    a. Simple Annuity Due
    b. General Annuity Due
    c. Simple Annuity Immediate
    d. General Annuity Immediate

15. What is the interest rate per annum in decimal form?
    a. 2.5
    b. 0.25
    c. 0.025
    d. 0.0025

Lesson 1 Future and Present Values of Simple Annuity

Have you ever tried getting an appliance by applying in a Home Credit, Flexi Finance, or through credit cards? If yes, you will realize that this lesson is the direct application of this. With this, you can also see or compute how lending institutions really work. You will also realize if they are really worth it.

What's In

Most of us have had the experience of making a series of fixed payments over a period of time—such as rent or car payments—or receiving a series of payments for a period of time, such as interest from a bond or CD. These recurring or ongoing payments are technically referred to as "annuities" (not to be confused with the financial product called an annuity, though the two are related).

There are several ways to measure the cost of making such payments or what they're ultimately worth. Here's what you need to know about calculating the present value or future value of an annuity.

Definition

Simple Annuity is a type of annuity in which the payment period is the same as the interval period (conversion period).

Example: Monthly payment where interest is compounded monthly

- Payment period refers to the time between successive period of annuity.
- Term refers to time from the start of the first payment up to the last payment.
- Periodic Payment (R) is the size of each annuity payment

Notes to the Teacher

Regular payments, such as the rent on an apartment or interest on a bond, are sometimes referred to as "annuities."

In ordinary annuities, payments are made at the end of each time period. With annuities due, they're made at the beginning.

The future value of an annuity is the total value of payments at a specific point in time. The present value is how much money would be required now to produce those future payments.

What's New

How much will I earn?

You decided to join a Kabataan Savers Club which aims for financial growth of the youth nowadays. If you pay ₱1,000.00 at the end of each month for 5 months on account that pays interest at 12% compounded monthly, how much money will you have after 5 months?

Guide Questions:

1. What type of annuity is present in the problem?
2. What were the given presented?
3. What formula should you use to solve the problem?
4. What would be the answer in the problem?

What is It

The future value of an annuity is the total accumulation of the payments and interest earned. The present value of an annuity is the principal that must be invested today to provide the regular payment of an annuity.

	Present Value	Future Value
Simple Annuity	$P = R * \left[\frac{1-(1+i)^{-n}}{i}\right]$ Where P-Present Value R-periodic payment R -interest rate per period; where i=r/m i-annual rate m-number of conversion period in a year n-total number of conversion periods n = t(m) t-number of years	$F = R * \left[\frac{(1+i)^{n}-1}{i}\right]$ Where F-Future Value or Amount R-Periodic Payment r-interest rate per period where i =r/m i-annual rate m-number of conversion period in a year n-total number of conversion periods n = t(m) t-number of years

In this case, with the example presented above we can answer the following questions. (1) Since the interest conversion is equal or the same as the payment interval so we will use simple annuity.

(2) Identifying the given facts, we have:

P = ₱1,000.00

$i^{(12)}$ =r/m= 0.12/12 =0.01 t= 5 months/12

n = t* m= (5 months/12) *12=5

(3) Since we will find the amount of money after 5 months, we will use the formula: $F = R * \left[\frac{(1+i)^n - 1}{i}\right]$

(4) Then substituting all the given facts, we will obtain: $F = \frac{1000[(1+0.01)^5 - 1]}{0.01}$

Future Value = ₱5,101.01

Example 1.B

Contrast in calculating the future value, a present value (PV) tells you how much money would be required now to produce a series of payments in the future, again assuming a set interest rate.

Using the same example above, the given is as follows:

P =?

$i^{(12)}$ = 0.12/12 =0.01 t= 5 months/12

n = t*m =(5/12)*12= 5

Since we are looking for the present value, we use the formula

$$P = R * \left[\frac{1 - (1+i)^{-n}}{i}\right]$$

By substituting it in the formula, we will obtain

$$P = \frac{1000[1 - (1+0.01)^{-5}]}{0.01}$$

Present Value = ₱4,853.43

As you can notice, future value is higher than the present value. This is because of the time value of money—the concept that any given sum is worth more now than it will be in the future because it can be invested in the present.

Definition. The cash value or cash price is equal to the down payment (if there is any) plus the present value of the installment payments.

