Strengthened Senior High School

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplars for General Mathematics

CORE SUBJECT

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FEATURES OF THE SENIOR HIGH SCHOOL LESSON EXEMPLAR

The **Senior High School Lesson Exemplar (LE)** is designed to support teachers in delivering meaningful, engaging, and standards-based instruction that responds to the diverse needs of Senior High School learners. Anchored on the **Senior High School Instructional Design Framework (SHSIDF**), the LE ensures constructive alignment among curriculum standards, teaching and learning experiences, and assessment practices. Through this alignment, learners are provided with opportunities to develop the knowledge, skills, and competencies necessary for higher education, skills development, employment, and entrepreneurship.

At the heart of the LE is the **AID** Instructional Flow, a structured approach to teaching and learning composed of three interconnected phases: Activating Prior Knowledge, Instituting New Knowledge, and Demonstrating Knowledge and Skills. This instructional flow guides teachers in creating coherent learning experiences that build from what learners already know, deepen understanding through meaningful engagement, and provide opportunities for authentic application and assessment.

The **Activating Prior Knowledge** phase serves as the entry point of the lesson. It helps learners connect prior experiences and existing knowledge to new concepts, making learning more relevant and meaningful. This phase also establishes the purpose of the lesson by clarifying learning goals, highlighting real-life applications, and motivating learners to actively engage in the learning process.

The **Instituting New Knowledge** phase focuses on the development of understanding and mastery of concepts. Learners are introduced to new ideas through carefully selected examples, guided exploration, and explicit instruction. Through discussions, collaborative activities, and structured practice, learners progressively deepen their understanding and develop the skills necessary to achieve the intended learning outcomes.

The **Demonstrating Knowledge and Skil**ls phase provides opportunities for learners to apply, synthesize, and showcase their learning. Through practical applications, reflective activities, evaluations, and differentiated follow-up tasks, learners demonstrate their understanding while teachers gather evidence of learning. This phase also ensures that learners receive appropriate support through remediation, reinforcement, or enrichment activities based on their individual learning needs.

To further enhance learning experiences, the LE incorporates several key program integrations. **Integrative Performance Tasks (IPTs**) are embedded and scaffolded throughout the lessons to ensure that learners gradually develop the competencies required to successfully complete authentic and interdisciplinary performance assessments. Rather than being treated as isolated end-of-quarter projects, IPTs are woven into classroom instruction, allowing learners to build the necessary knowledge and skills over time.

Recognizing the demands of a rapidly evolving digital world, the LE also promotes **EdTech Integration**. Educational technologies are strategically incorporated to enrich instruction, foster collaboration, encourage creativity, and provide learners with engaging and interactive learning experiences.

In addition, the LE strengthens **Literacy and Numeracy** by embedding literacy and numeracy skills across learning activities and assessments. This integration ensures that learners continuously develop the competencies needed to interpret information, communicate effectively, solve problems, make informed decisions, and navigate real-life situations confidently.

Through these features, the Senior High School Lesson Exemplar serves as a practical and comprehensive guide for teachers, supporting the delivery of high-quality instruction that is learner-centered, inclusive, relevant, and responsive to the aspirations of Senior High School learners and the demands of the 21st century.

GUIDE FOR FACILITATING INTEGRATIVE PERFORMANCE TASKS (IPT)

The **Integrative Performance Task (IPT)** is designed to serve as authentic demonstrations of learning that synthesize competencies across learning areas. To ensure that an IPT becomes the natural culmination of classroom instruction rather than a stand-alone project assigned at the end of a grading period, teachers are encouraged to observe the following principles in the development and implementation of IPT.

First, the Performance Standard should be translated into a concrete, authentic, and real-world product, performance, or solution. Clearly defining the expected output enables teachers and learners to understand the purpose of instruction and maintain focus on the desired end goal throughout the learning cycle.

Second, the accomplishment of the IPT should be developmental and cumulative. Learning Competencies (LCs), technical skills, and disciplinary knowledge required for the final output should be strategically distributed across learning areas and taught within the appropriate lessons. Each lesson should contribute a meaningful component toward the completion of the IPT.

Third, when establishing the purpose of the lesson, teachers should draw from the same real-world context or scenario presented in the IPT. Introducing the scenario early in the learning cycle helps learners recognize the relevance of each lesson and encourages them to continually connect newly acquired knowledge and skills to the final task. The IPT should be presented at the beginning of the quarter and revisited regularly as a reference point throughout instruction.

Fourth, in Finding Practical Applications part of the lesson, teachers should design learning activities that mirror the thinking processes, skills, or performance requirements of the IPT. These formative tasks serve as opportunities for practice and feedback. Whenever possible, teachers should use criteria aligned with the IPT rubric to help learners understand expectations and improve their performance progressively.

Fifth, any digital platforms, educational technologies, mathematical procedures, research methods, laboratory techniques, or other tools required for the successful completion of the IPT should be explicitly taught during the discussion, guided practice, and mastering the concept. Learners should have sufficient opportunities to practice using these tools before they are expected to apply them independently in the IPT.

Sixth, summative assessments should contribute directly to the development of the IPT. Rather than functioning as isolated evaluation activities, these assessments should require learners to produce or refine components of the final output of IPT. This approach strengthens the coherence between instruction, assessment, and performance expectations.

Lastly, the final Lesson Exemplar in the learning cycle should provide opportunities for learners to consolidate, refine, and complete their IPT outputs. This stage may include peer review, consultation, revision, rehearsal, and final polishing of outputs before formal presentation or submission. Teachers should facilitate reflection and feedback to ensure that learners demonstrate both mastery of competencies and meaningful application of learning.

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Unit 1. BUSINESS AND FINANCE

I. LEARNING GOALS	
Content Standard	The learners should have knowledge and understanding of business and finance through problems involving earning money, buying, and selling. *The learners demonstrate knowledge and understanding of business mathematics and compensation structures through core payroll computations, commission-based models, piece-rate earnings, and statutory employee deduction guidelines in the Philippines.*
Performance Standard	By the end of the term, the learners are able to prepare accurate payrolls and digital payslips with correct gross pay, deductions, and net income. *By the end of the term, the learners are able to independently build an automated, professional payroll spreadsheet and digital payslips that accurately calculate gross pay, statutory contributions (SSS, PhilHealth, Pag-IBIG), withholding taxes, and net take-home income.*
Learning Competencies	The learners … 1. calculate weekly or monthly wage from an annual salary, wages from an hourly rate including situations involving overtime and other allowances and earnings based on commission or piecework. 2. apply percentage increase or decrease in various contexts. a. determining the impact of inflation on costs and wages over time. b. calculating percentage mark-ups and discounts c. calculating VAT. d. calculating profit or loss in absolute and percentage terms. 3. solve problems involving salaries, wages, benefits, and deductions (tax computations, overtime pay, and gross and net incomes) using appropriate technology.
II. REFERENCES and MATERIALS	
Textbook and Modules	Bangko Sentral ng Pilipinas (BSP). *Inflation and You: A Learning Module*. BSP Financial Education Stakeholder Engagement Group, 2021. https://www.bsp.gov.ph/Media_And_Research/Publications/Learning%20Modules/Inflation%20and%20You.pdf Bureau of Internal Revenue (BIR). *Value-Added Tax (VAT) Guide*. BIR, 2023. https://www.bir.gov.ph/index.php/tax-information/value-added-tax.html Commission on Higher Education (CHED). *Senior High School Teaching Guide: Applied Economic*s. CHED K to 12 Transition Program Management Unit, 2016. https://chedk12ph.github.io/curriculum-guides/ Danao, Napoleon G. *Entrepreneurship*. Vibal Group, Inc., 2019. Department of Education (DepEd). *Mathematics Grade 10 Learner's Module*. Bureau of Learning Resources, 2015. https://lrmds.deped.gov.ph/detail/10483 Danao, Napoleon G. *Entrepreneurship*. Vibal Group, Inc., 2019. Department of Education (DepEd). *Mathematics Grade 10 Learner's Module*. Bureau of Learning Resources, 2015. https://lrmds.deped.gov.ph/detail/10483 Department of Labor and Employment (DOLE). *Labor Advisory No. 23, Series of 2022*: Payment of Wages for the DepEd. *Mathematics Grade 7 Learner's Module*. Department of Education, 2016. https://lrmds.deped.gov.ph/detail/10482 DepEd. Personal Finance Teaching Guide: Senior High School. Paner, Teresita R. et al. *Business Math*. Rex Book Store, 2016
Websites	https://www.sss.gov.ph https://www.philhealth.gov.ph https://www.pagibigfund.gov.ph

Video Lessons	Khan Academy. "*Hourly Rate and Salary*." Khan Academy, https://www.khanacademy.org/math/pre-algebra/decimals-pre-alg/money-word-problems-pre-alg/v/hours-and-pay. Accessed 6 May 2025. Math Lessons by Professor Fern. "*How to Calculate Commission, Salary, and Overtime*." YouTube, 10 May 2021, https://www.youtube.com/watch?v=kN9nBwvx21k. Accessed 6 May 2025. Department of Education. "*Business Math Lessons*." DepEd TV, https://commons.deped.gov.ph. Accessed 6 May 2025	
Materials and EdTech	Calculators Visual aids/PowerPoint presentation Worksheets Task cards Budget template Application Software • *Microsoft Excel*. Microsoft, • *Desmos Scientific Calculator*.	
AI Declaration	AI tools were used to assist in generating activity ideas, refining instructions, organizing content, creating visual prompts and images, and improving the clarity of this Senior High School lesson exemplar. All AI-assisted outputs were reviewed, revised, and validated to ensure accuracy, relevance, appropriateness, and alignment with the curriculum and intended learning competencies.	
III. CONTENT	**Lesson 1.1. Computing Salary, Wage, and Commission**	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. differentiate among annual salary, hourly wage, commission, and piecework income; 2. accurately compute weekly and monthly wages from an annual salary and hourly rate including overtime pay and allowance; 3. calculate earnings from commission and piecework; and 4. solve word problems involving weekly and monthly wages from an annual salary and hourly rate including overtime pay and allowance.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS** (For the purpose, strategies, integration guide, answer keys, and summative assessments, and additional tips please refer directly to the Teacher's Notes.)
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. Leveling Learners Readiness *Instructions:* Working with your group, create a concept map to show your ideas about the central word "Income." Your concept map must connect and include all the terms from the word bank below. Feel free to add any other related terms not provided. Salary Taxes Wages Deductions Gross Income Net Income Benefits *Processing Questions:* 1. What was the most challenging part about deciding where to place and connect the terms in your concept map? 2. Based on your completed map, if someone asked you to explain why Gross Income is always a larger number than Net Income,	Activity A.1 **Leveling Learners Readiness** Follow the instructions below to facilitate this activity. 1. Group learners into 5s. 2. Provide each group with markers and a large sheet of paper (cartolina, manila paper, or construction paper). 3. Ask them to create a concept map about the word "Income." 4. They must include these words: Salary; Wages; Deductions; Gross Income; Net Income; Taxes; and Benefits. 5. They can add more related terms. 6. After the groups finish the Word Mapping Activity, you may instruct them to display or post their works around the classroom (on walls or tables) to have a gallery walk activity. 7. Give time for learners to walk around in groups, reading each other's work. 8. Each group leaves a comment or question on the other groups' maps.

how would you explain it using the words Taxes and Deductions?

3. Now that you see how these terms fit together, what is something new you want to learn about how income works in the real world?

9. After the walk, instruct groups to return to their own maps, read the comments, and share what they learned with the class by answering the processing questions.

A.2. Establishing the Purpose of the Lesson

Activity A. 2. **Appreciating Lesson Relevance**

Instructions: Read the job descriptions below to see how each worker earns his income. Analyze the jobs and decide which worker you think earns more in a month.

1. Factory Worker

***Job Description*:** Factory workers are employed in manufacturing plants where they operate machinery, assemble products, and ensure quality standards are met. Their tasks may vary depending on the industry they work in.

***How they Earn*:** Factory workers often earn wages based on the number of items they produce (piecework) or receive a fixed hourly wage.

2. Online Seller

***Job Description*:** Online sellers promote and sell products through digital platforms like Facebook, TikTok, and other trendy digital platforms. They create engaging content, conduct live streams, and interact with customers to drive sales.

***How They Earn*:** Online sellers typically earn profits based on the margin between the cost of goods sold and the selling price. Their income can vary depending on sales volume and marketing effectiveness.

Activity A.2. **Appreciating Lesson Relevance**

To facilitate this activity, the teacher may apply one of the suggested strategies in Step 4. You may also include tasks or examples that are familiar to learners and relevant to your local context.

1. Prepare 4 to 5 job role images with short descriptions (e.g., factory worker, teacher, online seller, sales agent, call center agent). Include how each person is paid (salary, per item, per sale, hourly + overtime, profit).
2. Begin the activity by saying: "Let's do a quick game to see what we already know about how people earn money."
3. Post job images on the walls or board.
4. To perform this activity, choose any of the following strategies:
   a. **Strategy 1: Stand and Vote**
      Ask learners to stand beside the job they think earns more.
   b. **Strategy 2: Thumbs Up Polling**
      Learners will show
      👍 = Yes 👎 = No 🤔 = Not sure
   c. **Strategy 3: Digital Poll**
      - Use application software for instant anonymous voting. (e.g. Mentimeter, Google forms, etc.)
      - Show results live to stimulate discussion.
5. Briefly ask for 1 to 2 volunteers to explain their choice.
6. Connect to the lesson by facilitating the processing questions.
7. End the activity by saying: "Different people earn in different ways. Today, we'll learn how to compute income from various pay types so you can make smart money decisions in the future."

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.

3. Teacher

***Job Description*:** Teachers are responsible for preparing lesson plans, educating learners at all levels, assigning homework, grading tests, and documenting learner progress. They instruct in various subjects and aim to reach learners with engaging lesson plans.

***How They Earn*:** Teachers usually receive a fixed monthly salary, which may be determined by their qualifications, experience, and the institution's pay scale.

4. Call Center Agent

***Job Description*:** Call center agents handle inbound and outbound calls to address customer needs, provide information about products and services, take orders, respond to complaints, and process returns. They are often the frontline of customer service for organizations.

***How They Earn*:** Call center agents are typically paid an hourly wage, with opportunities for overtime pay and performance-based bonuses.

5. Sales Agent

***Job Description*:** Sales agents establish relationships with new customers, maintain and grow relationships with existing customers, and strive to improve sales. They may work in various industries, presenting and demonstrating products to potential customers.

How They Earn: Sales agents often earn a base salary plus commissions based on the sales they generate. Higher sales typically lead to higher earnings.

Processing Questions:

1. When you were comparing these five jobs, what criteria or factors did your group focus on the most to decide who earns more? Was it easy or difficult to reach a final agreement on the ranking?
2. Based on the job descriptions, how does the way an Online Seller earns income (profits/margins) differently from how a teacher

<table>
<tr>
<td></td>
<td>earns income (fixed monthly salary)? Which structure do you think offers more stability and why?
3. A Sales Agent earns a base salary plus commissions, while a Call Center Agent can earn overtime pay and bonuses. How do these extra earning opportunities change your outlook on a job's potential income?</td>
<td></td>
</tr>
<tr>
<td rowspan="2">B. Instituting New Knowledge</td>
<td colspan="2">B.1. Presenting Examples</td>
</tr>
<tr>
<td>Activity B.1. Exploring Key Concepts: How Worker Get Paid?

Instructions: Given the sample pay slip, explore how an employee's or worker's net pay is calculated. Be ready to share your findings with the class.

1. Factory Worker Payslip

<table>
<tr><td>Employee Information</td><td>Pay Period</td></tr>
<tr><td>Name: Juan Dela Cruz</td><td>Start Date: May 1, 2026</td></tr>
<tr><td>Employee ID: FW-001</td><td>End Date: May 15, 2026</td></tr>
<tr><td>Position: Assembly Line Operator</td><td>Pay Date: May 17, 2026</td></tr>
<tr><td>Earnings Section</td><td>Amount</td></tr>
<tr><td>Basic Pay (Hourly)</td><td>₱6,000.00</td></tr>
<tr><td>Piecework Bonus</td><td>₱1,500.00</td></tr>
<tr><td>Gross Income</td><td>₱7,500.00</td></tr>
<tr><td>Deductions</td><td>Amount</td></tr>
<tr><td>SSS Contribution</td><td>₱250.00</td></tr>
<tr><td>Withholding Tax</td><td>₱100.00</td></tr>
<tr><td>PhilHealth / Pag-IBIG</td><td>₱150.00</td></tr>
<tr><td>Total Deductions</td><td>₱500.00</td></tr>
<tr><td>Net Pay:</td><td>₱7,000.00</td></tr>
</table>
</td>
<td>Activity B.1. Exploring Key Concepts: How Worker Get Paid?

To facilitate this activity, follow these procedures:
1. Distribute the provided payslip and income statement samples reflecting various job types and pay structures (e.g., hourly wage, monthly salary, commission-based).
2. Divide the class into small groups of 3 to 5 learners.
3. Ensure each group has access to one unique profile card and provide them with the processing questions to guide their analysis.
4. Remind learners that the figures in the sample payslips are for illustrative purposes only and do not represent exact calculations under existing tax and contribution laws.
5. Briefly explain the goal by saying, "In this activity, you will examine a sample payslip to identify different income structures and observe how deductions affect an employee's final take-home pay."
6. Perform the activity applying one of these aligned strategies:
Strategy 1: Guided Dissection of a Payslip
a. Project or distribute a sample payslip to the whole class.
b. Go over each section together to show how they connect:
• Employee Information & Pay Period: Who is working and when.
• Earnings Section: Locate the basic pay and any variable additions (e.g., bonuses, overtime, or commissions) that make up the Gross Income.
• Deductions Section: Identify fixed reductions (SSS, tax, PhilHealth/Pag-IBIG).
• Net Pay: Observe how subtracting the total deductions from the Gross Income results in the final take-home pay.
c. Ask the processing questions to check for understanding.
Strategy 2: Income Type Sorting and Reflection
a. Provide a list of different income types (e.g., hourly wage, monthly salary, sales commission).
b. Facilitate the discussion by asking the following questions:</td>
</tr>
</table>

2. Online Seller Income Statement

Business Information	Reporting Period
Seller: Maria's Digital Shop	**Start Date:** April 1, 2026
Platform: FB/TikTok Live	**End Date:** April 30, 2026

Earnings Section	Amount
Total Sales Volume	₱50,000.00
Shipping Fees (Collected)	₱2,000.00
Gross Income (Revenue)	**₱52,000.00**

Business Deductions	Amount
Cost of Goods Sold	₱30,000.00
Platform/Ads Fees	₱3,000.00
Shipping Expenses	₱2,000.00
Total Expenses	**₱35,000.00**
Net Income (Profit):	**₱17,000.00**

3. Teacher Payslip

Employee Information	Pay Period
Name: Elena Santos	**Start Date:** May 1, 2026
Employee ID: TCH-452	**End Date:** May 31, 2026

Earnings Section	Amount
Monthly Basic Salary	₱28,000.00
Professional Allowance	₱2,000.00
Gross Income	**₱30,000.00**

Deductions	Amount
SSS / GSIS	₱2,520.00
Withholding Tax	₱1,800.00
Pag-IBIG/PhilHealth	₱600.00
Total Deductions	**₱4,920.00**
Net Pay:	**₱25,080.00**

- *"Locate where your assigned profile's income type appears in the earnings section."*
- *"Match your profile's income type to their specific job role (e.g., teacher = salary, sales agent = commission)."*
- *"Reflect: Based on the payslip, which parts of their income are fixed and which parts can change?"*

c. Follow up with the final processing questions.

4. Call Center Agent Payslip

Employee Information	Pay Period
Name: Roberto Reyes	**Start Date:** May 1, 2026
Employee ID: BPO-990	**End Date:** May 15, 2026
Position: Customer Service Rep	**Pay Date:** May 17, 2026

Earnings Section	Amount
Basic Pay (Hourly)	₱9,000.00
Overtime Pay	₱1,500.00
Performance Bonus	₱2,000.00
Gross Income	**₱12,500.00**

Deductions	Amount
SSS Contribution	₱400.00
Withholding Tax	₱350.00
PhilHealth / Pag-IBIG	₱250.00
Total Deductions	**₱1,000.00**
Net Pay:	**₱11,500.00**

5. Sales Agent Payslip

Employee Information	Pay Period
Name: Clara Gomez	**Start Date:** May 1, 2026
Employee ID: SLS-772	**End Date:** May 31, 2026
Position: Real Estate Agent	**Pay Date:** June 2, 2026

Earnings Section	Amount
Monthly Base Salary	₱15,000.00
Sales Commission	₱12,000.00
Travel Allowance	₱3,000.00
Gross Income	**₱30,000.00**

Deductions	Amount
SSS Contribution	₱1,200.00
Withholding Tax	₱1,500.00
PhilHealth / Pag-IBIG	₱400.00
Total Deductions	**₱3,100.00**
Net Pay:	**₱26,900.00**

Processing Questions:

1. What was the most interesting or surprising thing your group discovered while looking over your assigned payslip or income statement?
2. Based on the examples, what is the main difference between an employee's 'Gross Income' and their actual 'Net Pay'?
3. If you were choosing a job, would you prefer a stable monthly basic salary (like the teacher) or a variable commission-based income (like the sales agent)? Why?

B.2. Discussing the Concept

Activity B.2. **Deepening Conceptual Understanding**

Instructions: With the guidance of your teacher and support from your classmates, study the key concepts, formulas, and examples to help you learn how to compute salary, wages, and commission.

Key Terms and Formulas

Wage means the remuneration or earnings, however designated, capable of being expressed in terms of money, whether fixed or ascertained on a time, task, piece, or commission basis, which is payable by an employer to an employee under a written or unwritten contract of employment for work done or to be done, or for services rendered or to be rendered.

- Hourly wage is the amount earned for each hour worked.
- Daily wage is the amount of money a worker earns for each day of actual work. It does not include payment for days the employee did not work (e.g., rest days, holidays, or leaves), unless otherwise required by law or employer policy.

Salary refers to a fixed, regular payment—typically distributed monthly, semi-monthly, or weekly—offered to employees regardless of the exact number of hours worked. It is standard for professional, managerial, supervisory, or administrative positions.

- Annual salary is the total gross amount of money an employee earns in a full calendar year before tax deductions.
- Monthly Salary is the fixed amount an employee earns each calendar month.

$$\text{Monthly Salary} = \frac{\text{Annual Salary}}{\text{12 months}}$$

$$\text{Monthly Salary} = \frac{\text{Daily Wage} \times \text{Factor}}{\text{12 Months}}$$

(DOLE use the Factor 313 days for a 6-day workweek, and 261 days for a 5-day workweek).

Activity B.2. **Deepening Conceptual Understanding**

To effectively deliver this part of the lesson, you may use any of the suggested strategies below. Take note of the corresponding tips in the teachers' notes to enhance implementation.

A. Explicit Teaching

1. Prepare Necessary Materials
   a. Prepare visual aids with key terms and formulas.
   b. Prepare printed or digital copies of the problems.
   c. Use a projector or board to show step-by-step computation.
2. Presentation of the Lesson
   a. Introduce Key Concepts
      - Define wage, salary, commission, piecework, and related terms.
      - Explain differences between hourly, daily, weekly, monthly, and annual pay.
      - Present key formulas clearly.
   b. Model Sample Problems
      - Walk through one or two example problems from each category.
      - Show step-by-step computation using real-life figures from the given problems.
      - Verbalize your thinking process ("First I determine the regular hours…", etc.).
3. Check for Understanding
   a. Ask comprehension questions:
      - "What's the difference between a daily wage earner and a salaried employee?"
      - "How do we adjust pay when overtime is involved?"
4. Practice with Supervision
   a. Distribute practice problems from the activity set.

	• A semi-monthly salary is the amount of money paid to a worker twice a month. By law, the payment intervals must not exceed sixteen (16) days. $\text{Semi-Monthly Salary} = \frac{\text{Monthly Salary}}{2}$ • Weekly salary is the income received or computed for a single workweek. $\text{Weekly Salary} = \frac{\text{Annual Salary}}{52 \text{ weeks}}$ $\text{Weekly Salary} = \text{Daily Wage} \times \text{No. of Workdays per Week}$ **Premium Pay** refers to the additional compensation required by law for work performed within the first eight regular hours on non-working days, such as a scheduled Rest Day, Special Non-Working Day and Regular Holiday. For work performed during regular 8-hour shifts on non-working days, multiply the basic daily rate by the following standard factors from the DOLE Labor Code rules on premium pay: • Work on a Scheduled Rest Day: $\text{Daily Rate} \times 1.30$ • Work on a Special Non-Working Day: $\text{Daily Rate} \times 1.30$ • Work on a Special Non-Working Day falling on a Rest Day: $\text{Daily Rate} \times 1.50$ • Work on a Regular Holiday: $\text{Daily Rate} \times 2.00$ • Work on a Regular Holiday falling on a Rest Day: $\text{Daily Rate} \times 2.60$ • Work on Double Special Non-Working Day: $\text{Daily Rate} \times 1.50$ • Work on a Double Special Non-Working Day falling on a Rest Day: $\text{Daily Rate} \times 1.95$ • No Work on a Double Regular Holiday: $\text{Daily Rate} \times 2.00$ • Work on a Double Regular Holiday: $\text{Daily Rate} \times 3.00$ • Work on a Double Regular Holiday falling on a Rest Day: $\text{Daily Rate} \times 3.90$	b. Provide scaffolding: start with simpler problems, gradually introduce those involving overtime, commission, and allowances. 5. Provide Feedback: Go over selected problems on the board and correct common errors. **B. Guided Discovery** 1. Present Key Terms and Formulas 2. Start with a Real-Life Scenario 3. Group Work: Observe and Discover Patterns a. Let learners work in groups to solve similar problems (e.g., hourly to weekly wage). b. Ask learners to identify patterns: • "What changes when the number of days increases?" • "How do commissions or bonuses affect income?" 4. Prompt Guided Questions a. "What do you notice when someone works overtime?" b. "Why do we divide the annual salary by 12 or 52?" 5. Facilitate Sharing a. Have groups present their findings or strategies on how they solved a problem. b. Write down the discovered formulas and rules on the board. 6. Clarify and Formalize: After learner insights, present the standard formulas and correct misconceptions **C. I Do, We Do, You Do** 1. I DO (Teacher Models) a. Present Key terms and Formulas b. Choose one problem type (e.g., overtime computation). c. Solve the first example aloud, explaining each step and writing formulas. 2. WE DO (Guided Practice) a. Solve the next problem with the class. b. Use a think-pair-share format: Let learners first try in pairs, then solve them together. c. Ask prompting questions to guide them through: • "What is regular pay? How many overtime hours? • What is the overtime rate?" 3. YOU DO (Independent Practice) a. Assign problems (e.g., 2 to 3 from each computation category). b. Let learners solve independently or in pairs. c. Encourage showing step-by-step solutions. 4. REFLECTION / WRAP-UP

	Overtime Pay refers to the additional compensation an employee must receive for work performed beyond the standard eight (8) hours in a single workday. When work exceeds 8 hours, multiply the hourly premium rate of that specific day by an additional 125% (1.25) for ordinary days, and by an additional 130% (1.30) for Rest Day, Special Non-Working Day and Regular Holiday. ● Overtime on an Ordinary Day: $\text{Regular Hourly Rate} \times 1.25$ ● Overtime on a Rest Day or Special Non-Working Day: $\text{Regular Hourly Rate} \times 1.69$ ● Overtime on a Special Non-Working Day that Falls on the Rest Day: $\text{Regular Hourly Rate} \times 1.95$ ● Overtime on a Regular Holiday: $\text{Regular Hourly Rate} \times 2.60$ ● Overtime on a Regular Holiday falling on a Rest Day: $\text{Regular Hourly Rate} \times 3.38$ ● Overtime on a Double Regular Holiday: $\text{Regular Hourly Rate} \times 3.38$ ● Overtime on a Double Special Non-Working Day: $\text{Regular Hourly Rate} \times 1.95$ **Night Shift Differential (NSD)** - often called night differential or graveyard pay - is the mandatory additional compensation paid to employees who perform work during late-night and early-morning hours. For any work performed between 10:00 PM and 6:00 AM, the employee receives an additional 10% on top of the applicable hourly rate for that day. $\text{Hourly Rate} \times 1.10$ **Commission Income** refers to earnings calculated as a percentage of total sales. This can be paid as a straight commission or a combination of a base salary plus commission. **Piecework Earnings** refer to compensation paid to an employee based on the specific quantity of items or products they complete. **Computing Weekly Wages from an Annual Salary** 1. An office clerk has an annual salary of ₱312,000. What is his/her weekly wage? Solutions:	a. Review key takeaways: formulas, when to apply them, and common pitfalls. *Processing Questions:* 1. While working through the various examples, which scenario did you find the most challenging to solve, and what specific step in the formula required the most focus? 2. What was your most surprising discovery regarding how 'factors' or 'premium pay' multipliers affect a worker's total earnings? Now that you can accurately compute earnings from piecework, commissions, and hourly rates with overtime, how might you use these formulas in the future to compare two different job offers—for instance, one offering a high base salary versus one with a lower base but high commission or incentive-based piecework?

$$\text{Weekly Wage} = \frac{\text{Annual Salary}}{52 \text{ weeks}}$$
$$= \frac{₱312{,}000}{52 \text{ weeks}}$$
$$= \mathbf{₱6{,}000}$$

2. A manager is offered an annual salary of ₱936,000 for a role requiring a 6-day workweek. To assess the value of the offer, calculate the weekly wage and then determine the equivalent daily wage.
   Solutions:

   A. Weekly Wage

$$\text{Weekly Wage} = \frac{\text{Annual Salary}}{52 \text{ weeks}}$$
$$= \frac{₱936{,}000}{52 \text{ weeks}}$$
$$= \mathbf{₱18{,}000}$$

   B. Daily Wage

$$\text{Weekly Wage} = \text{Daily Wage} \times \text{No. of Workdays per Week}$$
$$\text{Daily Wage} = \frac{\text{Weekly Salary}}{\text{No. of Workdays per Week}}$$
$$= \frac{₱18{,}000}{6 \text{ days}}$$
$$= \mathbf{₱3{,}000}$$

3. A junior supervisor earns a semi-monthly salary of ₱19,500. The company is transitioning from this semi-monthly pay cycle to a weekly cycle. What will be his/her new weekly wage
   Solutions:

   A. Monthly Salary

$$\text{Semi-Monthly Salary} = \frac{\text{Monthly Salary}}{2}$$
$$\text{Monthly Salary} = 2 \times \text{Semi-Monthly Salary}$$
$$= 2 \times ₱19{,}500$$
$$= \mathbf{₱39{,}000}$$

   B. Annual Salary

$$\text{Monthly Salary} = \frac{\text{Annual Salary}}{12 \text{ months}}$$
$$\text{Annual Salary} = 12 \text{ Months} \times \text{Monthly Salary}$$
$$= 12 \text{ Months} \times ₱39{,}000$$
$$= \mathbf{₱468{,}000}$$

C. Weekly Wage

$$\text{Weekly Wage} = \frac{\text{Annual Salary}}{52 \text{ weeks}}$$
$$= \frac{₱468{,}000}{52 \text{ weeks}}$$
$$= ₱\mathbf{9{,}000}$$

Computing Weekly Wages from an Hourly Rate

1. A part-time worker earns an hourly wage of ₱100. In one week, he works on a standard 40-hour schedule. What is his total weekly wage?

   Solutions:

   $$\text{Weekly Wage} = \text{Hourly Rate} \times \text{No. of Hours}$$
   $$= ₱100 \times 40 \text{ hours}$$
   $$= ₱4{,}000$$

2. An employee earns ₱150 per hour and worked 45 hours this week. The first 40 hours are regular time, and 5 hours are overtime on an ordinary day. He also receives a fixed ₱500 weekly allowance. What is the employee's total weekly wage?

   Solutions:

   A. Regular Pay

   $$\text{Regular Pay} = \text{Hourly Rate} \times \text{No. of Hours}$$
   $$= ₱150 \times 40 \text{ Hours}$$
   $$= ₱6{,}000$$

   B. Overtime Pay

   $$\text{Overtime Pay} = \text{Regular Hourly Rate} \times 1.25 \times \text{No. of Hours}$$
   $$= ₱150 \times 1.25 \times 5 \text{ hours}$$
   $$= ₱937.50$$

   C. Weekly Wage

   $$\text{Weekly Wage} = \text{Regular Pay} + \text{Overtime Pay} + \text{Allowance}$$
   $$= ₱6{,}000 + ₱937.50 + 500$$
   $$= ₱7{,}437.50$$

3. A technician has a ₱200 hourly rate. This week he worked 40 regular hours plus 4 hours of overtime on his scheduled rest day. He also receives a ₱1,000 weekly allowance. Overtime on a rest day is calculated at 1.69 times the regular hourly rate. What is the technician's total wage for the week?

   Solutions:

   A. Regular Pay

   $$\text{Regular Pay} = \text{Hourly Rate} \times \text{No. of Hours}$$
   $$= ₱200 \times 40 \text{ Hours}$$
   $$= ₱8{,}000$$

B. Overtime Pay

$$\text{Overtime Pay} = \text{Regular Hourly Rate} \times 1.69 \times \text{No. of Hours}$$
$$= ₱200 \times 1.69 \times 4 \text{ hours}$$
$$= ₱1{,}352$$

C. Weekly Wage

$$\text{Weekly Wage} = \text{Regular Pay} + \text{Overtime Pay} + \text{Allowance}$$
$$= ₱8{,}000 + ₱1{,}352 + 1{,}000$$
$$= ₱10{,}3525$$

Computing Monthly Wages from an Annual Salary

1. An employee has a fixed annual salary of ₱240,000. What is the employee's monthly wage?
   Solutions:

$$\text{Monthly Wage} = \frac{\text{Annual Salary}}{12 \text{ months}}$$
$$= \frac{₱240{,}000}{12 \text{ months}}$$
$$= ₱20{,}000$$

2. A teacher earns an annual salary of ₱480,000. Calculate his equivalent monthly wage and determine the gross amount he will receive in each of the two semi-monthly pay periods.
   Solutions:
   A. Monthly Wage

$$\text{Monthly Wage} = \frac{\text{Annual Salary}}{12 \text{ months}}$$
$$= \frac{₱480{,}000}{12 \text{ months}}$$
$$= ₱40{,}000$$

   B. Semi-Monthly Wage

$$\text{Semi-Monthly Wage} = \frac{\text{Monthly Wage}}{2}$$
$$= \frac{₱40{,}000}{2}$$
$$= ₱20{,}000$$

3. An executive is considering a job with an annual salary of ₱1,200,000. To compare this to the current daily rate of ₱4,000 (based on a 5-day workweek with a 261-day factor), calculate the monthly wage for the new offer and the monthly equivalent of the current daily rate.
   Solutions:

A. New Monthly Wage

$$\text{Monthly Wage} = \frac{\text{Annual Salary}}{\text{12 months}} = \frac{₱1{,}200{,}000}{\text{12 months}} = ₱100{,}000$$

B. Current Monthly Wage (Daily based)

$$\text{Monthly Wage} = \frac{\text{Daily Wage} \times \text{Factor}}{\text{12 Months}} = \frac{₱4{,}000 \times 261}{\text{12 Months}} = ₱87{,}000$$

Computing Monthly Wages from an Hourly Rate

1. An employee has an hourly rate of ₱150 (Daily Rate: ₱1,200) and works a 5-day workweek (261-day factor). During the month, the employee worked 20 hours that fell between 10:00 PM and 6:00 AM. Find the employee's total monthly wage.

   Solutions:

   A. Base Monthly Wage

   $$\text{Monthly Wage} = \frac{\text{Daily Wage} \times \text{Factor}}{\text{12 Months}} = \frac{₱1{,}200 \times 261}{\text{12 Months}} = ₱26{,}100$$

   B. Night Shift Differential (NSD)

   $$\text{NSD} = \text{Hourly Rate} \times 0.10 \times \text{No. of Hours} = ₱150 \times 0.10 \times 20 \text{ hours} = ₱300$$

   C. Total Monthly Wage

   $$\text{Monthly Wage} = \text{Base Monthly Wage} + \text{NSD} = ₱26{,}100 + ₱300 = ₱26{,}400$$

2. A technician earns ₱125 per hour on a 6-day workweek (313-day factor). In a specific month, he was required to work 10 hours on his scheduled Rest Day. What is the technician's total monthly wage?

   Solutions:

   A. Base Monthly Wage

   $$\text{Monthly Wage} = \frac{\text{Daily Wage} \times \text{Factor}}{\text{12 Months}} = \frac{₱1{,}000 \times 313}{\text{12 Months}}$$

$= ₱26,083.33$

B. Rest Day Premium Pay

$$\text{Premium Pay} = \text{Daily Rate} \times 1.30$$
$$= ₱1,000 \times 1.30$$
$$= ₱1,300$$

C. Rest Day Overtime Pay

$$\text{Overtime Pay} = \text{Hourly Rate} \times 1.69 \times \text{No. of Hours}$$
$$= ₱125 \times 1.69 \times 2 \text{ hours}$$
$$= ₱422.50$$

D. Total Monthly Wage

$$\text{Monthly Wage} = \text{Base Monthly Wage} + \text{Premium Pay} + \text{Overtime Pay}$$
$$= ₱26,083.33 + ₱1,300 + ₱422.50$$
$$= ₱27,805.83$$

3. A specialized nurse earns ₱200 per hour with a 261-day factor. This month, he worked 12 hours on a Regular Holiday that fell on his Rest Day. The last 4 hours (which were all overtime) occurred between 10:00 PM and 2:00 AM (Night Shift window). What is the nurse's total wage for the month?

Solutions:

A. Base Monthly Wage

$$\text{Monthly Wage} = \frac{\text{Daily Wage} \times \text{Factor}}{\text{12 Months}}$$
$$= \frac{₱1,600 \times 261}{\text{12 Months}}$$
$$= ₱34,800$$

B. Premium Pay on Regular Holiday Falling on Rest Day

$$\text{Premium Pay} = \text{Daily Rate} \times 2.60$$
$$= ₱1,600 \times 2.60$$
$$= ₱4,160$$

C. Overtime Pay on Regular Holiday Falling on Rest Day

$$\text{Overtime Pay} = \text{Hourly Rate} \times 3.38 \times \text{No. of Hours}$$
$$= ₱200 \times 3.38 \times 4 \text{ hours}$$
$$= ₱2,704$$

D. Night Shift Differential (NSD) on Overtime Pay

$$\text{Overtime Hourly Rate} = \text{Hourly Rate} \times 3.38, \text{ thus}$$
$$\text{NSD} = \text{Overtime Hourly Rate} \times 0.10 \times \text{No. of Hours}$$
$$= \text{Hourly Rate} \times 3.38 \times 0.10 \times \text{No. of Hours}$$
$$= ₱200 \times 3.38 \times 0.10 \times 4$$
$$= ₱270.40$$

E. Total Monthly Wage

$$\begin{aligned}\text{Monthly Wage} &= \text{Base Monthly Wage} + \text{Premium Pay} \\ &\quad + \text{Overtime Pay} + \text{NSD} \\ &= ₱34{,}800 + ₱4{,}160 + ₱2{,}704 + ₱270.40 \\ &= ₱41{,}934.40\end{aligned}$$

Calculating Earnings from Commission and Piecework

1. A real estate agent earns a 5% straight commission on all sales. This month, he closed a deal worth ₱2,000,000. How much is the agent's commission?
   Solutions:

$$\begin{aligned}\text{Commission Amount} &= \text{Total Sales} \times \text{Commission Rate} \\ &= ₱2{,}000{,}000 \times 0.05 \\ &= ₱100{,}000\end{aligned}$$

2. A sales representative has a base monthly salary of ₱15,000 plus a 3% commission on all sales made. His total sales for the month reached ₱500,000. What are his total earnings for the month?
   Solutions:
   A. Commission Amount

$$\begin{aligned}\text{Commission Amount} &= \text{Total Sales} \times \text{Commission Rate} \\ &= ₱500{,}000 \times 0.03 \\ &= ₱15{,}000\end{aligned}$$

   B. Total Earnings

$$\begin{aligned}\text{Total Earnings} &= \text{Base Monthly Salary} + \text{Commission Amount} \\ &= ₱15{,}000 + ₱15{,}000 \\ &= ₱30{,}000\end{aligned}$$

3. A factory worker is paid on a piecework basis. He earns ₱20 per unit for the first 500 units produced in a week, and ₱25 per unit for any units produced beyond that as an incentive. This week, he produced 650 units. What is the worker's total earnings?
   Solutions:
   A. Base Piecework

$$\begin{aligned}\text{Base Earning} &= \text{Base Quota} \times \text{Base Rate} \\ &= 500 \text{ units} \times ₱20 \\ &= ₱10{,}000\end{aligned}$$

   B. Incentive Piecework

$$\begin{aligned}\text{Incentive Amount} &= (\text{Total Units} - \text{Base Quota}) \times \text{Incentive Rate} \\ &= (650 \text{ units} - 500 \text{ units}) \times ₱25 \\ &= 150 \text{ units} \times ₱25 \\ &= ₱3{,}750\end{aligned}$$

   C. Total Earnings

$$\text{Total Earnings} = \text{Base Earning} + \text{Incentive Amount}$$

	$= ₱10{,}000 + ₱3{,}750$ $= ₱13{,}750$	
	B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity B.3. **Practicing Learned Skills: The Master Payroll Conversion Table** This activity integrates EdTech and Literacy. Please see the Teacher's Notes for integration details. To implement this activity effectively, use the "Payroll Station" Rotations strategy. This approach encourages peer collaboration and active auditing, allowing learners to learn from their own calculations and the work of their classmates. It breaks down the cognitive load by grouping problems of similar complexity together, enabling the teacher to provide targeted support at specific stations. 1. Divide the classroom into five distinct physical or digital stations, assigning one word problem from Activity 2 to each station. 2. Divide the class into five groups and assign each group a starting station. Provide them with a "Payroll Log" (a worksheet or digital sheet) to record their step-by-step calculations. 3. Rotation and Audit (The "Peer Audit" Phase): a. Give groups 5 to 7 minutes to solve the problem at their current station. b. When time is up, have groups rotate to the next station. c. Before solving the next problem, the group must audit the previous group's work. They should check if the correct multipliers (e.g., 1.30 for rest days or 3.38 for holiday-rest day overtime) were applied and if the base rate for the calculation was correct. 4. Circulate between stations 3, 4, and 5 to assist learners with the compounding of multipliers. For instance, remind them that at Station 5, the Night Shift Differential (NSD) must be applied to the already increased holiday overtime rate, not just the base hourly rate. 5. After all groups have rotated through the stations, convene as a class to review the Answer Key. Have groups who disagreed with a previous group audit explain their reasoning, using the Labor Code rules as their primary evidence.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections** *Instructions:* Analyze the scenario and do the indicated task. *Scenario*: You have just been hired as the Payroll Officer for a local company called Likhang Kabuhayan Services, a growing business that provides administrative, manufacturing, and delivery services. The company relies on you to make sure that all employees are paid correctly and on time. During this payroll period, you are in charge of computing the salaries and deductions of the employees. Each one has a different way of earning: some are paid hourly, some get overtime, some earn through commissions, and others are paid per item or delivery completed. *Task A – Manual Calculations* Compute the total weekly earnings of each of the employees below: ● Juan earns ₱240,000 per year. ● Maria earns ₱120 per hour. This week, she worked 45 hours, including 5 hours of overtime.	Activity C. **Making Real-World Connections** Strategy 1**. Real-World Simulation** 1. Turn the classroom into a simulated payroll office, where each group acts as a Payroll Department Team responsible for computing the salaries of the employees. 2. Group learners into teams of 3 to 5. 3. Assign each team a set of employees. *Note: You may add more employees.* 4. Each team works together using calculator or spreadsheet software (Google Sheets or Excel) to compute total earnings. 5. The group will present their output for feedbacking. Strategy 2**. Peer Audit and Feedback** 1. Divide the class into groups. 2. Each group shall prepare a table to show the salaries of the given set of employees. Learners may use a calculator or spreadsheet. 3. Each team exchanges their completed table or spreadsheet with another group. 4. Using a provided Audit Checklist, they: a. Review formulas (Are they correct and automated?

- Carlo earns a fixed base of ₱5,000 and gets 8% commission on his ₱30,000 in sales.
- Lea gets paid ₱25 per product. She made 200 products this week.

Task B– Spreadsheet Practice

1. Open Microsoft Excel or Google Sheets.
2. Create a table with the same employees from Task A.
3. Insert cell formulas to calculate the weekly earnings of the employee.
4. Format your spreadsheet using bold headings, clear borders, and the Philippine Peso (₱) currency format.

b. Check accuracy of the computation of salary
c. Evaluate formatting and clarity

5. Each team writes a short feedback report, including:
   a. What was done well
   b. What needs correction (if any)
   c. Suggestions for improvement
   d. After receiving feedback, teams revise and finalize their output

Processing Questions:

1. Looking at how Juan, Maria, Carlo, and Lea earn their income, what are the advantages and disadvantages of being paid an annual salary versus being paid by the hour, commission, or piece-rate?
2. Why is it better to use cell formulas and references (like =B5*C5) rather than just typing the calculated numbers directly into the cells? How does this automation help a Payroll Officer?
3. As a Payroll Officer for Likhang Kabuhayan Services, why is it absolutely critical to double-check your calculations and have a process like a 'Peer Audit'?

C.2. Making Generalization

Activity C.2. **Wrapping Up the Lesson**

Instructions: Analyze the terms below and sort them into the correct Compensation Box based on what specific event or condition triggers the payment.