Example 1.C

Mr Angeles paid ₱200,000.00 as a downpayment for a car. The remaining amount is to be settled by paying ₱ 16,200.00 by the end of each month for 5 years. If interest is 10.5% compounded monthly, what is the cash price of his car?

To solve this, let us identify the given:

Downpayment= ₱200,000.00 R= periodic payment

i = r/m $\frac{0.105}{12}$= 0.00875

n= t*m=5*12=60 years

R= ₱16,200.00

Obtain the present value of the car by plugging the given in our formula

$$P = 16{,}200 * \left[\frac{1-(1+0.00875)^{-60}}{0.00875}\right]$$

The present value of the car is ₱ 753,702.20

To get the cash value, simply add the obtained present value and the downpayment made, so;

CV= 200,000 + 753,702.20

The total cash value of the car is ₱ 973,702.20.

Example 1.D

Mr. Edgar borrowed from his friend ₱ 200,000.00 He promised to pay the amount plus its interest by an equal amount of money each year for 3 years. What must be his annual payment if they agreed on an interest of 10% compounded annually?

This example is different from the examples presented above. This time, you are going to compute the Regular periodic payment. We will be manipulating the formula of present value to obtain the formula for the periodic payment.

$$R = \frac{P}{\frac{1-(1+i)^{-n}}{i}}$$

Given:

P= ₱ 200,000.00

i= 0.10

n= 3

Substituting the values to our formula, we get,

$$R = \frac{200{,}000}{\frac{1-(1+0.1)^{-5}}{0.1}}$$

Mr Edgar must pay ₱ 80,422.96 every year.

What's More

Read each problem carefully and answer each question to solve the problem. Have Fun!

Practice Activity 1:

Find the Present Value (P) and the Future Value (F) of quarterly payments of ₱ 2,000.00 for 5 years with interest rate of 8% compounded quarterly.

Hint: State the given. Identify which formula to be used. Substitute the value to the formula.

$$P = R * \left[\frac{1-(1+i)^{-n}}{i}\right] \qquad F = R * \left[\frac{(1+i)^{n}-1}{i}\right]$$

Independent Activity 1

Find the Present Value (P) and the Future Value (F) of semi-annual payments of ₱ 8,000.00 for 12 years with interest rate of 12% compounded semi-annually.

Practice Activity 2:

How much should you invest in a fund each year paying 2% compounded annually to accumulate ₱ 100,000.00 in 5 years?

Hint: State the given. Identify which formula to be used. Substitute the value to the formula.

$$R = \frac{P}{\frac{1-(1+i)^{-n}}{i}}$$

Independent Activity 2

Starting on her 30th birthday, a woman will invest an amount every year on her birthday in an account that grows at an annual rate of 7%. What should be the amount invested should she want her fund to ₱ 300,000.00 just before her 65th birthday?

Practice Activity 3

The value of a car requires a ₱ 169,000.00 cash downpayment and a monthly payment of ₱ 12,000.00 If money is computed at 10% compounded monthly, how much is the cash price of the car payable in 5 years?

Hint: State the given. Identify which formula to be used. Substitute the value to the formula.

CV = Downpayment + Present Value

Independent Activity 3

The buyer of a lot pays ₱ 50,000.00 cash and ₱ 10,000.00 every month for 10 years. If money is 8% compounded monthly, how much is the cash price of the lot?

What I Have Learned

A. Write down the formula need to solve the following.

1. Present Value of a Simple Annuity
   _____.

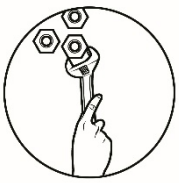
2. Future Value of a Simple Annuity
   _____.

3. Regular Periodic Payment
   _____.

4. Cash Value/Price
   _____.

B. This lesson will help you to become more practical through considering your financial situation before involving yourself with any type of investments or loans. It is important to know the amount that you may get after several periods of time. Cite any situation where you apply practical decision in terms of financial concern.

_____
_____
_____



What I Can Do

Let's be practical!

A new brand of cell phone is for sale in SM Lucena at ₱ 13,499.00 in cash or in instalment terms, ₱ 2,500.00 each month for the next 6 months at 9% compounded monthly.