The Terms to Sort:

- Annual Salary
- Piecework Earnings
- Night Shift Differential (NSD)
- Commission Income
- Monthly Salary
- Overtime Pay
- Premium Pay
- Hourly Wage

Task: Fill the Box

Box 1: Time-Based Compensation

Trigger: Pay that is tied to a fixed schedule or the mere passage of hours/days.

Activity C.2. **Wrapping Up the Lesson**

Think-Pair-Share Engagement Strategy

Instead of running this as a quiet, individual worksheet task, transform it into a collaborative sorting exercise to encourage debate.

1. Give learners two minutes to silently match the terms to the boxes on their own.
2. Have them compare boxes with a seatmate. If they disagree on where a term like *"Hourly Wage"* or *"Overtime Pay"* goes, they must justify their reasoning based on the "Trigger" descriptions.
3. Call on different pairs to fill in a box on the whiteboard and explain why they put a specific item there.

The Litmus Test Framework

Learners sometimes stumble on overlapping categories (e.g., confusing *Hourly Wage* with *Overtime Pay* because both involve hours). Teach them to use a simple "Litmus Test" question for each term:

- **Box 1 Test:** *"Do I get paid simply because a specific block of time passed on the clock?"* (Yes Annual, Monthly, Hourly).
- **Box 2 Test:** *"If I sit here for 8 hours and produce absolutely nothing, do I still get paid for this specific item?"* (No Piecework, Commission).

	Box 2: Output-Based Compensation *Trigger:* Payment is tied strictly to performance, sales volume, or units produced. **Box 3: Condition-Based Compensation** *Trigger:* Extra payment is triggered because work was performed under special or hazardous conditions, or outside standard working hours	• **Box 3 Test:** *"Is this an add-on payment given only because the environment or the hours became unusual?"* (Yes Overtime, Premium, Night Shift Differential). **Bridge to Real-World Analysis** Once the boxes are filled correctly, use the completed categorization to drive home a broader lesson on financial literacy and labor economics. Ask the class the processing questions to provoke deeper thought. *Processing Questions* 1. Between Box 1 and Box 2, which structure offers greater financial stability, and which offers higher earning potential? Explain your reasoning. 2. Why does the law mandate "extra pay" for Box 3 triggers, such as working night shifts, working on holidays, or rendering overtime? How does understanding these three categories empower you to verify if an employer is calculating your payroll fairly and accurately according to the Labor Code?
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners' instructions on this activity).	
	Activity C.3. **Assessing Learning Outcomes** This activity must be completed individually by each learner. Its completion is essential for assessing their level of understanding of the lesson. Review their work promptly so you can provide timely and appropriate intervention for those who require additional support or remediation.	
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.4: **Extending and Reinforcing Learning** This additional exercise may be given as an assignment or homework. Remediation should be provided to learners who have not yet achieved mastery of the lesson, while enrichment activities should be offered to those who are ready for further learning.	
III. CONTENT	**Lesson 1.2. Computing Gross and Net Pay**	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. differentiate gross pay from net pay; 2. use technology to compute tax, SSS or GSIS, Pag-IBIG, PhilHealth contributions, gross and overtime pay; and 3. solve word problems involving gross and net pay.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness** *Instructions:* Analyze and solve the following problems: 1. Marvin works at a manufacturing plant and earns ₱105 per hour. He worked a total of 45 hours this week.	Activity A.1. **Leveling Learners Readiness** To facilitate this activity, follow the suggested steps. Provide additional items if needed to reinforce learning. 1. Have printed copies of the problems.

	a. How much is his regular pay? b. How much is his overtime pay? c. What is his total pay? 2. Sarah is a real estate agent. She earns a ₱10,000 monthly base salary plus 3% commission on sales. In one month, she sold properties worth ₱800,000. a. How much is her commission? b. What is her total income? 3. Lara earns ₱18 per pouch of bag she sews. In a week, she sewed 250 pouches. How much did she earn this week? 4. Dan earns ₱22 per pair of slippers he finishes. He completes 180 pairs in one week and gets a weekly food allowance of ₱500. What is his total weekly income? *Processing Questions*: 1. Which of the four compensation types in the activity did you feel most confident in calculating? 2. How does a "piece-rate" payment method like Lara's differ from an hourly wage like Marvin's? 3. What must be added to a person's basic earnings to determine their true total income?	2. Introduce the title and purpose of the activity. 3. Divide the class into small groups or pairs, depending on the class size. 4. Facilitate the activity applying any of the following strategies: *Strategy 1.* **Rotating Worksheet** Each group will be given one problem at a time. After the given time, they will rotate the worksheet to answer another problem. This process will continue until all groups complete all the problems. *Strategy 2.* **Quiz Show** Display one problem at a time for all teams to solve. Each team will work together to answer the problem within the given time limit. After time is up, teams will present or write their answers. Points are awarded for correct answers. The team with the highest score at the end of the game wins. 5. Ask a few groups to present one solution each to the class. Use this as an opportunity to reinforce key concepts, correct common errors, and highlight different earning methods. 6. Connect the activity to the current lesson by facilitating the processing questions.
	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. **Appreciating Lesson Relevance** *Instructions:* Read the scenario carefully and complete the tasks that follow. Rubic will be presented by the teachers. Juan Dela Cruz has just been hired as a full-time employee at a department store. As stated in his employment contract, he will receive a monthly salary of ₱16,770. Juan wants to be financially responsible, so he is planning his monthly budget. To do that, he needs to know how much he will take home after all government deductions. *Tasks*: 1. Describe the method and the specific information needed to calculate Juan's monthly net take-home pay. 2. Provide a comprehensive summary of Juan's gross income, total deductions, and net income using a spreadsheet, calculator, or any preferred tool to ensure mathematical accuracy. 3. Answer the following guide questions:	Activity A.2. **Appreciating Lesson Relevance** To facilitate this, present the rubric and you may apply one of the given strategies. Strategy 1: Scenario-Based 1. Display or distribute the scenario. 2. Ask guiding prompts like questions. 3. Let learners brainstorm and share ideas in pairs or small groups. 4. Facilitate a short class sharing of their thoughts—without confirming or correcting answers yet. Strategy 2: Predict and Post Strategy 1. Present Juan's scenario either verbally or on screen/paper. 2. Ask learners to silently reflect and answer the questions. 3. Learners write one idea or question per sticky note or post. 4. Let them post their responses on the board or wall. 5. Briefly scan the wall together and let a few volunteers read or group similar ideas.

	a. What are the mandatory deductions taken from an employee's salary in the Philippines? b. Why is it important to know your net income? c. How can knowing your net income help you in planning your finances?	***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1 **Exploring Key Concepts** *Instructions:* Examine the sample payslip shown. Then, answer the activity questions that follow to better understand how salaries and deductions are computed. **MATHENTERPRISE INC.** PAYSLIP Name of Employee: JUAN DELA CRUZ Employee No.: 1435254 Month: June **Description** — **Amount (₱)** Gross Income — 20,000.00 **Less Deductions:** Withholding Tax — 1,500.00 SSS Contribution — 800.00 PhilHealth — 300.00 Pag-IBIG — 200.00 **Net Income** — 17,200.00 Received by: _____ Activity Questions: 1. What is the total combined amount of money deducted from Juan Dela Cruz's gross income for the month of June? 2. What mathematical operation must be performed on the Gross Income and the individual deductions to verify that the listed Net Income of ₱17,200.00 is correct? 3. Which specific item listed under the deductions represents Juan's government income tax, and which items represent his mandatory social insurance contributions?	Activity B.1 **Exploring Key Concepts** To facilitate this activity, you may employ any of the strategies provided. To better reflect the Philippine setting, consider presenting an actual payslip as an example. Interactive Budget Puzzle 1. Prepare printed or digital "puzzle pieces" (each with a line from the payslip: Gross Income, deductions, net income, etc.). 2. Divide learners into small groups. Give each group a mixed-up set of pieces representing the payslip items. 3. Ask them to arrange the items in the correct order and match the right amounts. 4. Once completed, ask groups to: a. calculate the total deductions; b. use the formula to check if the net income is correct; and c. answer the guiding questions (amount deducted, percentage, and purpose of deductions). 5. Discuss the answers and confirm their understanding of the payslip structure. 6. You will say: “Now that we’ve seen what a real payslip looks like, let’s learn how to compute each of these amounts ourselves. We’ll even use spreadsheets to make the process easier and faster” Role-Play as HR and Employee 1. Assign learners in pairs or small groups to role-play a conversation between: a. an HR officer explaining the payslip; and b. a new employee asking questions about their first salary. 2. Provide each group with a copy of the sample payslip. 3. Ask the "HR officer" to explain each line of the payslip clearly. 4. Encourage the "employee" to ask questions such as: a. Why is my take-home pay lower than my salary? b. What do these deductions mean? 5. After the role-play, bring the class together and ask: a. How did the activity help you understand the parts of the payslip better?

b. What's one thing you learned about your future salary?

6. You will say: "Now that we've seen what a real payslip looks like, let's learn how to compute each of these amounts ourselves. We'll even use spreadsheets to make the process easier and faster".

B.2. Discussing the Concept

Activity B.2. **Deepening Conceptual Understanding**

Instructions: With the guidance of your teacher and support from your classmates, study the key concepts, formulas, and examples to help you learn how to compute gross and net income.

Computing Net Income

a. Key Concepts and Formulas

Gross income is the total earnings before any deductions are made. Includes base salary, overtime, commission, and piecework pay.

Gross income = Salary + Allowances

Net Pay is also called "take-home pay." This is the amount left after deductions are subtracted from gross pay.

Net Pay = Gross Income – Total Deductions

Deductions are the amounts subtracted from gross pay by law or agreement. In the Philippines, common deductions include:

1. **Social Security System (SSS)**
   Applicable to: Private sector employees
   Purpose: Retirement, disability, maternity, sickness, and death benefits
   Rate: Based on a schedule tiered to the employee's monthly gross income.

   The total SSS contribution rate is 15% of the employee's designated Monthly Salary Credit (MSC). This total percentage is split between the worker and the company:
   - Employee Share: 5%
   - Employer Share: 10%

   SSS has strict boundaries that dictate how wages are categorized.
   The Minimum Cap (Income Floor): ₱5,000.00 MSC
   - If an employee's gross monthly salary is less than ₱5,250.00, their wage defaults to the lowest bracket base of ₱5,000.00.
   - Absolute Minimum Employee Share: ₱5,000.00 × 5% = ₱250.00

   The Maximum Cap (Income Ceiling): ₱35,000.00 MSC

Activity B.2. **Deepening Conceptual Understanding**

To effectively deliver this part of the lesson, you may use any of the suggested strategies below. Take note of the corresponding tips to enhance implementation.

A. Explicit Teaching

1. Prepare Necessary Materials
   a. Prepare visual aids with key terms and formulas
   b. Prepare printed or digital copies of the problems
   c. Use a projector or board to show step-by-step computation
2. Presentation of the Lesson
   a. Introduce Key Concepts
      - Gross income
      - Net pay
      - Deduction
   b. Present the sample problem and demonstrate the use of Spreadsheet to compute net pay
3. Check for Understanding
   a. Ask comprehension question:
      - How can technology help us compute faster and more accurately?
      - What happens if the gross income increases?
      - How can technology help us compute faster and more accurately?

B. Guided Discovery

1. Present Key Terms and demonstrate the use of spreadsheet
2. Start with a real-life scenario presented
3. Group Work: Observe and discover patterns. Let learners work in groups to solve the remaining problems
4. Prompt Guided Questions:
   a. How can technology help us compute faster and more accurately?
   b. What happens if the gross income increases?
   c. How can technology help us compute faster and more accurately?

C. I Do, We Do, You Do

	- If an employee earns an exceptionally high salary (e.g., ₱50,000.00 or ₱100,000.00), their premium computation hits the maximum bracket base of ₱35,000.00. - Absolute Maximum Employee Share: ₱35,000.00 × 5% = ₱1,750.00 Step-by-Step Payroll Computation To determine an employee's exact deduction during payroll processing, follow this workflow: 1. *Calculate the Gross Monthly Earnings:* Sum the base salary and any taxable allowances or overtime pay received during the month. 2. *Find the Income Bracket:* Locate the official SSS Contribution Table and find where the gross income fits along the "Range of Compensation" column. https://www.sss.gov.ph/wp-content/uploads/2024/12/2025-SSS-Contribution-Table-rev.pdf 3. *Identify the MSC:* Look at the corresponding Monthly Salary Credit (MSC) assigned to that specific bracket. 4. *Multiply by the Employee Rate:* Multiply that specific MSC by 5% to find the exact salary deduction. **2. Government Service Insurance System (GSIS)** *Applicable to*: Government employees only *Purpose:* Life insurance, retirement, disability, and survivorship benefits *Rate:* 9% of monthly salary rounded to the nearest peso (employee share) Under Republic Act No. 8291 (the GSIS Act), mandatory monthly contributions are computed as a direct percentage of the employee's Actual Monthly Basic Salary (MBS). The total mandatory contribution rate is 21%, split as follows: ● Employee (Personal) Share: 9% of the actual Monthly Basic Salary. ● Employer (Government) Share: 12% of the actual Monthly Basic Salary. There is no maximum salary ceiling or income cap for regular GSIS members. Additionally, there is no fixed statutory "floor amount." GSIS membership is compulsory for all government personnel who receive compensation and hold a recognized appointment, regardless of their employment status. This includes regular employees and casual employees. Job Orders (JO), Contract of	1. I DO (Teacher Models) a. Present Key Terms and demonstrate the use of spreadsheet b. Choose one problem type c. Solve the first example aloud, explaining each step of solving the problem using the problem 2. WE DO (Guided Practice) a. Use a think-pair-share format: Let learners first try in pairs, then solve together b. Ask prompting questions to guide them through: • How did you compute the SSS, PhilHealth, and Pag-IBIG? • What is the net pay? 3. YOU DO (Independent Practice) a. Assign problems (e.g., 2–3 from each computation category) b. Let learners solve independently or in pairs c. Encourage showing step-by-step solutions 4. Reflection / Wrap-Up a. Review key takeaways: common deductions on the salary, how to determine these deductions, how to encode formulas in spread sheet. Synthesize the discussion by asking the Processing Questions. 1. Which specific step or calculation rule in the payroll workflow did you find the most challenging or surprising to compute during the activity? 2. How does a person's monthly basic salary, rather than their total gross pay, dictate the actual deduction amounts for mandatory contributions like GSIS and PhilHealth? 3. Why is it conceptually important to subtract non-taxable statutory contributions from an employee's gross income before calculating their monthly withholding tax?

Service (COS) workers, and uniformed personnel are not covered by GSIS.

3. Pag-IBIG Fund (HDMF)

Applicable to: All employees
Purpose: Housing loans, savings, and calamity loans
Rate: 2% of monthly salary rounded to the nearest peso (employee share).

Pag-IBIG (HDMF) has a strict minimum baseline and a maximum cap. The parameters are governed by Pag-IBIG Circular No. 460, which outlines the mandatory contribution rules based on an employee's Monthly Fund Salary (MFS) or Regular Income.

The Maximum Fund Salary cap is exactly ₱10,000.00.

- Any income earned *above* ₱10,000.00 is completely ignored for the mandatory calculation.
- Because the standard rate for incomes over ₱1,500 is 2%, the maximum deduction is locked:
  - Maximum Employee Share: 10,000.00 × 2% = ₱200.00
  - Maximum Employer Share: 10,000.00 × 2% = ₱200.00
  - *Total Maximum Remittance:* ₱400.00

The Minimum Cap

- There isn't a "floor" that forces low-income earners to pay a higher flat amount (unlike PhilHealth's ₱10,000 floor). Instead, the minimum rules change the percentage rate applied to actual earnings:
  - Employees earning ₱1,500.00 or less per month qualify for a reduced Pag-IBIG deduction rate of 1% of their monthly basic contract pay. The employer is still legally required to pay a matching share of 2%.

Despite the set cap, Pag-IBIG allows employees to voluntarily contribute extra money beyond the standard limit to build up personal savings and retirement investments.

4. PhilHealth

Applicable to: All employees
Purpose: Healthcare benefits and hospitalization coverage
Rate: 5% of monthly salary, shared between employee and employer

The total premium rate for PhilHealth Contribution is 5% of the Monthly Basic Salary (MBS) or the Regular Income, which is split

equally (2.5% each) between the employee and the employer. However, the calculation is strictly bound by these limits:

The Minimum Cap (Income Floor): ₱10,000.00

- If an employee earns *less* than ₱10,000.00 a month, their contribution is calculated as if they earned exactly ₱10,000.00.
  - Minimum Total Premium: ₱500.00 per month
  - Minimum Employee Share: ₱250.00

The Maximum Cap (Income Ceiling): ₱100,000.00

- If an employee earns *more* than ₱100,000.00 a month, their contribution is capped exactly at the ₱100,000 limit.
  - Maximum Total Premium: ₱5,000.00 per month
  - Maximum Employee Share: ₱2,500.00

Republic Act No. 11223 (Universal Health Care Act) is the current legal mandate that explicitly governs the progressive increase of PhilHealth premium collections up to the 5% rate along with the designated salary floor and ceiling limits.

5. Withholding Tax (BIR)

Applicable to: All employees

Purpose: To deduct and remit an employee's income tax liabilities progressively

Rate: Based on monthly salary bracket and applicable exemptions for tax rate. Refer to this link https://mpm.ph/bir-tax-table/#incometaxtable

The tax charged directly to a person's income, salary, or wages is called the Withholding Tax on Compensation (often referred to broadly as Individual Income Tax). It is called a *withholding* tax because the employee doesn't have to manually pay it to the Bureau of Internal Revenue (BIR) every month. Instead, the employer is legally mandated to deduct (withhold) the tax directly from the employee's paycheck and remit it to the government on their behalf.

The Philippines uses a progressive tax system regulated by the TRAIN Law (RA 10963- Tax Reform for Acceleration and Inclusion). Under this system, those who earn more are taxed at higher percentage rates, while lower earners are exempted entirely.

The tax is calculated using a structured tiered table.

Payroll Frequency	Bracket/ Column	From	To	Fix Tax	Tax Rate on Excess
Monthly	1	0	20,833	0	0
	2	20,833	33,332	0	15%
	3	33,333	66,666	1,875	20%
	4	66,667	166,666	8,541.80	25%
	5	166,667	666,666	33,541.80	30%
	6	666,667	and above	183,541.80	35%

Step-by-Step Payroll Computation

1. *Determine Gross Compensation Income*: Base Salary + Overtime + Allowances.
2. *Deduct Non-Taxable Items:* Subtract the employee's statutory contributions *(SSS or GSIS, PhilHealth, and Pag-IBIG shares). These are strictly non-taxable.*
3. *Compute* Taxable Income:
   Taxable Income = Gross Income - (SSS or GSIS + PhilHealth + Pag-IBIG)
4. *Apply the Bracket Table:* Look up the Taxable Income amount in the monthly tax bracket table to calculate the exact deduction.

6. Other Deductions (Optional or Conditional)

These deductions depend on agreements between the employee and employer

- Loans
- Cash Advances
- Insurance Premiums
- Union Dues
- Deductions for Absences or Tardiness

b. Computing the Net Income or Net Pay

Examples

Problem 1.

Anna works in a factory and earns ₱550 per day. She worked for 22 days this month. What is Anna's gross income for the month? Considering her deductions for SSS, PhilHealth, Pag-IBIG, and tax, compute her net income for the month.

Solutions

Items	Computation	Amount (₱)
1. Gross Income	**550.00 × 22**	**12,100.00**
2. SSS	12,000.00 × 5%	600.00
3. PhilHealth	12,100.00 × 2.5%	302.50

4. Pag-IBIG	Max: 200.00	200.00
5. Tax	Exempted	0.00
Deductions	Sum of items 2 to 5	**1,102.50**
Net Pay	Gross Income – Deductions	**10,997.50**

Note:

- A Gross Income of ₱12,100.00 falls under a Monthly Salary Credit (MSC) of ₱12,000.00. To compute Anna's SSS Personal Share, multiply the MSC by 5%. *(Refer to the 2025 SSS Contribution Table under SSS Circular No. 2024-006)*.
- In computing the PhilHealth premium, the total 5% contribution is divided equally between the employee and the employer. Therefore, Anna will only contribute her personal share of 2.5%.
- The Pag-IBIG employee share is computed at 2% of the monthly compensation but is strictly capped at a maximum of ₱200.00.

Problem 2.
James earns ₱75 per hour. He worked 160 regular hours and 10 hours Over Time (125% rate). What is James's total gross income, including OT? Considering his mandatory government deductions, compute his net income for the month.

Solutions:

Items	**Computation**	**Amount (₱)**
1. Regular	160 × 75.00	12,000.00
2. Overtime	10 × 75.00 X 1.25	937.50
3. Gross Income	**Sum of items 1 and 2**	**12,937.50**
4. SSS	13,000.00 × 5%	650.00
5. PhilHealth	12,000.00 × 2.5%	300.00
6. Pag-IBIG	Max: 200.00	200.00
7. Tax Withheld	Exempted	0.00
Deductions	Sum of items 4 to 7	**1,150.00**
Net pay	Gross Income - Deductions	**11,787.50**

Note:

- A Gross Income of ₱12,937.50 falls under a Monthly Salary Credit (MSC) of ₱13,000.00. To compute Jame's SSS Personal Share, multiply the MSC by 5%.

Problem 3.
Ms. Rivera is a public-school teacher in the Philippines with a Salary Grade (SG) 22, Step 1. She receives a monthly salary of ₱71,511.00

and non-taxable allowance of ₱2,000.00, but she also has deductions including taxes, contributions, and a GSIS loan of ₱5,000 per month. Find her net pay after all deductions.

Solutions:

Items	Computation	Amount (₱)
1. Regular Salary	Given	71,511.00
2. Allowance	Given	2,000.00
3. Gross Pay	**Sum of items 1 to 2**	**73,511.00**
4. GSIS	71,511.00 × 9%	6,435.99
5. PhilHealth	71,511.00 × 2.5%	1,787.78
6. Pag-IBIG	Max: 200.00	200.00
7. Tax	1,875.00 + (Taxable Income – 33,333.00) × 20%	7,825.85
8. Loan	Given	5,000.00
Deductions	Sum of items 4 to 8	**21,249.62**
Net Pay	Gross Pay - Deductions	**52,261.38**

Note:

- The contributions for GSIS, PhilHealth, and Pag-IBIG are computed strictly based on the Monthly Basic Salary, not the Gross Pay. Allowances, such as the ₱2,000.00 ACA/PERA, are non-taxable and excluded from these computations.
- Under the TRAIN Law, the withholding tax is determined using the Taxable Income (Basic Salary minus mandatory GSIS, PhilHealth, and Pag-IBIG contributions).
- Since the taxable income for this specific bracket falls between ₱33,333.00 and ₱66,667.00, the tax is computed as a fixed ₱1,875.00 plus 20% of the amount exceeding ₱33,333.00.
- The Pag-IBIG employee share is computed at 2% of the monthl compensation but is strictly capped at a maximum of ₱200.00.

B.3. Developing Mastery (Please see the Learning Activity Sheet (LAS) for learners' instructions on this activity.)

Activity B.3: **Practicing Learned Skills: Computing Gross and Net Pay**

Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.
Strategy 1. **Rotating Stations (Activity-Based Learning)**

1. Set Up 5 Stations:
2. Divide class into groups. Assign each to start at one station.
3. Give each station sufficient time. Use a timer to manage transitions.
4. Provide instruction cards or printed guides at each station.
5. Encourage collaboration within groups.
6. Rotate groups clockwise when the timer goes off.

7. Monitor learner work and provide feedback as needed.
8. End with a group debrief to summarize findings from each station.

Strategy 2. **Real-Life Role Play Simulation (Experiential Learning)**

1. Assign learner roles:
   a. HR Officer – manage employee salaries and benefits
   b. Payroll Officer - computes salaries and deductions
   c. Employee – asks about net pay and budgeting
2. Provide each group with a role card and a unique scenario.
3. Give them sufficient time calculate gross, deductions and net pay using spreadsheet
4. Prepare a short role-play conversation explaining deductions and budget decisions.
5. Let each group present or role-play in front of the class.
6. After each group, facilitate reflection.
   a. How did you apply the lesson in the scenario?
   b. In your personal perspective, what is the significance of the lesson in your future?
   a. *Question 5* asks them to act as a financial advisor, predicting the outcome of a ₱2,000 raise using the rules they just discovered.
   b. *Question 6* pushes them into real-world critical thinking, weighing the pros and cons of basic salary vs. allowances for long-term goals like securing bank loans.

C. Demonstrating Knowledge and Skills

C.1. Finding Practical Application

Activity C.1. **Making Real-World Connections**

Instructions:
Analyze the following scenario and do the indicated task.

Scenario:
You have just been hired as the Payroll Officer for a local company called Likhang Kabuhayan Services, a growing business that provides administrative, manufacturing, and delivery services. The company relies on you to make sure that all employees are paid correctly and on time.

During this payroll period, you are in charge of computing the salaries and deductions for five employees. Each one has a different way of earning: some are paid hourly, some get overtime, some earn through commissions, and others are paid per item or delivery completed.

As the Payroll Officer, it is your job to:

1. Compute their gross income based on their work details

Name	**Type of Pay**	**Data Given**
Juan	Annual Salary	₱450,000/year
Maria	Hourly + Overtime	45 hours, ₱120/hour

Activity C.1. **Making Real-World Connections**

In this part, you may apply any of the following strategies. Do not forget to present the rubric in the teachers notes to the learners,

Strategy 1. **Real-World Simulation**

Technology Integration

1. Turn the classroom into a simulated payroll office, where each group acts as a Payroll Department Team responsible for computing the gross pay, deductions, and net pay of the employees.
2. Group learners into teams of 3 to 5.
3. Assign each team a set of employees.
   Note: You may add more employees.
   a. Each team works together using calculator or spreadsheet software (Google Sheets or Excel) to compute. If a laptop is not available, the group may use google sheets through an available phone.
   b. Compute gross pay
   c. Apply all deductions using formulas
   d. Calculate net pay
   e. Format the sheet professionally
4. The group will present their output for feedbacking.

Strategy 2: Peer Audit and Feedback

Carlo	Commission + Base	₱20,000 base + 8% of ₱30,000
Lea	Piece Rate	₱75 per piece, 200 pcs

2. Apply government deductions such as SSS, PhilHealth, Pag-IBIG, and Tax
3. Calculate their net income
4. Use spreadsheet formulas so calculations are automatic and accurate

- Input all employee details
- Use formulas to calculate each part
- Format your payroll sheet clearly (use bold labels, currency symbols, and borders)

5. Submit printed payroll and individual payslip of the employee.

Processing Questions

1. What was the most challenging part of acting as a real-world Payroll Officer while calculating the different payment structures for each employee?
2. How does automated spreadsheet formatting help ensure that an employee's final payslip is legally compliant and easy for them to understand?
3. How will your experience managing this payroll sheet change the way you review your own compensation details or contracts when you enter the workforce?

1. Divide the class into groups.
2. Each group shall prepare a table to show the salaries of the given set of employees. Learners may use a calculator or a spreadsheet. *Note: You may add more employees.*
3. Each group exchanges their completed table or spreadsheet with another group.
4. Using a provided Audit Checklist, they:
   a. Review formulas (Are they correct and automated?)
   b. Check accuracy of the computation of the gross pay, deductions, and net pay of the employees.
5. Each team writes a short feedback report, including:
   a. What was done well
   b. What needs correction (if any)
   c. Suggestions for improvement
6. After receiving feedback, teams revise and finalize their output.

C.2. Making Generalization

Activity C.2. **Wrapping Up the Lesson**

Option 1**. One-Minute Summary Challenge**

Instructions: Analyze your learning from today's lesson and complete the tasks listed below.

1. On a piece of paper or digital document, write a one-paragraph summary of what you learned today about computing salaries, deductions, and net pay.
2. Use your own words and aim to include:
   a. One concept about gross pay
   b. One concept about deductions
   c. One insight about net income and budgeting
3. Use this starter if needed:
   "Today I learned that calculating net income is important because…"

Activity C.2.**Wrapping Up the Lesson**

In this part of the lesson, learners will share their insights on what they have learned and how they can apply their learning in real-life situations. This serves as an opportunity for reflection and practical connection. It also allows the teacher to gather feedback from the learners on which parts of the lesson were clear and which topics may need further clarification. For the summary or generalization, the teacher may select and facilitate one of the suggested activities to reinforce key concepts and ensure understanding.

	4. Share your summary with a seatmate or submit it to the teacher. Option 2. **Explain It Like a Professional** *Instructions*: Collaborate with your peers to complete the activity based on the scenario below. *Scenario* Imagine you are explaining gross income, deductions, and net income to a fellow employee who is confused about how their salary is calculated. Tasks: 1. Pair up or form a small group. 2. Create a short explanation or analogy using simple, real-life examples. 3. Write your explanation clearly on paper or a poster. 4. Share your work with the class or display it on the wall.	
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3, **Assessing Learning Outcomes** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This activity must be completed individually by each learner, as it is essential for assessing their level of understanding of the lesson. Review their work promptly to identify those who may need additional support. Provide timely and appropriate interventions or remediation as necessary. Add more items if needed to reinforce key concepts.	
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.4. **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. These additional exercises may be given as an assignment or homework. Remediation should be provided to learners who have not yet achieved mastery of the lesson, while enrichment activities should be offered to those who are ready for further learning. Add more items if necessary to address the varying needs of learners.	
III. CONTENT	**Lesson 1.3. Applying Percentages in Various Contexts**	
IV. OBJECTIVES	By the end of the lesson, learners will be able to: 1. explain the concept of percentage increase and decrease; 2. apply percentage calculations in various contexts such as inflation, VAT, discounts, and profit/loss; and 3. solve problem involving percentage.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness**	Activity A.1. **Leveling Learners Readiness** *Note: Feel free to add more items as needed to reinforce learning.*

	Instructions: Solve the practical financial problems on your group's challenge cards using your knowledge of percentages. *Card A: Grocery Budget Check* You had ₱1,000 last year for monthly groceries. Prices have gone up by 10%. How much more would you need this year to buy the same items? *Card B: Sale Season Surprise* A shirt originally costs ₱800. It's now on sale with a 25% discount. How much will the shirt cost after the discount? *Card C: VAT Reality Check* An appliance is priced at ₱15,000. Add 12% VAT to find the final price. What is the total amount to be paid? *Card D: Small Business Scenario* You bought a bag for ₱450 and sold it for ₱600. What is your profit in pesos and in percentage? *Card E: Inflation Reflection* Five years ago, the minimum daily wage was ₱400. Now it's ₱610. What is the percentage increase in the wage? *Processing Questions*: 1. What types of problems did you find the easiest? Hardest? 2. How do these problems relate to real-life situations like inflation, business, or taxes? 3. Why is understanding percentage change important when making financial decisions?	To facilitate this activity, follow the steps provided. 1. Prepare challenge cards or slides with the five scenarios (Grocery Budget, Sale Discount, VAT, Profit, and Inflation). You may print them or project them. Ensure learners have access to calculators, scratch paper, or spreadsheets for computations. 2. Arrange learners into small groups of 3–5 members. 3. Introduce the Activity briefly. Say: "*Today, we'll review how percentages work in real-life situations like shopping, inflation, and business. You'll work in groups to solve practical money problems using your percentage skills.*" 4. Distribute or Present the Challenge Cards: a. Give each group a set of challenge cards (or assign one card at a time). b. Instruct them to read the scenario, discuss, and solve the problems as a group. 5. Guide the learners in solving the problem: a. Move around the room to observe, support, and ask guiding questions (without giving direct answers). b. Remind learners to show their solution steps and explain their reasoning. 6. Facilitate Group Sharing: a. After all cards are answered, ask each group to present one of their answers. b. Encourage other groups to comment, confirm, or ask questions. 7. Conclude the Activity: a. Lead a short class discussion using the processing questions. b. Highlight that these problems are a bridge to the new lesson on applying percentage increase or decrease in various financial contexts. 8. Introduce the lesson by saying: "*Today, you've seen how percentages play a big role in your everyday life—from shopping discounts to wages and even taxes. In our next lesson, we'll go deeper and learn how to apply percentage increase or decrease to real-life financial problems such as inflation, mark-ups, VAT, and profit or loss. Let's get started!*
	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. **Appreciating Lesson Relevance** *Instructions:* Look at the price tags shown to you. These show the prices of common grocery items (like rice, oil, and milk) from 5 years ago and their current prices today.	Activity A.2. **Appreciating Lesson Relevance** To facilitate this activity, you may select any of the two strategies. Strategy 1. **Rotating Stations**

	With your group, complete the following tasks: 1. Compare the prices and identify which item increased the most in price. 2. Answer these questions together: ● Which item increased the most? ● How do you know? 3. Estimate the percentage increase for each item. 4. Take turns sharing your group's answers. Then answer these questions: ● Which item had the highest price increase? ● How did you compute the percentage increase? *Processing Questions*: 1. Looking at your results, if an item's price increased by ₱15 and another item's price also increased by ₱15, does that mean they both had the exact same percentage increase? Why or why not? 2. How do these changing "price tags" affect a family's daily or monthly grocery budget? If wages stay the same, but percentages of goods go up, what must a family do? 3. Besides grocery items, in what other real-life financial situations do you think we will experience or see percentages being added to or subtracted from a base cost?	1. Show several price tags from common grocery items (e.g., rice, oil, milk) from 5 years ago and their current prices. 2. Set up stations or tables around the room, each showing price tags for 2 to 3 grocery items with their past and current prices (e.g., rice: ₱40 → ₱55, oil: ₱90 → ₱130). 3. Each group rotates through stations 4. Let learners estimate the percentage increase and share how they computed it. 5. Rank the items from smallest to largest increase 6. Record their observations on a group worksheet Strategy 2. **Math Messenger** Assign roles within each group (e.g., calculator, recorder, presenter, messenger). 1. Show several price tags from common grocery items (e.g., rice, oil, milk) from 5 years ago and their current prices. 2. The "Math Messenger" is the only learner who can walk to the board or teacher's station to get one price tag at a time and bring it back to the group. 3. This turns it into a relay-style game, encouraging teamwork and information sharing. 4. Once all price tags are gathered, the group performs their comparisons and computations. ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1 **Exploring Key Concepts** *Instructions:* Read and understand the scenario below. Then, answer the questions that follow. *Scenario*: A learner sells homemade cookies. Each pack costs ₱80 to make (including ingredients and packaging), and she sells each pack for ₱100. *Questions*: 1. If you spent ₱80 to make a product and sold it for ₱100, did you gain or lose money? Support your answer.	Activity B.1 **Exploring Key Concepts** This activity helps learners understand the basic concepts of profit and loss through a relatable real-life scenario. By analyzing a simple business case of a learner selling homemade cookies, learners will apply mathematical reasoning to determine gains or losses based on cost and selling price. The activity encourages critical thinking about pricing strategies and decision-making in small business situations. It also allows learners to reflect on the importance of understanding financial outcomes, especially for young entrepreneurs or learner sellers. To deliver this activity follow these steps: 1. Start by presenting the scenario.

	2. If the learner offers a promo and sells the cookies for ₱75, is there a gain or a loss? Explain your answer. *Processing Questions:* 1. How does understanding profit and loss help a learner seller? 2. Would you sell at a lower price to attract more buyers, even with less or no profit? Why or why not?	2. Facilitate the activity by applying any of the following suggested strategies: a. Interactive Math Market Game • Divide the class into small "business teams." Give them different product cost scenarios and selling price options. • Ask each team to decide on their pricing, compute the profit or loss, and present their choices as if they are real sellers explaining to potential customers. b. Visual and Hands-On Computation with Charts • Provide worksheets or visual tables where learners fill in cost, selling price, profit/loss, and percent gain/loss for different prices. • Let learners present their completed charts to the class and explain their pricing decisions 3. Wrap up with processing questions. 4. Conclude with discussion: a. How can visualizing profit and loss help you manage a business? b. Would you still sell at a lower price even if you don't earn much?
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding** *Instruction*: To deepen your understanding listen attentively and participate actively in the discussion. **Percentage in the Various Contexts** **1. Understanding Percentage Change** a. *Introduction to Percentage Increase and Decrease* Percentage change (PC) indicates the extent to which a quantity has increased or decreased in relation to its original value. It is often utilized in finance, sales, budgeting, and data analysis. b. *Formula for Computing Percentage Change* $\text{Percentage Change} = \frac{\text{New Value} - \text{Original Value}}{\text{Original Value}} \times 100$ c. *Determining Percentage Change Direction* • If the result is positive, it indicates a percentage increase. • If the result is negative, it indicates a percentage decrease.	Activity B.2. **Deepening Conceptual Understanding** To deepen learners' understanding, facilitate the discussion of the following topics using the suggested steps. You may include additional examples as needed 1. Organize learners into small, mixed-ability groups to encourage peer support and discussion. 2. Provide a learner-friendly handout that explains the key concepts. Allow groups time to read, discuss, and collaborate to ensure everyone understands the material. 3. Create task cards featuring real-world problem sets aligned with the concepts in the handout. Each group will apply what they've learned to solve these scenarios. 4. After solving the tasks, have each group present not only their answers but also what their solution means in a real-life context. 5. Encourage learners to relate the problems to their own live such as budgeting at home, school fundraisers, or small business ideas to deepen understanding and relevance.

d. *Interpreting Positive and Negative Percentages*

- +15%: The value increased by 15% from the original.
- -10%: The value decreased by 10% from the original.

Examples:

1. An item was priced at ₱600 last week. Today, it is being sold for ₱650. By what percentage did the price change, and in what direction?

   Given:

   Original Value= ₱600
   New Value= ₱650
   Percentage Change=?
   Direction=?

   Solutions:

$$\text{PC} = \frac{\text{New Value} - \text{Original Value}}{\text{Original Value}} \times 100$$
$$= \frac{650 - 600}{600} \times 100$$
$$= 8.33\%$$

   Direction: Percentage Increase

2. A stock's value dropped from ₱120 to ₱90. By what percentage did the value change?

   Given:

   Original Value= ₱120
   New Value= ₱90
   Percentage Change=?
   Direction=?

   Solutions:

$$\text{PC} = \frac{\text{New Value} - \text{Original Value}}{\text{Original Value}} \times 100$$
$$= \frac{90 - 120}{120} \times 100$$
$$= -25\%$$

   Direction: Percentage Decrease

2. Inflation and Its Effects

a. *What is Inflation?*

Inflation is the general increase in prices of goods and services over time, resulting in decreased purchasing power.

b. *How Inflation Affects the Cost of Goods*

When inflation occurs, everyday items like rice, bread, or gasoline become more expensive, meaning your money buys less.

c. *Adjusting Wages for Inflation*
To maintain the same standard of living, wages need to increase at the same rate as inflation (or keep pace with inflation). If wages stay the same while prices rise, people will effectively earn less.

d. *Rate of Inflation*
The Inflation Rate measures the percentage change in the overall price level of a country, typically tracked using the Consumer Price Index (CPI) over a specific period (usually a year).

e. *Formula*

$$\text{Inflation Rate} = \frac{\text{CPI}_{\text{Current Year}} - \text{CPI}_{\text{Previous Year}}}{\text{CPI}_{\text{Previous Year}}} \times 100$$

f. *Understanding the Consumer Price Index (CPI)*
CPI represents the average price of a standard "basket" of goods and services (like food, housing, transportation, and utilities) consumed by households.

Examples

1. The average Consumer Price Index (CPI) of the Philippines was 120.0 in 2023 and rose to 124.8 in 2024. What is the country's inflation rate for 2024?
   Given:
   $\text{CPI}_{\text{Previous Year}} = 120.0$
   $\text{CPI}_{\text{Current Year}} = 124.8$
   Inflation rate =?
   Solutions:

$$\text{Inflation Rate} = \frac{\text{CPI}_{\text{Current Year}} - \text{CPI}_{\text{Previous Year}}}{\text{CPI}_{\text{Previous Year}}} \times 100$$
$$= \frac{124.8 - 120.0}{120.0} \times 100$$
$$= 4.0\%$$

2. If the Consumer Price Index (CPI) for food items jumped from 115 to 122 due to agricultural supply shortages, what is the food inflation rate?
   Given:
   $\text{CPI}_{\text{Previous Year}} = 115$
   $\text{CPI}_{\text{Current Year}} = 122$
   Inflation rate =?

Solutions:

$$\text{Inflation Rate} = \frac{\text{CPI}_{\text{Current Year}} - \text{CPI}_{\text{Previous Year}}}{\text{CPI}_{\text{Previous Year}}} \times 100$$
$$= \frac{122 - 115}{115} \times 100$$
$$= 6.09\%$$

3. Mark-ups and Discounts in Business

a. *Difference Between Selling Price and Cost Price*

Cost Price (CP): The original amount a business pays to buy, manufacture, or produce a product.

Selling Price (SP): The final retail price tag set for the consumer. This amount must cover the cost price plus operational expenses (like rent and salaries) to yield a profit.

b. *Computing Mark-up Percentage*

The Mark-up Percentage (MP) indicates how much a business increases the cost price to determine its retail selling price.

$$\text{Mark} - \text{up Percentage} = \frac{\text{Selling Price} - \text{Cost Price}}{\text{Cost Price}} \times 100$$

The top part of the formula (Selling Price − Cost Price) is simply the Mark-up Amount in cash value.

c. Calculating Final Prices after Discounts

A discount reduces the selling price. To find the final price (Discounted Price or DP) in a single step, multiply the original selling price by the remaining percentage (1 − Discount Rate or 1 − r) the customer actually has to pay.

$$\text{Discounted Price} = \text{Selling Price} \times (1 - \text{Discount Rate})$$

Examples:

1. If the cost price of an item is ₱50 and its selling price is ₱75, then what is its mark-up percentage?

   Given:

   Cost Price= ₱50

   Selling Price= ₱75

   Mark-Up Percentage=?

   Solutions:

$$\text{MP} = \frac{\text{SP} - \text{CP}}{\text{CP}} \times 100$$
$$= \frac{75 - 50}{50} \times 100$$
$$= 50\%$$

2. If the cost price of a material is ₱200 and is mark-up to 30%, then what is its selling price?
Given:
Cost Price= ₱200
Mark-Up Percentage= 30
Selling Price=?
Solutions:

$$MP = \frac{SP - CP}{CP} \times 100$$

$$\frac{CP}{100}\left(MP = \frac{SP - CP}{CP} \times 100\right)\frac{CP}{100}$$

$$\frac{MP \times CP}{100} + CP = SP - CP + CP$$

$$SP = \frac{MP \times CP}{100} + CP$$

$$= \frac{30 \times 200}{100} + 200$$

$$= 260$$

3. A product is discounted to 20%. If its selling price is ₱1,000, then what is its discounted price?
Given:
Selling Price= ₱1,000
Discount Rate= 20%
Discounted Price=?
Solutions:

$$\mathrm{DP} = \mathrm{SP}(1 - \mathrm{r})$$
$$= 1000(1 - 0.20)$$
$$= 1000(0.80)$$
$$= 800$$

4. Value Added Tax (VAT)

a. *Introduction to Value Added Tax (VAT)*

- VAT is an indirect consumption tax levied on the sale, barter, exchange, or lease of goods, properties, and services in the Philippines, as well as on items imported into the country.
- Under the National Internal Revenue Code, the standard tax rate is 12%.
- It is an indirect tax. The consumer bears the economic burden of the tax, but businesses act as collection agents that remit the funds directly to the national government.
- VAT-Inclusive Price: The final retail price tag shown to the customer, which already includes the 12% tax. In the

Philippines, businesses are legally required to display VAT-inclusive prices on price tags.

- VAT-Exclusive Price: The base value or net price of an item before the 12% tax is added. This represents the actual revenue the business keeps for itself.

b. *Converting Between VAT-Inclusive and VAT-Exclusive Prices*

VAT can be separated or added using these mathematical formulas:

- Finding the Price Without VAT (VAT-Exclusive Price): To strip the 12% tax out of a retail price tag, divide by 1.12.

$$\text{VAT-Exclusive Price} = \frac{\text{VAT-Inclusive Price}}{1.12}$$

- Finding the Retail Price with VAT (VAT-Inclusive Price)**:** To add the 12% tax to a wholesale or net baseline price, multiply by 1.12.

$$\text{VAT-Inclusive Price} = \text{VAT-Exclusive Price} \times 1.12$$

c. *Computing the VAT Amount*

To determine the exact cash value of the tax collected for the government, use either of these methods.