1. If you were the buyer, what do you prefer? Cash or installment?
2. Why did you choose cash? Installment?
3. What is the advantage of choosing cash basis?
4. What is the advantage of choosing installment basis?

Submit on a long bond paper an essay containing your answer on the questions above. You should note that the computation must be included in the front page of your paper. The essay must consist of at least 5 sentences and a maximum of 10 sentences on why you must choose your payment options. Justify your answer with the computations you had and your own personal reasons.

Below is the rubrics for you to be guided in this activity.

Areas of Assessment	4 pts	3 pts	2 pts	1 pt
Computations	Computations are free of error and is accurate.	Computations are slightly inaccurate and close to correct answers.	Computations are slightly inaccurrate but not close to correct answers.	Erroneous and inaccurate computations.
Ideas	Presents ideas in an original manner.	Presents ideas in a consistent manner.	Ideas are too general.	Ideas are vague or unclear.
Organization	Strong and organized beg/mid/end	Organized beg/mid/end	Some organization; attempt at a beg/mid/end	No organization; lack beg/mid/end
Word Choice	Sophisticated use of nouns and verbs make the essay very informative.	Nouns and verbs make essay informative.	Needs more nouns and verbs.	Little or no use of nouns and verbs.
Sentence Structure	Sentence structure enhances meaning; flows throughout the piece.	Sentence structure is evident; sentences mostly flow.	Sentence structure is limited; sentences need to flow.	No sense of sentence structure or flow.

Lesson 2 Future and Present Values of General Annuity

In this course, you will solve all sorts of general annuity problems. A general annuity is an annuity where the payments do not coincide with the interest periods. You will be able to see that it is very easy to deal with general annuities once an equivalent interest rate is determined with that equivalent rate being compounded as often as the payments are made.

What's In

Why do you need to know investments, bonds, stocks, interests? Why is there a need to invest your hard earned money?

Having the knowledge in basic concepts in business mathematics or the mathematics of investment may help you decide whether to use that credit card for a 5% interest compounded monthly or a simple interest for a period of 6 months. Some topics might shed light on which banks would give a higher interest rate for your savings.

For you to begin, consider the lesson on the previous module which is essential in obtaining success in this lesson. General annuity is not like a simple annuity. Unlike simple annuity, general annuity deals with different payment period and interval period. Here, you have to convert the rate first before substituting the values to the formula.

Definition

General Annuity is a type of annuity in which the payment period is not the same as the interval period (conversion period). You will be able to easily identify this .

Example:

A four-year lease agreement between Alfred and Thrifty Mall Inc. (TMI) indicates that, Alfred pays TMI ₱100,000.00 at the end of every year if the agreed interest rate is 5% compounded quarterly

In this example, the payment period is a whole year. However, the interest period is quarterly or every 3 months. Hence, the annuity is a general annuity

Notes to the Teacher

In general ordinary annuities, payments are made at the end of each time period. With annuities due, they're made at the beginning.

The terms used in simple annuity have the same meaning in general annuity.

What's New

What is the present value of an annuity of ₱ 2,000.00 payable annually for 9 years if the money is worth 5% compounded quarterly.

Guide Questions:

1. What type of annuity is present in the problem?
2. What were the given presented?
3. What formula should you use to solve the problem?
4. What would be the answer in the problem?

What is It

The future value of an annuity is the total accumulation of the payments and interest earned. The present value of an annuity is the principal that must be invested today to provide the regular payment of an annuity.

General Annuity	$P = R * \left[\frac{1-(1+i)^{-n}}{(1+i)^{b}-1}\right]$ Where R-regular payment r-interest rate per period; where i=r/m i-annual rate m-number of conversion period in a year n-total number of conversion periods n = t(m) t – number of years $b = \frac{p}{c}$, where ***p*** is the number of months in a payment interval and **c** is the number of months in a compounding period.	$F = R * \left[\frac{(1+i)^{n}-1}{(1+i)^{b}-1}\right]$ Where R-regular payment r-interest rate per period; where i=r/m i-annual rate m-number of conversion period in a year n-total number of conversion periods n = t(m) t – number of years $b = \frac{p}{c}$, where ***p*** is the number of months in a payment interval and ***c*** is the number of months in a compounding period.

Example 2.A

If you will notice, the interest conversion period is different from the payment interval. Since this is the case, we will refer to general annuity.