- Subtraction Method

$$\text{VAT Amount} = (\text{VAT-Inclusive Price}) - (\text{VAT-Exclusive Price})$$

- Direct Percentage Method

$$\text{VAT Amount} = (\text{VAT- Exclusive Price}) \times 0.12$$

Examples:

1. If the VAT-Inclusive Price is ₱112, then what is the VAT-Exclusive Price and the VAT Amount?

   Solutions:

$$\begin{aligned}\text{VAT-Exclusive Price} &= \frac{\text{VAT-Inclusive Price}}{1.12}\\ &= \frac{112}{1.12}\\ &= 100\end{aligned}$$

$$\begin{aligned}\text{VAT Amount} &= (\text{VAT- Exclusive Price}) \times 0.12\\ &= 100 \times 0.12\\ &= 12\end{aligned}$$

2. If the VAT-Inclusive Price is ₱560, determine the VAT-Exclusive Price and the VAT Amount.

   Solutions:

$$\text{VAT-Exclusive Price} = \frac{\text{VAT-Inclusive Price}}{1.12}$$

	$= \frac{560}{1.12}$ $= 500$ VAT Amount $=$ (VAT- Exclusive Price) $\times 0.12$ $= 500 \times 0.12$ $= 60$ 3. If the VAT-Exclusive Price is ₱1,200, then what is the VAT Amount and the VAT-Inclusive Price? Solutions: VAT Amount $=$ (VAT- Exclusive Price) $\times 0.12$ $= 1{,}200 \times 0.12$ $= 144$ VAT-Inclusive Price $=$ VAT-Exclusive Price $\times 1.12$ $= 1{,}200 \times 1.12$ $= 1{,}344$	
	B.3. Developing Mastery	
	Activity B.3: **Practicing Learned Skills** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Math Gallery Walk** 1. Learners or groups solve one problem on chart paper or whiteboards. 2. Their work is displayed around the room for a gallery walk. 3. Peers leave comments or suggestions using sticky notes. **Differentiated Problem Sets** 1. Create three sets of problems aligned to the same learning goal: a. Basic – Focuses on foundational skills b. Intermediate – Involves moderate challenge and reasoning c. Advanced – Includes complex, real-life, or multi-step problems 2. Assign or let learners choose a problem to solve. 3. Explain the activity's purpose. 4. While learners work, circulate and offer guidance or feedback. 5. Lead a short class discussion.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1: **Making Real-World Connections** *Instructions:* Analyze a recent grocery receipt from your home to determine how value-added tax (VAT) and macroeconomic inflation affect your family's actual household expenses. Tasks:	Activity C.1: **Making Real-World Connections** Strategy 1. **Explicit Scaffolding & Model-Lead-Test** 1. Demonstrate the entire process on the board using a sample dataset, executing calculations aloud and showing exactly where to record each value.

1. Select three (3) distinct items from your receipt and write their descriptions down on your paper.
2. Complete the table below:

Item Name	VAT Inclusive Price	VAT Exclusive Price	VAT Amount
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
Total:	_____	_____	_____

3. Multiply each item's VAT-Inclusive Price by 1.05 to find its inflation-adjusted cost, then calculate the new total.
4. Determine the percentage change of the baseline purchase total into its newly projected future total cost to calculate your inflation validation.
5. Write a summary explaining what happens to your family's purchasing power and total take-home grocery volume if your household income remains frozen during this price spike.

2. Present a second sample dataset and call on students to dictate each sequential step, solving the calculations collectively as a class.
3. Direct students to perform the exact same sequence independently using their own unique source data.
4. Circulate around the room while students work, checking their initial calculations to correct structural or procedural mistakes immediately.

Strategy 2. Comparative Peer Checking & Data Validation

1. Have students pair up and exchange their completed task sheets and original data sources with their partners.
2. Instruct students to act as external verifiers by recalculating specific key steps on a separate sheet to check their partner's work.
3. Direct pairs to compare answers and review the task instructions together if any calculated values do not match.
4. Have students check their final calculation against a uniform control number that should match across the entire class to confirm system accuracy.

Strategy 3. Socratic Dialogue & Real-World Synthesis

1. Poll the class to confirm a universal directional trend in their data results to establish a shared baseline experience.
2. Present a hypothetical change in external variables and ask students how that shift impacts their baseline system.
3. Guide the class discussion toward the target professional terminology, using a visual analogy on the board to connect the math to the concept.
4. Direct students to complete their final reflection independently, requiring the use of the newly introduced technical terms.

C.2. Making Generalization

Activity C.2.**Wrapping Up the Lesson**

Option 1. **One Thing I Learned, One I Can Apply**

Instructions: On a small sheet or form, write down the following. Be specific and honest.

1. One thing you learned from today's lesson (e.g., how to compute profit or calculate VAT).
2. One way you can apply it in real life (e.g., during a sale, while checking a receipt, budgeting for lunch, etc.).

Activity C.2. **Wrapping Up the Lesson**

You may choose any of the following activities for wrapping up the lesson.

Option 1. **One Thing I Learned, One I Can Apply**

The primary purpose of this opening activity is to foster rapid metacognition and personal connection by serving as a low-stakes formative assessment. Learners are expected to engage in brief, honest self-reflection to identify their most significant takeaway and

	Option 2. **Think-Write-Share** *Instructions:* Reflect on today's lesson about percentage changes, markups, discounts, and VAT. Write a brief 2–3 sentence reflection addressing the points below. Be ready to share your insights with the class during our discussion. 1. Your key takeaway from the lesson. 2. How this concept applies to your daily life. Option 3. **Foldable Summary Tool** *Instructions:* You will be given a foldable cube template. Write one of the following items on each of the six sides or flaps. Once completed, fold and assemble your cube. Use it as a personal study tool or display it in class for others to see. ● A math term from today's lesson (e.g., markup, VAT) ● Its definition in your own words ● A formula or mathematical rule ● A real-life example ● A sample problem with its step-by-step solution ● A brief reflection sentence	independently evaluate how that knowledge intersects with their daily routines. Option 2. **Think-Write-Share** This activity aims to facilitate collaborative processing and peer validation through structured verbal communication. Learners are expected to transition from internal reflection to expressive articulation by first documenting their insights in complete sentences and then actively listening to and building upon their partner's real-life connections during the sharing phase. Option 3. **Foldable Summary Tool** The purpose of this final task is to encourage kinesthetic synthesis and spatial cognitive organization by transforming abstract academic concepts into a tangible study aid. Learners are expected to systematically deconstruct a single mathematical topic into its component parts, demonstrating multidimensional mastery by mapping a definition, a formula, a real-world scenario, and a step-by-step solution onto a physical object.
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. **Assessing Learning Outcomes** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This activity must be completed individually by each learner, as it is essential for assessing their level of understanding of the lesson. Review their work promptly to provide timely and appropriate interventions for those who may need additional support or remediation. Add more items if necessary to ensure adequate practice and assessment.	
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.4. **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. These additional exercises may be given as an assignment or homework. Learners who have not yet achieved mastery of the lesson should receive remediation, while those who are ready for further learning should be given enrichment activities. Add more items if necessary to meet the needs of all learners.	
V. ASSESSMENT	**To evaluate learners' success in attaining the intended learning competencies, the assessment tools and strategies provided on the link in the table of contents can be utilized to measure understanding, skills, and application of concepts**	
VI. REFLECTION	**To assess and evaluate the effectiveness of the instruction, as well as to identify challenges and plan for improvements in this unit, teachers are encouraged to answer the reflective questions provided in the link indicated in the table of contents**	

Unit 2. SEQUENCE AND SERIES

I. LEARNING GOALS	
Content Standard	*The learners demonstrate knowledge and understanding of …* *a. patterns, arithmetic and geometric sequences.* *b. financial application of sequence and series*
Performance Standard	*The learners are able to describe and present how they use sequences and series to make informed decisions on real-life situations involving earning money, buying and selling, acquiring loans, making investments, and planning purchases.*
Learning Competencies	The learners… 1. describe patterns by inspection including patterns in art and nature. 2. determine the next term of a given pattern, including Fibonacci sequence. 3. identify the rule of a given pattern. 4. illustrate the attributes of arithmetic and geometric sequences. 5. solve problems involving arithmetic and geometric sequences. 6. differentiate sequences from series. 7. illustrate arithmetic and geometric series. 8. represent series using sigma notation and vice versa 9. find the sum of arithmetic and geometric series. 10. solve problems involving arithmetic and geometric series. 11. apply sequences and series to solve financial problems such as periodic payments for loans and mortgage. 12. determine the accumulated values of investment over time using sequences and series.
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Materials and EdTech Tool	**Writing & Drawing Tools** Pens or pencils; Notebook for notes and solutions; Scratch paper for computations; Colored pens or markers **Measurement & Timing** Calculator (optional); Ruler; Timer **Printed Activity Sheets & References** Activity sheets or worksheets; Learning Activity Sheet/worksheet; Meta strips or answer sheets; Formula reference sheet; Printed graph of enrollment data; Visual table/chart of sequences or number patterns; Reference notes or module; Mystery number pattern meta cards **Display & Presentation Materials** Board or visual presentation of sequences; Bond paper or cartolina; Illustration or image of petri dishes showing bacterial growth; Graph or visual presentation materials; Envelope or container for pattern cards **Devices** Laptop; TV/projector; Tablet; Smartphone **Digital Application and Platforms** Google Forms; Desmos Classroom; Lucidchart; Kahoot!; Jamboard; Microsoft Forms; Edmodo; Quizizz; PhET Interactive Simulations; Microsoft Excel; Nearpod; Blooket; Socrative; GeoGebra

	Google Sheets Desmos	Canva Google Slides	Learning Management System (LMS) platforms
	Digital Learning Resources		
	Digital worksheet or guided response form Interactive digital table tools Pre-formatted digital sequence tables Interactive slides	Presentation software Digital Venn diagram templates Simulation videos Interactive sequence simulators	Digital answer sheets with upload features Finance simulation tools LMS quiz tools Online forms for remediation and enrichment activities
AI Declaration	AI tools were used to assist in generating activity ideas, refining instructions, organizing content, creating visual prompts and images, and improving the clarity of this Senior High School lesson exemplar. All AI-assisted outputs were reviewed, revised, and validated to ensure accuracy, relevance, appropriateness, and alignment with the curriculum and intended learning competencies.		

III. CONTENT	**Lesson 2.1. Sequence**	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. identify patterns found in art and nature; 2. describe a sequence; 3. classify sequences as finite or infinite based on their structure and number of terms; 4. determine the next term of a given sequence, including a Fibonacci sequence; and 5. describe the rule for finding the next term in a sequence.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TECAHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learner Readiness** Option 1. **And so… Exploring Animal Life Cycles** *Instructions:* 1. The class will be divided into small groups. 2. Each group will watch a documentary video showcasing an animal's life cycle (for example: the transformation of caterpillar into a butterfly) 3. While watching, take note and/or sketch each stage of the animal life's cycle. Pay attention to the sequence, pattern and characteristics of each stage. 4. After the video, collaborate with your group to create a visual presentation—such as a poster, flipbook, or digital slideshow—illustrating the sequential stages of the observed life cycle. Presentation can also be done using Microsoft PowerPoint or Google Slides or Canva. 5. Presentation must include: a. Title and animal chosen	Activity A.1. **Leveling Learner Readiness** Option 1. **And so… Exploring Animal Life Cycles** Strategy 1. Collaborative Work 1. Begin by explaining the objective: to understand sequencing by observing the stages of an animal's life cycle. 2. Show a documentary video depicting the life cycle of a specific animal. Encourage students to watch attentively, noting the sequence of stages. 3. Introduce sequencing words such as "first," "next," "then," and "finally." Discuss how these words help describe the progression of events or stages. 4. Divide students into small groups. Instruct each group to create a visual representation (e.g., poster or storyboard) of the animal's life cycle, using sequencing words to label each stage. Encourage creativity. 5. Have each group present their visual representation to the class. Facilitate discussion by asking questions such as:

	b. Labeled life cycle stages c. Short descriptive sentences per stage (not just words) d. Correct sequence e. At least one paragraph summary written by the group 6. Present your group's output to the class. *Processing Questions*: 1. What words helped you understand the sequence of events? 2. How did writing sentences help you better understand the life cycle? 3. Why is it important to describe scientific processes in clear language? 4. How does sequencing help us organize information in real life? Option 2. **Innovation Challenge: Cracking the Growth Pattern** *Instructions*: 1. Form groups as assigned by your teacher and designate the following roles: Recorder Presenter Checker Tech Assistant (if using digital devices or Padlet) 2. Read and understand the given scenario carefully. "A team of Senior High School students is participating in a National Innovation Challenge. As part of the competition, they must analyze a numerical pattern used in a smart farming system that predicts crop production. The students need to identify the next values in the pattern to complete the system's data model. The pattern follows a special order called a sequence."5 Examine the sequence: 1, 1, 2, 3, 5, ____, ____ 3. Discuss the following questions with your group: a. What pattern do you observe? b. How are the numbers related to one another? c. What might the next two numbers be? 4. Work together to determine the next two terms in the sequence. Show your solution, computation, or reasoning on your worksheet, scratch paper, or mini whiteboard. 5. Prepare a brief explanation that includes: *The next two numbers in the sequence*	a. What did you learn about the animal's life cycle? b. How did using sequencing words help you understand the progression? Strategy 2. EdTech Integration - Using Padlet *Instructions*: 1. While watching the documentary video, each group will: ● Post each stage of the life cycle on Padlet ● Write complete sentence descriptions (literacy integration), not just keywords ● Example: "The caterpillar stage is when the larva eats leaves and grows rapidly." 2. Upload or attach: ● sketches ● screenshots (if allowed) ● keywords or patterns observed This allows learners to record sequences in real time and avoid forgetting stages. 3. After viewing, students will: ● Rearrange or refine their Padlet posts into the correct sequence ● Comment on groupmates' posts to: ● confirm order ● correct misunderstandings and add missing details This supports sequence-building and pattern recognition, aligning with: ● describing a sequence ● identifying structure ● preparing for finite vs infinite classification 4. During the **Literacy Integration Phase (Writing Support)** Students use Padlet to: ● Write a short paragraph summary of the life cycle ● Use sequencing words: first, next, then, finally ● Explain: pattern observed; rule of progression This strengthens; paragraph writing coherence and cohesion mathematical communication 5. During the Generalization Phase (Class Synthesis) The teacher uses Padlet as a: visual concept wall

	The rule or pattern used: A short explanation written in complete sentences *Example: "The next numbers are 8 and 13 because each term is obtained by adding the two preceding terms."* 6. Post your group's answer and explanation on Padlet (or present it to the class if Padlet is not available). 7. Review the responses of other groups. Participate in the class discussion by: Comparing answers *Giving constructive feedback* *Explaining why you agree or disagree with a solution* Example comments: "*We agree because the pattern follows the same rule throughout the sequence."* *"Please check the relationship between the previous terms.* 8. Participate in the Race Challenge Round. For each sequence shown by the teacher: Identify the next term. Explain the rules or patterns. 9. Work quickly and accurately with your group. 10. Complete the Group Reflection by answering the following question: *"How did your group identify the pattern and determine the missing terms?"* *Use mathematical vocabulary such as: sequence, term, pattern, rule, next term.* 11. Be prepared to share your group's findings and reflection with the class. *Processing Questions:* 1. What pattern or relationship did you observe among the terms in the sequence? 2. How did your group determine the missing terms in the sequence? 3. Why is it important to identify the rule of a sequence before predicting the next term? 4. What challenges did your group encounter while analyzing the sequence, and how did you overcome them?	source of student-generated ideas Teacher will: project selected posts highlight strong explanations connect student answers to formal concepts: sequence pattern finite/infinite rule of a sequence This helps learners construct the general rule from their own outputs. Option 2. **Pattern Detectives: Cracking the Innovation Code** 1. Print the sequences and gather pens. 2. Form groups of 4 to 5 learners. 3. Have each group assign roles (Recorder, Presenter, Checker, Tech). 4. Hand out the materials. 5. Share the real-world scenario. 6. Share the goal: Find the pattern and extend it. 7. Show this sequence: **1, 1, 2, 3, 5, ___, ___**. 8. Ask the class to observe the relationships and predict the next numbers using math vocabulary. 9. Tell groups to solve the sequence and find the next two terms. 10. Tell groups to write down their computations and a complete-sentence explanation. 11. Circle the room, ask guiding questions, and assist struggling groups. 12. Have groups post to Padlet or visual aids to present their work. 13. Have group representatives explain their answers to the class. 14. Lead a quick discussion to compare solutions, give polite feedback, and praise good math reasoning. 15. Flash these three patterns one by one: a. **2, 4, 8, 16, ___** b. **3, 6, 9, 12, ___** c. **5, 10, 20, 40, ___** 16. Give groups 30 to 60 seconds per pattern to find the next term and the rule. 17. Ask groups to write a reflection answering: *"How did you find the pattern and missing terms?"*

	5. How can recognizing patterns and sequences help you in real-life situations, future studies, or career pathways such as business, technology, engineering, or research? 6. If one term in the sequence were changed, how might it affect the succeeding terms? Explain your answer.	a. Require them to use the words: **sequence, term, pattern, rule,** and **next term**. b. Have a few groups share their reflections out loud. c. Collect each group's final sheet containing the answers (8 and 13), the rule, the explanation, and the reflection. Bridge to the next lesson: "Today you discovered that sequences follow patterns and rules. In our next discussion, we will formally study how sequences are classified and how rules help predict future terms."
	A.2. Establishing the Purpose of the Lesson	
	Activity A.2. **Appreciating Lesson Relevance: Pattern Hunt** *Instructions*: 1. Pictures from nature and artwork featuring striking images that highlight patterns will be shown through a slide show. 2. Observe the pictures and look for repetition, symmetry, shapes, or structure. 3. Discuss your observations with a partner, then share your insights with the class. Nature: Art: Wassily Kandinsky, Circles in a circle, 1923 Frank Stella's 'Harran II', 1967 *Processing Questions:* 1. What mathematical patterns (such as repetition, symmetry, or sequence) did you observe in the pictures and artworks?	Activity A.2. **Appreciating Lesson Relevance: Pattern Hunt** To facilitate this activity, the teacher may apply one of the following strategies: Strategy 1. **Hear Me** 1. Prepare a slideshow featuring various pictures captured from nature and art. 2. Let students observe the pictures carefully, noting details such as symmetry, repetition, shapes, and structure. 3. Have them discuss their observations with a partner, then share their insights with the class. 4. Connect to the lesson by asking students to give more examples of patterns they see in nature. 5. After sharing, say: "Just like we see patterns in nature and art, we can find patterns in numbers too. These number patterns are called sequences. Today, we will describe sequences of numbers through observation, inspecting what changes and what repeats—just like what we did with the images." Strategy 2. **Pattern Gallery Walk** 1. Post printed images from nature and art around the room. 2. Divide students into small groups and have them visit the posted images. 3. Ask them to describe the patterns they see using terms like repeating, increasing, decreasing, and symmetry. 4. Connect to the lesson by asking students to give more examples of patterns they observe in nature. 5. After sharing, say: "Just like we see patterns in nature and art, we can find patterns in numbers too. These number patterns are called sequences. Today, we will describe sequences of numbers through observation,

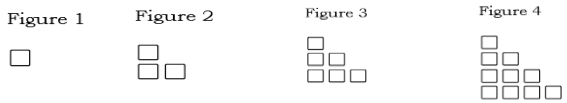
	2. How do the observed patterns help us understand the connection between mathematics, art, and nature? 3. Why is recognizing patterns important in solving mathematical problems and understanding real-life situations? 4. Which image best demonstrates symmetry or structure, and what specific details support your observation? 5. What insights or realizations did you gain about the relevance of mathematics in everyday life through this activity?	inspecting what changes and what repeats—just like what we did with the images." ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Pattern Please** *Instructions*: 1. Form small groups and examine the sequence written on each strip. 2. Observe the relationship between the terms and identify the pattern or rule used in the sequence. a. 4, 8, 12, ___, ___ b. 1, 2, 4, 8, ___, ___ c. 1, 1, 2, 3 ,5, ___, ____ d. 1, 4, 9, 16, 25, . . . e. 1, ½, 1/3, ¼, . . . 3. Discuss within the group how the terms are generated. 4. Write the next two terms of the sequence. 5. Explain your answer by describing the pattern or rule followed. 6. Share your group's observations and solutions with the class.	Activity B.1. **Exploring Key Concepts: Pattern Please** *Instructions*: 1. Introduce the activity by saying: "If nature has patterns, so do numbers. Let us now explore some examples of number sequences." 2. Hand out the strips to pairs of students. 3. Ask students to identify the pattern, continue the sequence, and explain their thinking. 4. Have them identify the rule they discovered and share it with the class. 5. Emphasize how to determine the next terms in the given sequences. *Processing Questions:* 1. What pattern did you observe in the sequence? 2. How did you determine the next terms? 3. Are the terms increasing or decreasing? 4. What operation or relationship exists between consecutive terms?
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding: Lesson Discussion of Sequences** *Instructions*: Study the information and examples and prepare for class discussion.	Activity B.2. **Deepening Conceptual Understanding: Lesson Discussion of Sequences** To facilitate the discussion, the teacher may select any of the given strategies or any strategy that suits the needs of the learners. Additional examples may be provided if necessary Strategy 1. **Interactive Formula Mapping** 1. Prepare sets of cards:

	Key Terms and Definitions **Sequence** - a list of numbers arranged in a specific order, following a rule. Example: 3, 6, 12, 24, . . . **Term** - each number in a sequence. Example: In sequence 3, 6, 12, 24, each of the numbers 3, 6, 12, and 24 is a term. **Position (or Index)** - the place of a term in the sequence, usually counted as 1st term, 2nd term, and so on **Notation**: a_1 is the first term, a_2 is the second term, etc. In general, a_n denotes the nth term **Rule (or Pattern Rule**) - a description of how the term is formed or how they change from one to the next. Example: "Add 2" in the sequence 2, 4, 6, 8, ... **Fibonacci Sequence** - a sequence where each term after the first two is the sum of the two preceding terms. Example: 1, 1, 2, 3, 5, 8, 13, ... **Classification of Sequences** (based on the number of terms) **Finite Sequence** A finite sequence has a specific number of terms – it has a beginning and an end. You can count all the terms. It stops after a certain point. Example: 2, 4, 6, 8, 10 (This sequence has 5 terms – it ends at 10) **Infinite Sequence** An infinite sequence has no end- it goes on forever. It keeps following the same rule endlessly. You can describe the rules, but you can't list all the terms. Example: 1, 2, 4, 8, 16, 32, ... (This keeps doubling and never stops.) In mathematical notation, an infinite sequence often includes ellipsis "..." to show it continues. *Processing Questions*:	Set A: Key terms Set B: Definitions Set C: Examples 2. Distribute shuffled cards to small groups. 3. Groups must correctly match all three: term, definition, and example. 4. After the given time, review answers as a class. Strategy 2. **Word Hunt Instructions** 1. Prepare cards with terms and definitions written on them. 2. Place the cards around the room or distribute them randomly. 3. Divide students into small teams. 4. Each team searches for cards that match terms with their corresponding definitions. When they find the correct pair, they return to the teacher for confirmation. 5. After all cards are matched, discuss each pair with the class, ensuring everyone understands how the definitions and terms connect. 6. Practice with examples using the definitions. Strategy 3. **Peer Teaching Instructions** 1. Create teaching stations for each term with its definition. 2. At each station, prepare: 3. The definition for that term. 4. An example related to the term. 5. Split the class into small groups and assign each group to a station. 6. Each group explains the term, definition, and example at their station. 7. After the given time, rotate the groups to the next station. 8. When all groups have visited each station, bring the class together to discuss any challenges or findings. Strategy 4. **Video Lesson** To reinforce student understanding of sequences and series, you may integrate the following video material into your lesson: Title: Sequences and Series Link: https://www.youtube.com/shorts/qW0yF2_-Lec How to Use: 1. Download or stream the video ahead of time to avoid connectivity issues in class.