Consider the following given,

P = ₱ 2,000.00

n = 9(4) = 36

$i = \frac{r}{K} = \frac{5\%}{4}$ or 0.0125

c = 3

p = 12

$b = \frac{p}{c} = \frac{12}{3} = 4$

Using the formula in getting the present value of general annuity we will obtain:

$P = R * \left[\frac{1-(1+i)^{-n}}{(1+i)^{b}-1}\right]$ then substituting the given facts, we will obtain

$PV = 2000\left[\frac{1-(1+0.0125)^{-36}}{(1+0.0125)^{4}-1}\right]$ we will obtain ₱ 14,155.99 as the present value of general annuity.

Example 2.B

Looking for the future value of the example above, let us use the given.

P = ₱ 2,000.00

n = 9(4) = 36

$i = \frac{r}{K} = \frac{5\%}{4}$ or 0.0125

c = 3

p = 12

$b = \frac{p}{c} = \frac{12}{3} = 4$

Using the formula for future value fo general annuity: $F = R * \left[\frac{(1+i)^{n}-1}{(1+i)^{b}-1}\right]$

And substituting the given to the formula, we will have

$$F = 2000\left[\frac{(1+0.0125)^{36}-1}{(1+0.0125)^{4}-1}\right]$$

Future Value is ₱ 22,139.17

What's More

Read each problem carefully and answer each question to solve the problem. Have Fun!

Practice Activity 1

Payment of ₱ 500.00 is made at each year for 10 years. Interest has a nominal rate of 8% convertible quarterly. Find the present and the future value.

Hint: State the given. Identify which formula will be used. Substitute the value to the formula.

$$F = R * \left[\frac{(1+i)^n - 1}{(1+i)^b - 1}\right] \qquad P = R * \left[\frac{1-(1+i)^{-n}}{(1+i)^b - 1}\right]$$

Independent Activity 1

Annual payments of ₱1,000.00 at the end of each term for 8 years with interest rate of 6% compounded quarterly. Find the present and the future value.

What I Have Learned

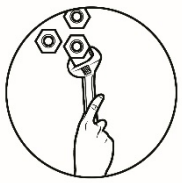
A. Write down the formula needed to solve the following.

1. Present Value of a General Annuity
   _____.

2. Future Value of a General Annuity
   _____.

B. Write down the differences and similarities between Simple Annuity and General Annuity.

_____
_____
_____
_____
_____
_____
_____.



What I Can Do

Ask someone borrowing from a five-six (Bumbay) money lender. How much will be charged if you want to loan ₱ 5,000.00, payable in one year? Determine the interest rate per period and the annual interest rate. Is it a good loan term? Why or why not?

Submit on a long bond paper an essay containing your answer on the questions above. You should note that the computation must be included in the front page of your paper. Then essay must consist of at least 5 sentences and a maximum of 10 sentences on why you must chose your answer. Justify your answer with the computations you had and your own personal reasons.

Below is the rubrics so that you are guided in this activity.

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Sentence Structure	Sentence structure enhances meaning; flows throughout the piece.	Sentence structure is evident; sentences mostly flow.	Sentence structure is limited; sentences need to flow.	No sense of sentence structure or flow

Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What is the present value of the simple annuity of ₱ 5,000.00 payable semi-annually for 10 years if money is worth 6% compounded semi-annually?
    a. ₱ 74,387.37
    b. ₱ 67,200.42
    c. ₱ 81,600.96
    d. ₱ 34,351.87

2. With the same given in number 1, what is the accumulated amount (future value)?
    a. ₱ 74,387.37
    b. ₱ 67,200.42
    c. ₱ 81,600.96
    d. ₱ 134,351.87

For number 3-6, refer to the problem below.

Mr. Michael's monthly insurance premium is ₱ 500.00, payable at the end of each month. His policy matures 20 years later, after which he can withdraw all his payments plus the interest earned. If the money is worth 15% compounded monthly, how much does he expect to withdraw on the maturity of his policy?