	1. Looking at the sequence 3, 6, 12, 24, …, what do we call each number in the sequence, and what pattern do you observe? 2. In the sequence 5, 10, 15, 20, …, what is the position of the number 15, and how would you represent it using sequence notation? 3. Why is it important to identify the rules or patterns of a sequence before finding the next terms? 4. How can you tell whether a sequence is finite or infinite? Give one example of each. 5. Compare the finite sequence 2, 4, 6, 8, 10 and the infinite sequence 1, 2, 4, 8, 16, … What similarities and differences do you notice? 6. A sequence is written as 7, 14, 21, 28, … without a last term shown. Can you immediately conclude that it is an infinite sequence? Why or why not? Sample Exercise1. Identifying a Sequence Observe the Pattern Figure 1 Figure 2 Figure 3 Guide Questions a. How many dots are in Figure 1? b. How many dots are in Figure 2? c. How many dots are in Figure 3? d. What sequence is formed? e. What pattern do you observe? Sample Exercise 2. Consider the sequence: 5, 10, 15, 20, 25, … **Question** **Answer** a. What is the first term? _____ b. What is the third term? _____ c. What is the fifth term? _____ d. What is a_2? _____ e. What is a_4? _____	2. The video provides a step-by-step explanation of the concepts with examples and visuals, ideal for learners needing reinforcement. 3. Play the video during the session, pausing at key points to explain or clarify. 4. After the video, engage students in practice problems to apply what they learned in a hands-on, guided way. **Teacher's Point:** Each number is called a term, and its location is called its position. *Processing Questions*: 1. Looking at the sequence 3, 6, 12, 24, …, what do we call each number in the sequence, and what pattern do you observe? 2. In the sequence 5, 10, 15, 20, …, what is the position of the number 15, and how would you represent it using sequence notation? 3. Why is it important to identify the rules or patterns of a sequence before finding the next terms? 4. How can you tell whether a sequence is finite or infinite? Give one example of each. 5. Compare the finite sequence 2, 4, 6, 8, 10 and the infinite sequence 1, 2, 4, 8, 16, … What similarities and differences do you notice? 6. A sequence is written as 7, 14, 21, 28, … without a last term shown. Can you immediately conclude that it is an infinite sequence? Why or why not?

Sample Exercise 3. Staircase Sequence Investigation
Count the number of squares in each figure and answer the questions that follow.

Pattern



Complete the Table

Figure Number	Number of Squares
1	_____
2	_____
3	_____
4	_____

Guide Questions

1. What sequence is formed by the number of squares?
2. What is the first term (a_1) of the sequence?
3. What is the fourth term (a_4) of the sequence?
4. How many squares are added from Figure 1 to Figure 2?
5. How many squares are added from Figure 2 to Figure 3?
6. Predict the number of squares in Figure 5.
7. Is the sequence finite or infinite? Explain your answer.

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3. **Practicing Learned Skills**

Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.

Strategy 1. **Think-Pair-Solve-Share**

1. Give each learner a set of problems.
2. Ask them to solve one problem alone (Think).
3. Then pair them with a seatmate to discuss and solve the next problem together (Pair + Solve).
4. Finally, invite volunteers or randomly chosen pairs to share their answers and explain their reasoning to the class (Share).
5. Use visual aids like posters or digital slides to display each problem.

Strategy 2. **Color-Coded Stations**

1. Prepare 5 index cards or printed task cards, each with one problem (use different colors for each type of problem).
2. Divide the class into small groups of 4–5 students.
3. Give each group one card to solve together.
4. After the allotted time, say “Pass!” and have groups pass their card clockwise to the next group.
5. Continue until all groups have solved all cards.
6. Conduct a quick review afterward to clarify steps and encourage reflection.

<table>
<tr><td></td><td colspan="2">Strategy 3. Interactive Whiteboard Relay
1. Divide the class into two teams.
2. Display one problem at a time on the board or projector.
3. A learner from each team race to solve and explain their answer on the board.
4. Award points for correct answers and clear explanations.
5. Encourage class discussion after each round—ask if anyone solved it differently or spotted errors.</td></tr>
<tr><td rowspan="2">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td>Activity C.1.
Making Real-World Connections: Saving Up Smartly

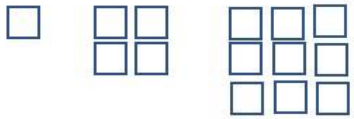
Instructions:
Read and analyze the given real-life situation about saving money using sequence. Study the pattern in the weekly savings and use the appropriate strategy to answer the questions that follow. Show your complete solution and explain your answers clearly. For the reflective question, write your answer in 2–3 sentences.

Scenario:
A student wants to build a personal savings fund. They commit to saving ₱50.00 in the first week and increase the amount they save by ₱15.00 each week.
Week 1: ₱50.00
Week 2: ₱65.00
Week 3: ₱80.00

Questions:
1. Determine the amount the student will save in Week 10.
2. Find the total amount saved after 10 weeks.
3. Determine the number of weeks needed for the student to save at least ₱1,500.00.
4. Explain how a savings plan like this can help a person achieve financial goals such as buying a gadget, funding a project, or starting a small business.</td><td>Activity C.1.
Making Real-World Connections: Saving Up Smartly

Instructions:
1. Begin by asking learners:
a. "Have you ever saved money for something you wanted to buy?"
b. "How do people gradually build savings over time?"
2. Facilitate a short discussion on the importance of budgeting and saving money for future goals.
3. Present the scenario and explain that learners will use their knowledge of sequences to analyze a realistic financial situation.
4. Distribute the activity sheets or display the scenario on the screen.
5. Ask learners to read the scenario individually.
6. Organize learners into pairs or small groups.
7. Instruct learners to:
a. Identify the pattern in the weekly savings.
b. Determine the rules governing the sequence.
c. Solve the given problems using appropriate mathematical procedures.
d. Explain their solutions clearly.
8. Answer the reflective question using complete sentences.
9. Monitor learners as they work and provide guidance when necessary.

Differentiation Strategy
For Learners Needing Support
• Provide a partially completed savings table.
• Allow the use of calculators.
• Pair learners with peers who can assist them.</td></tr>
</table>

		For Advanced Learners • Challenge them to modify the savings plan by changing the weekly increase. • Ask them to compare two different savings strategies and determine which reaches ₱1,500 faster.
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson: Patterns Speak** *Instructions*: Study each sequence carefully. Observe how the numbers change from one term to the next. Then answer the questions that follow. Sequence A 3, 6, 9, 12, 15 Sequence B  Sequence C 100, 50, 25, 12.5 Questions: 1. What changes do you observe in each sequence? 2. How is each term related to the term before it? 3. What rule or pattern can you generalize from each sequence? Part A: Think–Pair–Share Think (Individual Reflection) 1. Review the sequences and patterns discussed in today's lesson. 2. Reflect on the question: *"What patterns or rules did you notice in the sequences we studied today?"* 3. Write your answer in 2–3 sentences on your notebook or activity sheet. Pair (Collaboration) 1. Pair up with a classmate. 2. Share and compare your observations about the patterns and rules found in the sequences. 3. Discuss the similarities and differences in your answers.	Activity C.2: Wrapping Up the Lesson **Patterns Speak** To help students make meaningful generalizations, the teacher may use the Think-Pair-Share approach combined with sentence frames to promote reflection, discussion, and synthesis for deeper understanding. Steps: 1. Think (Individual Reflection) Let the student write his/her reflection on the question: "What patterns or rules did you notice in the sequences we studied today? 2. Pair (Collaboration) Sharing thoughts with a partner. Prompt: "Compare what you noticed in the lesson. Did you find the same rule? What general statement can you form?" 3. Share (Class Synthesis) Invite at least three student volunteers to share their general statements with the class. Write the shared generalizations on the board. Sequence Storytelling 1. Assign each group a sequence. 2. Groups create a short story or scenario where their assigned sequence is evident. 3. Classmates identify the sequence and discuss its characteristics. Processing Questions: 1. What is a sequence, and how is it different from an ordinary list of numbers? 2. How can we determine the rules or patterns of a sequence? 3. Why is it important to analyze the relationship between consecutive terms in a sequence?

	4. Together, formulate a general statement about what a sequence is and how patterns help describe sequences. Share (Class Synthesis) 1. Be ready to share your group's general statement with the class. 2. Listen to the ideas shared by other groups and take note of important insights. 3. Refine your understanding of sequences based on the class discussion. Part B: Sequence Storytelling 1. Work with your assigned group and receive a sequence from your teacher. 2. Analyze the pattern or rule of the assigned sequence. 3. Create a short story, situation, or real-life scenario in which the sequence naturally appears. 4. Prepare a brief presentation of your story without directly revealing the sequence rule. 5. Present your story to the class. 6. Listen carefully to the presentations of other groups. 7. Identify the sequence represented in each story and describe its characteristics or patterns. Remember: Use mathematical language when explaining patterns and support your ideas with examples from the sequence.	4. What is the difference between a finite sequence and an infinite sequence? 5. How do sequences help us understand and solve real-life problems?
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. Assessing Learning Outcomes Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Strategy 1. **Paper-and-Pencil Quiz (Traditional Assessment)** 1. Learners answer a short test similar to the given activity. 2. Multiple choice and short-answer items 3. Includes identifying rules, finding next terms, and explaining patterns briefly Strategy 2. EdTech-Based Evaluation Strategies 1. Online Quiz (Google Forms / Microsoft Forms) 2. Auto-graded multiple-choice and short-answer items 3. Instant feedback for students 4. Teacher analytics for mastery tracking	

	Game-Based Assessment (Kahoot / Quizizz) Timed sequence questions Immediate scoring and leaderboard Engaging review of concepts Strategy 3**. Board Work / Seatwork (Manual + Oral Checking**) 1. Selected students solve sequence problems on the board or paper. 2. Teacher checks solution steps 3. Class discusses corrections and patterns 4. Purpose: Assesses problem-solving process and step-by-step reasoning.
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4: Extending and Reinforcing Learning Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Strategy 1. **Differentiated Guided Practice (Teacher-Led Small Group Instruction**) *Facilitation Guide*: 1. Group learners based on their performance in the previous activity or assessment. 2. For the remediation group, revisit the basic concept of sequences (e.g., identifying patterns through addition or multiplication) using simple examples and step-by-step explanation. 3. Provide scaffolded exercises (e.g., completing missing terms, identifying rules from simple sequences). 4. For the enhancement group, present more challenging tasks such as multi-step sequences, word problems, or creating their own sequence problems. 5. Facilitate while circulating among groups, asking guiding questions like: *"What operation is repeated?"* or *"How does this term relate to the previous one?"* 6. Conclude by letting each group share one solution or insight. Strategy 2. **Station Rotation Activity (Paper-Based + Optional EdTech Integration**) *Facilitation Guide:* 1. Prepare 2–3 stations before class: Station 1 (Remediation): Basic sequence drills (identify patterns, fill in missing terms, guided examples). Station 2 (Core Practice): Mixed-level problems for independent practice. Station 3 (Enhancement): Higher-order tasks such as creating sequences, solving real-life problems, or explaining patterns. 2. Divide learners into small groups and assign rotation schedules (e.g., 10–15 minutes per station). 3. Provide clear written instructions at each station so students can work independently. 4. Monitor and give support where needed, especially for remediation learners. 5. End the activity with a quick whole-class sharing or reflection. Optional EdTech Integration: Use Google Forms or Quizizz at one station for immediate feedback practice

III. CONTENT	Lesson 2.2. Sequences and Series	
IV. OBJECTIVES	At the end of the lesson, the learners are should be able to: 1. describe a series; 2. identify whether a given list of numbers is a sequence or a series; 3. explain the key difference between a sequence and a series; and 4. write a given series in sigma notation and vice versa	
V. PROCEDURES	LEARNERS ACTIVITIES	ANNOTATION FOR TEACHERS
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness:** Part I. **Pattern Detectives the Rule** *Instructions:* 1. Form groups with 4–5 members. 2. Assign the following roles within the group: Leader, Recorder, Presenter, Timekeeper, Encourager 3. Analyze the number patterns shown on the screen. Pattern A: 2, 4, 6, ___ Pattern B: 1, 1, 2, 3, ___ Pattern C: 100, 90, 80, ___ Pattern D: Square tile patterns:1 tile, 4 tiles, 9 tiles, ___ 4. Solve the Challenge ● For each pattern, accomplish the following tasks: ● Write the next missing term. ● Identify the rules or patterns being followed. ● Explain how the pattern changes from one term to another. 5. Each group will creatively present one assigned pattern through: ● body movements ● clapping rhythm ● drawing ● gestures ● or real-life examples Example: ● Increasing pattern → stepping forward ● Decreasing pattern → stepping backward ● Fibonacci pattern → combining previous actions 6. Class Discussion ● The presenter explains the group's answers and reasoning. ● Other groups may agree, challenge, or add explanations. Part II. "Sequence or Series?" Quick Response Instructions:	Activity A.1. **Leveling Learners Readiness** Part I. **Pattern Detectives the Rule** 1. Prepare the Materials 2. Arrange learners into groups with 4–5 members. 3. Assign roles within the group. 4. Introduce the Activity by saying: "Today, you will become Pattern Detectives. You will analyze number patterns, discover rules, and explain how numbers are related. Your observations will help us understand sequences and series." 5. Present the Number Patterns 6. Give the Group Task: a. identify the next missing term b. determine the rule or pattern c. explain how the pattern changes d. prepare a short explanation for class sharing 7. While learners are working: a. move around the classroom b. observe participation c. ask guiding questions such as • "What do you notice about the numbers?" • "How does one term change to the next? • "Is there a repeated operation? 8. Provide support to groups that need assistance. Part II. "Sequence or Series?" Quick Response 1. Present examples of sequence and series and let learners identify if it is sequence or series. 2. Instruct learners to raise BLUE CARD for Sequence GREEN CARD for Series 3. Discuss the correct answers briefly. 4. Ask Processing Questions

	The teacher will flash a set of numbers on the screen. Raise: BLUE CARD → if it is a sequence GREEN CARD → if it is a series Examples 3,6,9,12,… 3+6+9+12+… 2,4,8,16,… 2+4+8+16+… *Processing Questions*: 1. What is the next term in Pattern C? How did you determine your answer? 2. Which patterns show numbers increasing? Which show numbers are decreasing? 3. Compare Pattern A and Pattern B. How are they similar and different? 4. How can you tell whether a set of numbers follows a rule or pattern? 5. Suppose you create your own pattern. What rule would you use, and how would you explain it to your classmates?	5. Conclude the activity by saying: "The patterns you analyzed today are examples of mathematical relationships. Some represent sequences, while others can form series when terms are added together. These concepts will help us learn how to represent series using sigma notation."
	A.2. Establishing the Purpose of the Lesson	
	Activity A.2. **Appreciating Lesson Relevance: Discovering Patterns in Real Life** *Instructions*: 1. Work with your group and carefully read the real-life scenario assigned to you. **Scenario 1:** Maria saves ₱50 on the first week and increases her savings by ₱20 every week. **Week** **Savings (₱)** 1 50 2 70 3 90 4 110	Activity A.2. **Appreciating Lesson Relevance: Discovering Patterns in Real Life** *Facilitation Guide*: 1. Present the real-life scenario and allow learners time to read and analyze the given information. 2. Encourage learners to observe the pattern and discuss their ideas within their groups. 3. Ask probing questions such as: a. What do you notice about the numbers? b. How is each term related to the previous term? c. Can you predict the next term? How? 4. Allow groups to share their observations and reasoning. 5. Highlight similarities and differences among the patterns identified by the learners.

	Questions: 1. What pattern do you observe? 2. How much will Maria save on the 10th week? 3. How can we predict future amounts without listing all weeks? **Scenario 2** The content creator has 100 followers. Each week, the number of followers doubles. Week Followers 1 100 2 200 3 400 4 800 **Questions:** 1. What happens to the number of followers each week? 2. Is the increase constant? 3. How many followers will there be after 10 weeks? **Scenario 3:** The first row has 10 seats, and each succeeding row has 2 additional seats. **Questions:** How many seats are in the 5th row? How many seats are there altogether in the first 10 rows? 2. Observe the numbers, quantities, or situations presented in the scenario. 3. Identify the pattern shown in the sequence of values. 4. Complete the table or organizer provided by your teacher. 5. Answer the guide questions and explain how you identified the pattern. 6. Predict the next three terms in the sequence and justify your answers. 7. Discuss how the pattern can help solve or predict outcomes in the given real-life situation. 8. Prepare a short explanation of your group's findings and be ready to share them with the class.	6. Guide learners to recognize that patterns can be represented mathematically as sequences. 7. Connect the real-life scenarios to the lesson by introducing the concepts of arithmetic and geometric sequences and their applications in everyday life. *Processing Questions*: 1. What pattern did you observe? 2. How did you determine the next term? 3. Why is recognizing patterns important in real-life situations? 4. How can sequences help us make predictions and decisions? ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	**B.1. Presenting Examples**	
	Activity B.1. **Exploring Key Concepts: From Blocks to Sums** *Instructions:*	Activity B.1. **Exploring Key Concepts: From Blocks to Sums** *Facilitation Guide*:

	Part 1. **Group Formation and Roles** Form groups of 4–5 members. Quickly assign the following roles: **The Architect (Leader):** Manages the workflow and ensures everyone participates. **The Scribe (Recorder):** Writes down the data and final patterns on the Manila paper. **The Voice (Presenter):** Speaks on behalf of the group during the presentation. **The Tracker (Timekeeper/Encourager):** Keeps the group on schedule and keeps energy high. Part 2. **The Discovery Phase** Step 1. Analyze the Data Your group has been assigned one of the following lists of numbers. Study it carefully. **Group A:** 2, 4, 6, 8 **Group B:** 1, 3, 5, 7 **Group C:** 5, 10, 15, 20 **Group D:** 2, 4, 8, 16 Task 1: On your Manila paper, describe the pattern of your list. What is the rule to get to the next number? Step 2**: The Accumulation Challenge** Imagine these numbers represent daily monetary savings, blocks built on a tower, or points scored per round in a game. **Day 1:** You get the 1st number. **Day 2:** You get the 2nd number. **Day 3:** You get the 3rd number. **Day 4:** You get the 4th number. Task 2: Calculate the grand total accumulated by the end of Day 4. On your Manila paper, write out the exact mathematical expression showing how you combined these numbers to get that final total.	**1. Before the Activity (Pre-Gaming)** • Crucially, do not use the words "series," "addition," or "sum" during your introductory remarks. The power of this lesson depends entirely on inductive discovery. Refer to the mathematical representations initially as "lists of numbers" or "ordered sequences." • Distribute activity materials, Manila paper, and markers to each team. Ensure that the "Action Cards" (the large numbers, plus signs, and equals signs) are stacked face-down on the tables, so groups do not guess the trajectory of the mechanics prematurely. **2. During the Activity (Monitoring & Scaffolding)** Part 2. **The Discovery Phase** • Circulate around the classroom. Ensure that groups are identifying the underlying arithmetic or geometric operational shift between terms (e.g., adding a constant 2, or doubling the preceding value). • If a group struggles to construct the mathematical expression for their accumulation total, prompt them with: "If you had to write out the exact, raw calculator strokes needed to prove your total to another team, what sequence of keys would you press?" You want them to write out the full additive framework (e.g., 2 + 4 + 6 + 8) rather than jumping directly to the single numerical value. Part 3. **The Living Equation** • Direct the students responsible for inserting the operational sign cards (+ and =) to move into position silently. These deliberate silent dynamic forces the rest of the observing class to focus visually on the structural transformation taking place.

Part 3. **The Living Equation**

1. Each group will stand up and physically build their mathematical expression for the class using their Action Cards.
2. Four students will hold up the individual daily numbers, standing in order from left to right.
3. Without speaking, other group members must step in and place the + and = signs between the students where they belong.
4. The final student will reveal the grand total.
5. The Voice will explain: "Our pattern was increasing by [X]. Our grand total is [Y]."

Part 4: Guided Inductive Analysis (Processing Questions)
Look at the work of all groups displayed on the board. Answer the following questions together as a class or in your groups to define today's math concepts.

Phase A. **Distinguishing Sequence vs. Series**

1. Look at how the numbers were originally listed in Step 1 (separated by commas) versus how they looked in Step 2 and the presentations (separated by plus signs).
   - What is the structural difference between a list of ordered numbers and the total accumulation of those numbers?
   - If the comma-separated list is called a Sequence, how would you define a Series in your own words based on what you just did?
2. Complete this sentence:

"A sequence is a list of numbers, whereas a series is the _____ of those numbers."

Phase B. **Deepening the Concept**

1. Compare the sequence 2, 4, 6, 8 and the expression 2 + 4 + 6 + 8.
   - Which one is a set of individual coordinates/points?
   - Which one results in a single, static value? What is that value?
2. Real World Connection: Think of a movie. A sequence is like watching individual frames of a movie one after the other. What part of the movie experience is like a series? (Think about the total runtime or the plot building up).

- Enforce tight pacing to maintain high energy. Keep each group's physical presentation concise, targeting a maximum window of 1.5 to 2 minutes per team.

3. After the Activity

Part 4. **Guided Inductive Analysis (Processing Questions)**

This structured reflection is where the conceptual definitions are formalized. Guard against the urge to lecture; extract the structural rules directly from their hands-on experiences.

- **Phase A (Sequence vs. Series Transition):** Draw the class's attention to a static sequence on the chalkboard next to a group's completed living equation.
  - Ask the class: "If a sequence behaves like individual, isolated cars spaced out along a highway, how does a series change that behavior?" Lead them toward identifying terms like accumulation, collective summation, or building a unified structure.
- **Phase B (Deepening the Structural Contrast):** Lead students to articulate clearly that a sequence serves as a list of distinct independent positions, whereas a series computes an active process that resolves into a single, unified numeric solution.
- **Phase C (The Bridge to Sigma Notation):** Use the "Lazy Mathematician" thought experiment to establish an immediate logical bridge into your next module. Have two or three groups draw their invented shorthand notations on the board.

The Instructional Hook:
"I see that writing out 100 terms of an addition pattern is tedious. It turns out that mathematicians centuries ago ran into the exact same frustration, so they adopted a specific Greek letter—Sigma (Σ)—to act as a structural command block. Tomorrow, we are going to learn how to code your patterns directly into it."

	Phase C. Bridge to Sigma Notation 1. Suppose your sequence didn't stop at 4 terms. Suppose it went on for 100 terms (2, 4, 6, 8, ..., 200). • Writing 2 + 4 + 6 + 8 + ... + 200 takes too much time and space. • Brainstorm as a group: If you had to invent a shortcut symbol or a shorthand way to tell someone to "add up the first 100 terms of a pattern that starts at 2 and goes up by 2," what would that symbol or notation look like? Sketch your idea!	
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding: Series and Sigma Notation** *Instructions*: Study the information and examples carefully and prepare for class discussion. ***Key Terms and Definitions*** **Series** - the sum of the terms of a sequence. *Example*: For the sequence 1, 3, 5, the series is 1 + 3 + 5 = 9 **Finite Series** - a series with a definite number of terms. *Example*: 2 + 4 + 6 + 8 (only 4 terms) **Infinite Series** - a series that continues without end. *Example*: 1 + ½ + ¼ + 1/8 + ... The *n*th term of a sequence is usually denoted by a_n **Partial Sum (S_n)** - the sum of the first n terms of a sequence. If the nth term of the sequences is a_n, then $S_n = a_1 + a_2 + a_3 + \ldots + a_n$ *Example*: In the sequence, 1, 3, 5, 7, 9, . . ., $S_4 = 1 + 3 + 5 + 7 = 16$ S_n is the nth term of the series **Sigma Notation (∑)** - a shorthand symbol used to express a series.	Activity B.2. **Deepening Conceptual Understanding: Series and Sigma Notation** To facilitate discussion, apply any of these strategies. Strategy 1. **Inquiry-Based Learning** 1. Display a sequence (1, 3, 5) and its corresponding series (1 + 3 + 5) without explanation. 2. Ask learners to observe silently for 1 minute and ask guiding questions: • "What do you notice?" • "What changed in the second expression?" 3. Allow think–pair–share (2–3 minutes). 4. Call volunteers to share answers. 5. Guide learners to define: • sequence • series 6. Introduce finite and infinite series using examples. 7. Explain a_n and S_n with visual illustration. 8. Confirm correct understanding through questioning. 9. Introduce the sigma notation. Strategy 2. **Teacher-Led Instruction** 1. Present sequence and corresponding series. 2. Define key terms clearly: • sequence • series • finite series • infinite series 3. Introduce a_n, S_n, and sigma notation.

	To write $a_1 + a_2 + a_3 + \ldots + a_n$ in sigma notation: $$\sum_{n=1}^{n} a_n$$ In general, $$\sum_{n=start}^{k=end} a_n \ (expression\ in\ terms\ of\ a_n)$$ Example: 1 + 2 + 3 + 4 + 5 in sigma notation is $$\sum_{n=1}^{5} a_n$$	4. Provide step-by-step examples. 5. Ask guiding questions during explanation. 6. Check understanding frequently. 7. Summarize key concepts at the end. Synthesize the discussion by facilitating the processing question. 1. What is the difference between a sequence and a series? Give an example of each. 2. How can you determine whether a series is finite or infinite? Explain using the examples discussed in class. 3. What does the notation S_n represent, and how is it related to the terms of a sequence? 4. Why is sigma notation (∑) useful when expressing a series? How does it make mathematical expressions easier to write and understand? 5. Suppose you are given sequence 2, 4, 6, 8, 10. How would you find the partial sum S_5, and how could you represent the series using sigma notation?
	B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity B.3. **Practicing Learned Skills: Sum It** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Strategy 1. Think-Pair-Solve-Share 1. Give each student the problems in Activity 1. 2. Ask them to solve one problem alone (Think). 3. Then, pair them with a seatmate to discuss and solve the next one together (Pair + Solve). 4. Finally, invite volunteers or randomly chosen pairs to share their answers and explain their reasoning to the class (Share). 5. Use visual aids like posters or digital slides to display each problem. Strategy 2. Color-Coded Stations 1. Prepare 5 meta cards with one problem each (different color for each type of problem). 2. Divide class into small groups of 4. 3. Give each group one card to solve together. 4. After the allotted time, say “Pass!” and have groups pass their card clockwise to the next group. 5. Continue until all groups have solved all cards. 6. Do a quick review afterward, clarifying steps and encouraging reflection. Strategy 3. Interactive Whiteboard Relay 1. Divide the class into two teams. 2. Display one problem at a time on the board or projector. 3. A student from each team races to solve and explain their answer on the board. 4. Award points for correct answers and clear explanation. 5. Encourage class discussion after each round—ask if anyone solved it differently or spotted errors.	

<table>
<tr><td></td><td colspan="2">Strategy 4. EdTech Tool: Quizizz
1. Create a Quizizz activity containing practice problems on the LAS.
2. Add visual aids or solution steps in selected items for guided feedback.
3. Prepare the game settings:
4. Shuffle Questions
5. Show Leaderboard
6. Enable Immediate Feedback
7. Set Time Limit per Item</td></tr>
<tr><td rowspan="2">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td>Activity C.1.
Making Real-World Connections: Arithmetic Sequence in Excel

Instructions:
1. Read the scenario carefully and understand Anna’s weekly saving pattern.
Scenario:
Anna decides to save money every week to buy a bicycle worth ₱3,000. She starts by saving ₱100 in the first week and increases her savings by ₱50 each week.
2. Open Microsoft Excel on your laptop, tablet, or cellphone.
3. Create a table with the following headings:
• Week Number
• Weekly Savings
• Total Savings
4. Enter the week numbers from 1 to 20.
5. Input Anna’s first-week savings amount (₱100).
6. Use a formula or pattern to increase the savings by ₱50 each week.
7. Compute the running total of Anna’s savings using the SUM formula.
8. Analyze the completed table and answer the guide questions provided by the teacher.
9. Show your solutions and computations step by step.
10. Create a graph or chart showing Anna’s savings growth over time.
Reminder:
Save your work properly and submit the completed Excel file or screenshot to the teacher after the activity
11. Work cooperatively with your group members and discuss your observations.</td><td>Activity C.1.
Making Real-World Connections: Arithmetic Sequence in Excel

Facilitation Guide:
1. Introduce the real-life scenario of Anna’s savings to activate learners’ interest and prior knowledge about arithmetic sequences.
2. Present the learning objectives and explain the expected outputs (table, computations, graph, and answers to guide questions).
3. Demonstrate how to use Microsoft Excel to set up the table:
• Week Number
• Weekly Savings
• Total Savings
4. Show learners how to input the initial value (₱100) and apply the pattern of increasing savings by ₱50 per week.
5. Guide students in using Excel formulas for automatic computation of terms and totals.
6. Circulate around the classroom to assist learners experiencing difficulty in encoding formulas or organizing data.
7. Encourage collaboration and discussion among learners during the activity.
8. Facilitate analysis by asking learners to interpret their generated data and graphs.
9. Check outputs for accuracy and completeness (table, graph, and answers).
10. Discuss the correct solution and clarify misconceptions, especially in identifying the arithmetic sequence and computing the sum.</td></tr>
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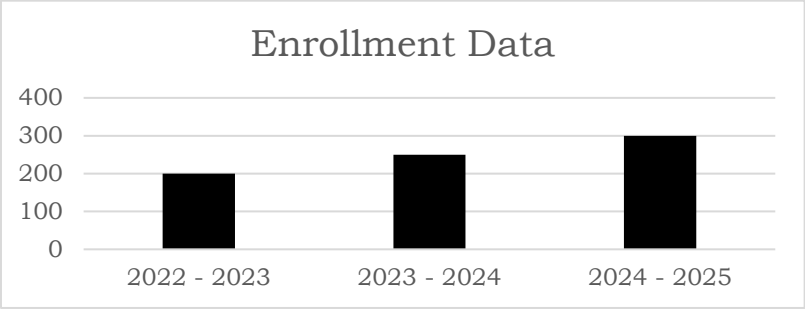
	12. Be prepared to present and explain your answers to the class. Questions for Presentation: a. How much will Anna save in the 5th week? b. What is the total amount saved after 5 weeks? c. Will she reach her goal in 5 weeks? If not, how many weeks will it take? d. How much will Anna save if she saves for 20 weeks? (You may use an Excel spreadsheet in finding the sum) e. Make letter of advise, how Anna can reach her savings goal using her arithmetic savings plan	11. Conclude the activity by connecting the concept to real-life applications such as budgeting and financial planning. 12. Provide feedback and reinforce key concepts of sequences and series. *Processing Questions:* 1. What pattern did you observe in Anna's weekly savings? 2. How did using Microsoft Excel help you identify and compute the sequence faster? 3. Why is Anna's savings an example of an arithmetic sequence? Explain your answer. 4. What strategies did you use to determine when Anna would reach her ₱3,000 goal? 5. How can arithmetic sequences and series help people in real-life situations such as budgeting and saving money?
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson: Concept Wall Generalization** *Instructions*: 1. Using meta cards or the Padlet 2. Observe the three columns: Sequence Series Sigma Notation 3. Post at least one entry in each column. Your post may include: A definition in your own words An example A key difference A real-life analogy 4. Read and react to at least two classmates' posts (like or comment respectfully). 5. After posting, prepare to share your final idea about the relationship among sequence, series, and sigma notation. 6. Be ready for the class synthesis discussion.	Activity C.2. **Wrapping Up the Lesson: Concept Wall Generalization** Facilitation Guide: 1. Allow learners to post their ideas under **Sequence**, **Series**, and **Sigma Notation** using meta cards or Padlet. 2. Encourage them to provide definitions, examples, key differences, or real-life analogies. 3. Ask learners to read and respond to at least two classmates' posts. 4. Circulate and ask guiding questions: • What pattern do you notice? • How is a series different from a sequence? • How does sigma notation relate to a series? *Processing Questions*: 1. What is a sequence? 2. How is a series related to a sequence? 3. What is the purpose of sigma notation? 4. How are these three concepts connected? *Synthesis*: Emphasize that a **sequence** is an ordered list of terms, a **series** is the sum of those terms, and **sigma notation** is a shorthand way of writing a series. Use learners' responses to transition into the formal lesson.

	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.3. **Assessing Learning Outcomes**: **Understanding on Sequence and Series** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Strategy 1. **Paper-and-Pencil Quiz (Traditional Assessment)** Let learners perform the activity in the LAS. Strategy 2. **EdTech-Based Evaluation Strategies** Teachers may convert the exercises in the LAS using digital tool.
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4. **Extending and Reinforcing Activity: Additional Exercises on Sequence and Series** For reinforcement, allow learners to perform Activity 3 in the LAS. Provide assistance and guidance to learners needing intervention.

III. CONTENT	**Lesson 2.3. Arithmetic Sequence and Series**	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. illustrate sequence and series; 2. define arithmetic sequence and series and their key components; 3. find the nth term of an arithmetic sequence; 4. use the appropriate formula $S_n = \frac{n}{2}(a_1 + a_n)$ or $S_n = \frac{n}{2}[2a + (n-1)d]$ in calculating the sum of an arithmetic series; 5. solve real world problem involving arithmetic sequence and series; and 6. demonstrate appreciation of the importance of arithmetic sequences and series by explaining or presenting how they are used in making informed decisions in real-life situations.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	*A.1. Eliciting Prior Knowledge*	
	Activity A.1. **Leveling Learners Readiness: Graphical Analysis of Enrollment Data** *Instructions:* 1. Carefully examine the enrollment graph and accompanying text to determine if the student population. *Scenario: The provided bar graph displays the enrollment figures for an educational institution over three consecutive academic years. In the 2022-2023 school year, the institution recorded an initial enrollment of 200 students. Moving into the 2023-2024 academic year, the graph shows a visible rise, with the total number of students reaching 250. Finally, for the 2024-2025 school year, the upward trend continues, showing a total enrollment of 300 students. By observing the heights of the bars across the horizontal*	Activity A.1. **Leveling Learners Readiness: Graphical Analysis of Enrollment Data** Strategy 1. **Think–Pair–Share** *Materials:* Printed graph of enrollment data Activity sheet Pen/pencil *Instructions:* 1. Prepare a printed copy of the enrollment data for each learner or pair. 2. Assign a partner pairing, preferably pairing a high-performing learner with one who needs assistance.

axis, students can analyze the specific numerical changes between each interval to identify the underlying mathematical pattern.

Visual Presentation:



2. Examine how the enrollment changes from one school year to the next.
3. Determine whether the pattern in the graph is:
   a. increasing or decreasing by the same amount each time;
   b. increasing or decreasing by the same factor each time; or
   c. neither of the two.
4. Analyze the trend shown in the graph.
5. Answer the process questions that follow.

Process Questions:

1. What trend can you observe from the enrollment data shown in the graph?
2. Does the graph show a pattern of adding the same amount, multiplying the same factor, or neither? Explain your answer briefly.
3. Based on the trend shown, what do you predict will be the enrollment for School Year 2025–2026?
4. If the pattern continues, what could be the possible enrollment for School Year 2029–2030?

3. Introduce the activity as a preparatory task that connects prior knowledge to the new lesson on **arithmetic sequences and their components**.
4. Guide learners through the Think–Pair–Share process:
   a. **Think:** Learners individually analyze the graph and answer the questions.
   b. **Pair:** Learners compare answers with their partner and discuss reasoning.
   c. **Share:** Selected pairs present their answers and explanations to the class.
5. Facilitate discussion by highlighting how identifying patterns supports understanding of arithmetic sequences and strengthens reasoning and communication skills.

Strategy 2. **Technology-Enhanced Assessment**

Materials:

Graph of enrollment data (projected or printed)
Laptop/TV/projector (if available)
Google Forms / Kahoot / Edmodo Quizzes
Internet access (if applicable)

Instructions:

1. Present the enrollment graph using a projector or printed visual.
2. Prepare a digital diagnostic quiz using platforms such as Google Forms, Kahoot, or Edmodo.
3. Convert the process questions into multiple-choice or short-response items.
4. Explain that the activity is a diagnostic assessment designed to connect prior knowledge to the concept of **arithmetic sequences**, particularly identifying patterns and components.
5. Administer the quiz individually or in small groups depending on device availability.
6. Provide clear instructions regarding time limits and submission procedures.
7. Clarify that the activity is low-stakes and intended for learning guidance rather than grading.
8. Facilitate post-activity discussion by reviewing common responses and emphasizing reasoning behind correct answers.

A.2. Establishing the Purpose of the Lesson

Activity A. 2.	Activity A. 2.
Appreciating Lesson Relevance: Discovering the Rule Behind Number Patterns	**Appreciating Lesson Relevance: Discovering the Rule Behind Number Patterns**

Instructions:

1. Consider a sequence that starts with the first term *a*, where each succeeding term is obtained by adding a constant difference *d*.
2. Observe how the second term becomes *a* + *d*, the third term becomes *a* + *2d*, and so on.
3. Complete the given table by determining the expressions for the missing terms up to the nth term.

Table of Exploration:

Term Position (n)	Term (Tn)
1	a
2	a + d
3	a + 2d
4	a + 3d
5	
6	
7	
8	
9	
n	

Process Questions:

1. What patterns do you observe as you move from one term position to the next?
2. What are the expressions for the 5th, 6th, and 7th terms?
3. What is the expression for the 10th term based on the observed pattern?
4. Based on your observations, how can you express the nth term of the sequence in general form?

Strategy 1. **Guided Inductive Reasoning**

Materials:

Activity worksheet (table of exploration)
Pen or pencil
Calculator (optional for checking answers)
Board or visual presentation of the sequence

Instructions:

1. Present the sequence where the first term is ***a***, and each succeeding term is formed by adding a constant difference ***d***.
2. Guide learners to observe how terms develop:
   2nd term = a + d
   3rd term = a + 2d, and so on.
3. Distribute the worksheet containing the incomplete table.
4. Instruct learners to complete the table up to the ***nth term*** by identifying the pattern.
5. Encourage learners to write expressions instead of numerical values to highlight generalization.
6. Facilitate discussion after completion, focusing on how the pattern evolves across term positions.

Strategy 2: Interactive Spreadsheet Pattern Exploration

Materials:

Laptop, tablet, or smartphone
Internet access
Google Sheets/Excel Online/Desmos Classroom/LMS quiz tool
Pre-formatted digital table of the sequence

Instructions:

1. Prepare a digital table of the sequence using **Google Sheets or an interactive LMS activity** with partially filled entries.
2. Share access via link or QR code to learners or groups.
3. Instruct learners to complete missing entries collaboratively by typing expressions for each term position.
4. Encourage learners to use formulas or pattern recognition rather than guessing values.
5. Allow real-time viewing of responses so learners can compare patterns across groups.
6. Facilitate a short discussion highlighting correct generalizations and common errors.
7. Use the platform's feedback or comment feature to clarify misconceptions immediately

		After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Discovering the Pattern Behind Number Sums** *Instructions:* 1. Explore how to find the sum of a number pattern using the strategy developed by the mathematician Carl Friedrich Gauss. 2. Carefully follow the steps to discover an efficient method for finding the sum of consecutive numbers. *Problem: Maria is tracking her younger brother's daily reading progress for 10 days, where he reads 1 page on the first day, 2 pages on the second, and so on up to 10 pages. She wants to find the total number of pages read across all 10 days. What is the sum of this number pattern?* Step 1. Write the sum of the numbers in increasing order. Below it, write the sum in decreasing order. Step 2. Pair corresponding terms in the sums you wrote in Step 3. How many pairs did you create? _____ Step 4. What is the sum of each pair? _____ Step 5. How do you get the sum of all the sums? Step 6. Is the sum you got in step 4 the same with the sum from 1 to 10? _____ Step 7. Since you added the series twice, divide the result by 2. _____ Step 8. Suppose you are adding numbers from 1 to 100, do the same steps above to find the sum. Step 9. Provide a general formula for the sum of the numbers from 1 to n. *Processing Questions:* 1. What pattern did you observe when pairing the numbers in increasing and decreasing order?	Activity B.1. **Exploring Key Concepts: Discovering the Pattern Behind Number Sums** **Strategy 1: Guided Discovery Learning** *Materials:* Activity worksheet Pen or pencil Calculator (optional) Board or visual presentation materials *Instructions:* 1. Present a short real-life context involving Maria's tracking of her brother's daily reading progress and guide learners in identifying the number pattern from 1 to 10 before finding its total sum. 2. Guide learners in writing the sequence in increasing order and then in decreasing order beneath it. 3. Instruct learners to pair corresponding terms from the two arrangements. 4. Ask learners to identify the sum of each pair and determine how many equal pairs are formed. 5. Facilitate discussion on how multiplying the number of pairs by the value of each pair gives the total of the two sums combined. 6. Guide learners to recognize why the result must be divided by 2 to obtain the actual sum. 7. Extend the activity by asking learners to apply the same strategy to the sum from 1 to 100. 8. Lead learners in deriving the general formula for the sum of numbers from 1 to n. **Strategy 2: Interactive Pattern Exploration** *Materials:* Laptop, tablet, or smartphone Internet access Google Sheets/Jamboard/Desmos Activity Builder/presentation software Digital worksheet or interactive slide

	2. Why is it helpful to arrange the numbers in two opposite orders? 3. Why did the result need to be divided by 2? 4. How did the strategy make finding the sum from 1 to 100 easier? 5. What relationship did you notice between the number of terms and the value of each pair? 6. Based on the activity, what general formula can be used to find the sum of the numbers from 1 to n?	*Instructions:* 1. Prepare an interactive digital activity showing the sequence arranged in increasing and decreasing order. 2. Share the digital worksheet or activity link with learners individually or by group. 3. Instruct learners to drag, connect, or highlight matching pairs of numbers digitally. 4. Encourage learners to observe that each pair has the same sum. 5. Use spreadsheet formulas or interactive tools to automatically compute totals and verify answers. 6. Facilitate collaborative discussion using projected learner responses or shared screens. 7. Guide learners in identifying the relationship between the number of terms, pair sums, and the resulting formula. 8. Conclude the activity by asking learners to formulate the general rule using symbolic representation.
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding** **Understanding Number Patterns and Their Sums** *Instructions:* 1. Study the key terms, definitions, formulas, and worked-out examples provided in the lesson discussion. 2. Take note of the important concepts such as sequence, series, term, common difference, nth term, and sum of terms. 3. Analyze how the formulas are used in solving problems involving number patterns and sums. 4. Observe the step-by-step procedures in each example problem. 5. Participate actively in the class discussion by sharing observations, explaining solutions, and asking questions when necessary. 6. Solve the practice examples together with the class and verify answers through substitution and computation. 7. Relate the concepts learned to real-life situations involving repeated patterns and cumulative totals. **Sequence** A ***sequence*** is a set of numbers arranged in a specific order or pattern. Example: 2, 4, 6, 8, 10, …	Activity B.2. **Deepening Conceptual Understanding** **Understanding Number Patterns and Their Sums5** Strategy 1. **Guided Concept Instruction with Worked Examples** *Materials:* Learner's activity sheet/module Pen or pencil Calculator (optional) Board or presentation slides Notebook for notes and solutions *Instructions:* 1. Present key concepts: sequence, series, term, common difference, nth term, and sum of terms. 2. Guide learners in carefully analyzing each definition and worked example provided. 3. Demonstrate step-by-step problem solving on the board, emphasizing reasoning behind each step. 4. Encourage learners to take notes of formulas and important patterns. 5. Facilitate class discussion by asking learners to explain solution steps in their own words. 6. Allow learners to solve sample problems collaboratively and verify answers through substitution and computation.

	Each number in the sequence is called a ***term***. **Series** A ***series*** is the sum of the terms of a sequence. Example: 2 + 4 + 6 + 8 + 10 **Term** A ***term*** refers to each individual element in a sequence or series. Example: In the sequence 3, 7, 11, 15, … • 3 is the 1st term • 7 is the 2nd term • 11 is the 3rd term **Arithmetic Sequence** An ***arithmetic sequence*** is a special type of sequence in which the difference between any two consecutive terms is constant. This constant difference is called the ***common difference (d)***. *Example: 5, 8, 11, 14, 17, …* Observe the pattern: 8 – 5 = 3 11 – 8 = 3 14 – 11 = 3 Since the difference between consecutive terms is always 3, the sequence is an arithmetic sequence with: d = 3 **Important Parts of an Arithmetic Sequence** *First Term (a_1)* The ***first term*** is the starting value of the sequence. Example 1. 7, 10, 13, 16, … The first term is: $a_1 = 7$ *Common Difference (d)* The ***common difference*** is the constant number added to each term to get the next term. Example: 12, 17, 22, 27, …	7. Connect each concept to real-life applications such as earnings, population changes, and savings. Strategy 2. **Interactive Practice (Digital Problem-Solving Platform)** *Materials:* Smartphones, tablets, or computers Internet access Google Forms/Quizizz/Nearpod/LMS platform Digital slides or interactive worksheet containing examples and practice problems *Instructions:* 1. Prepare a digital interactive lesson containing definitions, examples, and practice questions. 2. Share access links or QR codes to learners. 3. Present worked examples in a guided digital format where steps are revealed progressively. 4. Assign practice items through an online quiz or interactive worksheet. 5. Provide instant feedback for each response to help learners correct misconceptions immediately. 6. Monitor learner responses in real time and identify common errors for class discussion. 7. Facilitate a short synthesis discussion after the activity, highlighting correct reasoning and formula application. *Processing Questions:* 1. How can you differentiate a sequence from a series? 2. Why is the common difference important in identifying an arithmetic sequence? 3. How does the formula $a_n = a_1 + (n-1)d$ help in finding missing terms in a pattern? 4. In what situations is it more appropriate to use the formula $S_n = \frac{n}{2}(a_1 + a_n)$? 5. How does the formula $S_n = \frac{n}{2}[2a_1 + (n-1)d]$ help when the last term is not given? 6. How are arithmetic sequences and series applied in real-life situations such as earnings, savings, or measurement changes?