3. What is being asked in the problem?
    a. Cash Value
    b. Regular Periodic payment
    c. Future Value
    d. Present Value

4. What is the total conversion period of the insurance policy?
    a. 20
    b. 12
    c. 120
    d. 240

5. What is the annual interest rate of the insurance policy converted to decimal?
    a. 0.15
    b. 0.015
    c. 0.125
    d. 0.0125

6. How much does he expect to withdraw on the maturity of his policy?
   a. ₱ 800,519.00
   b. ₱ 798,716.74
   c. ₱ 748,619.74
   d. ₱ 543,519.84

7. Find the present value of an annuity of ₱ 10,000.00 payable semi-annually for 5 years if money is worth 6% per year compounded quarterly.
   a. ₱ 120,640.00
   b. ₱ 171,686.39
   c. ₱ 230,145.19
   d. ₱ 286,640.00

For number 8 and 9, refer to the problem below.
A high school student would like to save ₱ 50,000 for his graduation. He will be depositing on his savings every month for 5.5 years and interest is at 0.25% compounded monthly?

8. What is the interest rate per month converted to decimals?
   a. 0.25
   b. 0.025
   c. 0.0025
   d. 0.00025

9. How much should he deposit in his bank to get ₱ 50,000 after 5.5 years?
   a. ₱ 752.46
   b. ₱ 762.46
   c. ₱ 764.52
   d. ₱ 765.42

For number 10 and 11, refer to the situation below.
The buyer of a car pay ₱300,000.00 cash as downpayment and is going to pay ₱12,000.00 monthly for 5 years if money is worth 12% compounded monthly.

10. How much more will he be disbursing (present value) after paying the downpayment amount?
    a. ₱ 529,360.04
    b. ₱ 539,460.09
    c. ₱ 539,730.07
    d. ₱ 589,733.43

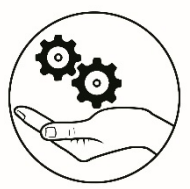
11. What is the cash value of the car?
    a. ₱ 829,360.04
    b. ₱ 839,460.09
    c. ₱ 839,730.07
    d. ₱ 889,733.43

12. Find the future value of an annuity of ₱ 10,000.00 payable quarterly for 3 years if money is worth 12% compounded monthly.
    a. ₱ 33,596.60
    b. ₱ 33,695.60
    c. ₱ 33,965.60
    d. ₱ 33,956.60

13. What is the present value of an annuity of ₱ 5,000.00 payable quarterly for 10 years If money is worth 5% per year compounded annually?
    a. ₱ 345,590.98
    b. ₱ 345,950.98
    c. ₱ 349,550.98
    d. ₱ 394,055.98

14. Find the future value of an annuity of ₱10,000.00 payable quarterly for 5 years if money is worth 12% compounded monthly.
    a. ₱ 64,395.55
    b. ₱ 64,935.55
    c. ₱ 69,435.55
    d. ₱ 69,534.55

15. Find the present value of an annuity of ₱20,000.00 payable semi-annually for 5 years if money is worth 6% per year compounded quarterly.
    a. ₱120,640.00
    b. ₱ 145,022.80
    c. ₱ 170,408.33
    d. ₱186,640.00



Additional Activities

Solve the following:

A. Mr. Barela's monthly amortization is ₱3,500.00, payable at the end of each month. His house and lot will be fully paid after 20 years. If the amount of house and lot is 5% compounded monthly, how much is its maturity value? Write your computation on the box provided below.

B. An cellphone is for sale at either (a) ₱15,999.00 cash or, (b) on terms, ₱1,499.00 each month for 12 months. Money is 9% compounded monthly. Which is lower, the cash price or the present value of the installment terms? Explain. Write your computation on the box provided below.

Explanation:

Answer Key

What I Know

1. A
2. B
3. A
4. B
5. C
6. D
7. C
8. A
9. B
10. B
11. D
12. D
13. A
14. C
15. C

What's More

Practice Activity 1

P=₱32,702.87

F= ₱48,594.74

Independent Activity 1

P= ₱100,402.90

F= ₱406,524.60

Practice Activity 2

₱19,215.84

Independent Activity 2

₱2,028.21

Practice Activity 3

₱733,784.43

Independent Activity 3

₱874,214.81

Practice Activity 4

P= ₱7,327.48

F= ₱3,318.54

Independen Activity 4

P= ₱6,176.42

F= ₱9,946.04

Assessment

1. A
2. D
3. C
4. D
5. D
6. C
7. B
8. C
9. A
10.B
11. B
12. C
13. C
14. A
15. B

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