	Find the difference between consecutive terms: 17 – 12 = 5 Thus, d = 5 *nth Term (a_n)* The ***nth term*** refers to the term found in the nth position of the sequence. To determine the nth term of an arithmetic sequence, use the formula: $a_n = a_1 + (n - 1)d$ where: • a_n = nth term • a_1 = first term • d = common difference • n = position of the term Example 2. Find the 10th term of the arithmetic sequence: 5, 8, 11, 14, … Solution: Step 1: Identify the value of the variables of the formula. $a_1 = 5$ $d = 3$ $n = 10$ $a_n = ?$ Step 2: Substitute the values to the formula. Then, solve for a_n. $a_{10} = 5 + (10 - 1)3$ $= 5 + (9)3$ $= 5 + 27$ $a_{10} = 32$ Therefore, the 10th term in the arithmetic sequence is 32. Example 3. In the arithmetic sequence: 3, 9, 15, 21, … ; find the value of n if $a_n = 75$. Solution: Step 1: Identify the value of the variables of the formula. $a_1 = 3$ $d = 6$ $a_n = 75$ $n = ?$ Substitute the values to the formula. Then, solve for n. $75 = 3 + (n - 1)6$	

	$75 = 3 + 6n - 6$ $75 - 3 + 6 = 6n$ $78 = 6n$ n = 13 Therefore, 75 is in the 13th term of the arithmetic sequence.5 Example 4. The 5th term of an arithmetic sequence is 20, and the 12th term is 48. Find the following: (a) common difference, (b) first term, and (c) the 30th term. Solution: Step 1: Identify the given values. $a_5 = 20$ $a_{12} = 485$ Step 2: Substitute the given values to the formula For $a_5 = 20$ $20 = a_1 + (5 - 1)\ d$ $20 = a_1 + 4d$ (Equation 1) For $a_{12} = 48$ $48 = a_1 + (12 - 1)\ d$ $48 = a_1 + 11d$ (Equation 2) Step 3: Subtract the equations $20 = a_1 + 4d$ $48 = a_1 + 11d$ _____ $-28 = -7d$ $d = 4$ Step 4: Substitute the value of d = 4 to equation 1: $20 = a_1 + 4(4)$ $20 = a_1 + 16$ $20 - 16 = a_1$ $a_1 = 4$ Step 5. Solve for the 30th term. $a_{30} = 4 + (30 - 1)\ 4$ $= 4 + (29)4$ $= 4 + 116$ $a_{30} = 1205$ Therefore, the common difference is 4, the first term is 4, and the 30th term is 120.	

	Example 5. During the dry season, a farmer in your town is testing a new water irrigation system for his rice field. After 1 minute of turning on the water pump, the water level in the irrigation canal rose to 30 centimeters. After 2 minutes, it reached 85 centimeters, and after 3 minutes, the level was 140 centimeters. If the water level continues to rise at this constant rate, how high will the water level be after 16 minutes? Solution: Let a_n = the water level after n minutes Step 1: Identify the given. a_1 = 30cm d = 55 cm n = 16 min a_n = ? Step 2: Substitute the given values to the formula. $a_{16} = 30 + (16 - 1)55$ $= 30 + (15) \cdot 55$ $= 30 + 825$ a_{16} = 855 cm Therefore, after 16 minutes, the water level will be 855 centimeters high in the irrigation canal. **Arithmetic Series** *Arithmetic Series* is the sum of terms of an arithmetic sequence. It represents adding the terms of the sequence together. Let's say we have the arithmetic sequence: 3, 6, 9, 12. This is an arithmetic sequence where the common difference d = 3. Now, let's add the terms: 3 + 6 + 9 + 12 = 30. The sum is an example of arithmetic series. Let us compute the sum of the first n terms of an arithmetic series. $\boldsymbol{S_n = a_1 + a_2 + \ldots + a_n}$ $\boldsymbol{S_n = a_1 + (a_1 + d) + (a_1 + 2d) + \ldots + [a_1 + (n-1)d]}$ There are n terms, so we add together all the a_1's $S_n = na_1 + [1 + 2 + \ldots + (n-1)]d$ We have already derived the formula for the sum of the numbers from 1 to n-1.	

$$S_n = na_1 + (n-1)nd/2 = n[2a_1 + (n-1)d]/2$$

Now we know that $a_1 + (n-1)d = a_n$. Therefore,
$S_n = n(a_1 + a_n)/2$

We therefore have the following formulas to compute the sum of the first n terms of an arithmetic series:
If the last nth term (a_n) is given: $S_n = \frac{n}{2}(a_1 + a_n)$, or
If the last nth term (a_n) is not given:
$S_n = \frac{n}{2}[2a_1 + (n-1)d]$

where:
S_n = the sum of first n terms
a_1 = first term
a_n = last nth term
d = common difference

Example 1. Find the sum of the arithmetic sequence with 10 terms: 3, 10, 17, …, 66.

Solution:
Since the last nth term is given, use the 1st formula.
Step 1. Identify the given values.
$a_1 = 3$
$a_n = 66$
$n = 10$
$S_n = ?$

Step 2. Substitute the values to the formula.

$$S_{10} = \frac{10}{2}(3 + 66)$$
$$= 5(69)$$
$$S_{10} = 345$$

Therefore, the sum of the arithmetic sequence is 345.

Example 2: Find the sum of the first 15 terms of the arithmetic sequence: 4, 9, 14, 19, …

Solution:
Since the last nth term is not given, use the 2nd formula.
Step 1. Identify the given values.
$a_1 = 4$
$n = 15$
$d = 5$
$S_n = ?$

Step 2. Substitute the given values to the formula.

$$S_{12} = \frac{15}{2}[2(4) + (15 - 1)5]$$
$$= 7.5\,[8 + (14)5]$$
$$= 7.5\,[8 + 70]$$
$$= 7.5\,[78]$$
$$S_{12} = 585$$

Therefore, the sum of the arithmetic sequence is 585.

Example 3. Mang Tonyo is a kalesa driver in the historic streets of Vigan, Ilocos Sur. On his first day, he earns ₱200. As more tourists visit throughout the week, his earnings increase by ₱100 each day. If this pattern continues for 15 days, how much will Mang Tonyo earn in total?

Solution:
Since the last earning or nth term is not given, use the 2nd formula.
Let a_n = the earning of Mang Tonyo on day n.

Step 1: Identify the given values.
a_1 = ₱200
d = ₱100
n = 15 days
S_n=?

Step 2: Substitute the given values to the formula.

$$S_{15} = \frac{15}{2}[2(200) + (15 - 1)100]$$
$$= 7.5\,[400 + (14)100]$$
$$= 7.5\,[400 + 1400]$$
$$= 7.5\,[1800]$$
$$S_{15} = ₱13,\ 500$$

Therefore, Mang Tonyo will earn a total of ₱13,500 in 15 days.

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

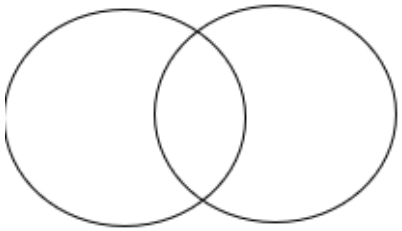
Activity B.3. **Practicing Learned Skills: Problems on Number Patterns and Their Sums**

Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.

Strategy 1: Guided Problem-Solving Approach
Instructions:
1. Present each problem clearly and guide learners to read and understand what is being asked.
   a. Find the 8th term of the arithmetic sequence: 5, 11, 17, 23, ...

	b. The 5th term of an arithmetic sequence is 40, and the common difference is 6. Find the 1st term of the sequence. c. Find the sum of the first 12 terms of the arithmetic sequence: 4, 7, 10, ... d. What is the sum of the first 15 terms of the sequence: 3, 6, 9, ...? e. Mang Ernesto, a jeepney driver in Manila, starts with a fare of ₱20 on his first trip of the day. For each succeeding trip, he earns ₱5 more than the previous trip. How much will he earn in total after 10 trips? 2. Instruct learners to classify each problem as either finding a specific term or finding the sum of terms. 3. Guide learners in identifying given values such as first term, common difference, number of terms, or specific term. 4. Encourage learners to select the appropriate formula before solving. 5. Require learners to show complete and organized solutions step-by-step. 6. Remind learners to verify answers by substituting values back into the formula when applicable. 7. Facilitate discussion after completion to compare different solution approaches. Strategy 2. **Interactive Practice Online Problem-Solving Quiz** *Instructions:* 1. Upload the practice problems into an online quiz or interactive worksheet platform. 2. Provide learners with a link or QR code to access the activity individually or in pairs. 3. Set the quiz to allow step-by-step answering or include multiple parts per problem. 4. Enable immediate feedback (if available) to guide learners in checking their reasoning. 5. Monitor responses in real time to identify common errors or misconceptions. 6. Conduct a short debriefing session highlighting correct approaches and frequent mistakes. 7. Encourage learners to reflect on which items required careful interpretation of the problem
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***
	Activity C.1. **Making Real-World Connections: Planning and Growing Savings for a Family Trip** *Instructions:* 1. Carefully read and understand the problem about saving money for a family trip. 2. Identify the key information in the problem: a. First term (a_1) b. Common difference (d) c. Number of terms (n) 3. Determine the amount of money saved in the 8th week using the appropriate formula. 4. Compute the total savings after 8 weeks using the correct sum formula. 5. Show complete and organized solutions for both required values. 6. Answer the guide questions and reflect on the real-life application of the concept. ***Problem Context:***
	Activity C.1. **Making Real-World Connections: Planning and Growing Savings for a Family Trip** **Strategy 1: Guided Real-Life Problem Solving** *Materials:* Activity worksheet Pen or pencil Calculator (optional) Notebook for solution steps Formula reference sheet *Instructions:* 1. Present the real-life problem about saving money for a family trip. 2. Guide learners in carefully identifying key information: a. First term (a_1) b. Common difference (d) c. Number of terms (n)

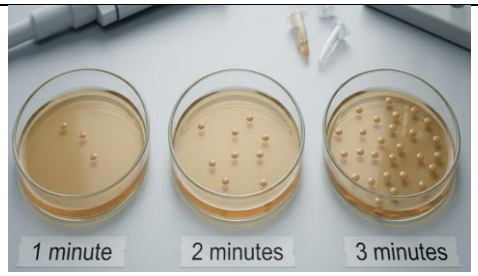
	A family is planning a trip to Tagaytay and is saving money to fund their travel expenses. To achieve their goal, they set a savings plan where they save ₱200 in the first week. To build their travel fund more effectively, they decide to increase their savings by ₱50 every succeeding week, following a consistent saving strategy similar to financial planning used in small businesses and household budgeting. *Process Questions:* 1. How much money will be saved in the 8th week? 2. How much is the total savings after 8 weeks? 3. How did you identify the values of a_1, d, and n in the problem? 4. Which formula did you use to find the 8th week savings, and why? 5. How can this savings pattern help in planning real-life financial goals?	3. Instruct learners to determine the 8th week savings using the appropriate nth term formula. 4. Guide learners in computing the total savings after 8 weeks using the sum formula. 5. Require learners to show complete and organized solutions for both computations. 6. Facilitate a short discussion emphasizing how arithmetic sequences model increasing savings in real life. 7. Encourage learners to explain how they selected formulas and interpreted the problem context. **Strategy 2: Financial Simulation Digital Spreadsheet Activity** *Materials:* Smartphones, tablets, or computers Internet access Google Sheets / Excel Online Pre-made savings table template *Instructions:* 1. Prepare a digital spreadsheet showing weeks (1–8) with empty columns for savings values. 2. Share the spreadsheet link or QR code with learners individually or in groups. 3. Instruct learners to input values starting from ₱200 and increasing by ₱50 weekly. 4. Use formulas in the spreadsheet to automatically compute the 8th week value and total savings. 5. Encourage learners to observe how the pattern grows dynamically across rows. 6. Facilitate comparison of results between manual computation and spreadsheet output. 7. Conclude with a discussion on how digital tools support financial planning and pattern recognition.
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson**: **Comparing Number Patterns and Their Sums Using a Venn Diagram** *Instructions:* 1. Draw a Venn Diagram on your paper.	Activity C.2. **Wrapping Up the Lesson**: **Comparing Number Patterns and Their Sums Using a Venn Diagram** Strategy 1. Collaborative Visual Learning *Materials:* Bond paper or worksheet Pen or pencil

	 2. Label the left circle *"Arithmetic Sequence"* and the right circle *"Arithmetic Series."* 3. In the left section, write ideas that describe arithmetic sequences. 4. In the right section, write ideas that describe arithmetic series. 5. In the overlapping middle section, write shared characteristics or similarities between the two concepts. 6. Use clear keywords, formulas, examples, or descriptions to complete each section. 7. Be prepared to explain your diagram during class discussion. *Processing Questions:* 1. What characteristics are unique to arithmetic sequences? 2. What characteristics are unique to arithmetic series? 3. What similarities do arithmetic sequences and series share? 4. How are arithmetic sequences and series related in terms of formulas? 5. Why is it important to distinguish between a sequence and a series? 6. diagram help you better understand mathematical concepts?	Colored pens or markers (optional) Ruler (optional for layout) *Instructions:* 1. Instruct learners to draw a Venn diagram on their worksheet. 2. Label the left circle ***Arithmetic Sequence*** and the right circle ***Arithmetic Series***. 3. Guide learners to list characteristics of arithmetic sequences in the left section. 4. Instruct learners to write characteristics of arithmetic series in the right section. 5. In the overlapping section, learners identify similarities between the two concepts. 6. Encourage use of keywords, formulas, and examples to strengthen understanding. 7. Allow learners to present and explain their outputs during class discussion. 8. Facilitate comparison of answers to reinforce correct conceptual distinctions. Strategy 2. **Interactive Concept Mapping Tool** *Materials:* Smartphones, tablets, or computers Internet access Canva / Google Slides / Lucidchart / Jamboard (or similar tools) Digital Venn diagram template *Instructions:* 1. Provide learners with access to a digital Venn diagram template. 2. Assign learners to complete the diagram by typing or dragging concepts into the correct sections. 3. Instruct learners to include formulas, keywords, and examples in each part of the diagram. 4. Encourage collaboration in pairs or groups using shared editing features. 5. Allow groups to present their completed diagrams via screen sharing or projection. 6. Facilitate discussion comparing different group outputs and clarifying misconceptions. 7. Provide feedback focusing on accuracy of classification and clarity of explanations.

	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.3. **Assessing Learning Outcomes: Understanding of Number Patterns and Their Sums** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Strategy 1: Traditional Mixed-Format Assessment (Paper-and-Pencil Evaluation)** *Instructions:* 1. Distribute the assessment worksheet to learners. 2. Instruct learners to carefully read all items before answering. 3. For ***Part I***, select the letter of the best answer for each item. 4. For ***Part II***, solve each problem step-by-step and show complete solutions. 5. For ***Part III***, write a reflective essay of at least 200 words. 6. Remind learners to use correct formulas and organize solutions clearly. 7. Encourage learners to review answers before submission. 8. Collect and evaluate responses based on accuracy, reasoning, and completeness. **Strategy 2: EdTech-Enhanced Online Assessment (Digital Quiz and Submission Platform)** *Instructions:* 1. Upload Part I and Part II into an online assessment platform. 2. Set Part I as auto-graded multiple-choice questions for immediate scoring. 3. Provide text entry or file upload options for Part II solutions. 4. Assign Part III (reflective essay) as a long-form response section or separate submission. 5. Share the assessment link or QR code with learners. 6. Set a clear time limit and submission deadline. 7. Monitor learner progress through the platform dashboard. 8. Use results to identify mastery level and learning gaps for remediation or enrichment.
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4. **Extending and Reinforcing Learning: Strengthening Understanding of Number Patterns** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Strategy 1: Collaborative Peer-Assisted Learning (Remediation through Group Problem Solving)** *Instructions:* 1. Form groups of 3–4 learners with mixed ability levels to encourage peer support. 2. Conduct a warm-up activity where each group determines whether given number patterns are arithmetic sequences and identifies the common difference. 3. Provide 2–3 guided tasks involving incomplete sequences or missing values. 4. Instruct groups to: a. Identify the first term (a_1) b. Determine the common difference (d) c. Write the general formula $a_n = a_1 + (n - 1)\,d$ d. Compute required terms such as the 10th or 15th term 5. Allow each group to present one solution to the class.

	6. Facilitate peer questioning and clarification among groups. 7. Provide corrective feedback and emphasize proper solution structure after presentations. **Strategy 2: Real-World Problem Solving (Interactive Digital Application)** *Instructions:* 1. Upload enhancement problems into an interactive digital platform. 2. Present real-life contexts (desks, stairs, toothpicks) as structured digital tasks. 3. Instruct learners to solve individually or in pairs using guided input fields. 4. Require learners to identify key values (a_1, d, n) before solving. 5. Encourage step-by-step submission of solutions for better tracking of reasoning. 6. Provide instant feedback or hints where possible to support correction of errors. 7. Facilitate a short synthesis discussion comparing different solution approaches. 8. Highlight correct strategies and common misconceptions observed in responses.
III. CONTENT	**Lesson 2.4. Geometric Sequence and Series**
IV. OBJECTIVES	At the end of the lesson, the learners shall be able to: 1. illustrate the geometric sequence; 2. define geometric sequences and series, including their key components; 3. calculate the nth term of a geometric sequence; 4. compute the geometric series; 5. solve problem involving geometric sequences and series; and 6. demonstrate appreciation of the importance of arithmetic sequences and series by explaining or presenting how they are used in making informed decisions in real-life situations.

V. PROCEDURES	**LEARNER ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness: Analyzing Growth Patterns Through Bacterial Observation** *Instructions:* 1. Observe carefully the three petri dishes showing bacterial growth over time. *Scenario: A researcher tracks a specific strain of bacteria to see how quickly it spreads across a Petri dish. At the 1-minute mark, the dish contains only 3 colonies, but by the 2-minute mark, the population has grown to 9. As the clock hits 3 minutes, the growth reaches a total of 27 colonies. Learners must examine these figures to determine if the bacteria are increasing by the same amount each time or by a consistent factor.*	Activity A.1. **Leveling Learners Readiness: Analyzing Growth Patterns Through Bacterial Observation** **Strategy 1: Visual Inquiry-Based Learning (Guided Observation and Analysis)** *Materials:* Illustration or image of petri dishes showing bacterial growth over time Activity worksheet Pen or pencil Graph or visual presentation materials *Instructions:* 1. Present the illustration of petri dishes showing bacterial growth at different time intervals. 2. Instruct learners to carefully observe and compare the number of bacteria in each stage.

	 2. Compare the number of bacteria present in each petri dish. 3. Analyze how the bacterial population changes from one stage to the next. 4. Determine whether the bacterial growth follows a repeated multiplication pattern. 5. Record observations and predictions based on the given pattern. 6. Answer the process questions completely and be prepared to share your ideas during class discussion. *Process Questions:* 1. How would you describe the bacterial population shown in the three petri dishes? 2. What pattern can you observe from the changes in the bacterial population? 3. Does the bacterial growth increase by addition or multiplication? Explain your answer. 4. Based on the pattern, what do you think will be the bacterial population after 4 minutes? 5. What do you predict will happen to the bacterial population after 8 minutes if the pattern continues? 6. How can recognizing growth patterns help in understanding real-life situations such as population growth or spread of bacteria?	3. Guide learners to analyze how the bacterial population changes over time. 4. Ask learners to determine whether the pattern shows repeated addition or multiplication. 5. Have learners record their observations and make predictions based on the pattern. 6. Facilitate a short sharing session where learners explain their observations. 7. Connect responses to the idea of exponential or geometric growth patterns. **Strategy 2: Simulation-Based Learning (Interactive Growth Model)** *Materials:* Smartphones, tablets, or computers Internet access PhET Interactive Simulations / Desmos / Google Slides animation / simulation video Digital worksheet or guided response form *Instructions:* 1. Provide learners with access to a digital simulation or animated visualization to show the bacterial growth over time. *Link: https://luminouslearner.com/science/biology/biology-tool/bacterial-growth-curve-simulator/* 2. Instruct learners to observe how the population changes at each time interval based on the given visual presentation of bacterial growth in petri dish. 3. Allow learners to manipulate variables (if available) such as growth rate or time. 4. Guide learners to record observations directly in a digital worksheet or online form. 5. Facilitate discussion comparing simulation results with initial predictions. 6. Highlight how repeated multiplication leads to rapid population growth. 7. Reinforce the connection between the activity and geometric sequences.
	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. Appreciating Learning Relevance **Minute to Win It: What's My Number Pattern?**	Activity A. 2: Appreciating Learning Relevance **Minute to Win It: What's My Number Pattern?**

	Instructions: 1. Form working teams of 5 members each. 2. Each group will receive a mystery number pattern written on a meta card. Analyze the pattern and determine the rule. *Mystery Number Patterns:* a. 3, 6, 12, ___, ___ b. 5, 20, 80, ___, ___ c. 10, 5, 5/2, 5/4, ___ d. 1, 2, 4, 8, ___, ___, ___ 3. You will have *1 minute per pattern* to solve. After each round, groups will rotate to the next station with a new pattern. 4. Continue rotating until all patterns are completed. 5. Write final answers on meta strips and prepare them for presentation. 6. Post and compare answers with other groups. 7. Select a representative to briefly explain how your group identified the pattern rule. *Process Questions:* 1. What strategy did your group use to identify the pattern quickly? 2. How did you determine whether the pattern was increasing or decreasing? 3. Which pattern was the most challenging to solve? Why? 4. How did teamwork help in solving the patterns within the time limit? 5. What clues helped you identify whether the pattern is arithmetic or geometric?	Strategy 1. **Timed Collaborative Challenge (Game-Based Learning)** *Materials:* Mystery number pattern meta cards Meta strips or answer sheets Pen or marker Timer (1-minute interval) Envelope or container for pattern cards Board or visual space for final sharing *Instructions:* 1. Form groups of 5 learners each. 2. Each group receives a mystery number pattern card to analyze. 3. *Mystery Number Patterns:* a. 3, 6, 12, ___, ___ b. 5, 20, 80, ___, ___ c. 10, 5, 5/2, 5/4, ___ d. 1, 2, 4, 8, ___, ___, ___ 4. Learners determine the rule of the pattern within 1 minute per item. 5. After each round, groups rotate to a new station with a different pattern. 6. Continue rotation until all patterns are solved. 7. Record final answers on meta strips for submission. 8. Post answers on the board or designated display area. 9. Select a representative to explain the group's solution strategy for at least one pattern. 10. Facilitate comparison and discussion of different solutions across groups. Strategy 2. **Interactive Quiz Rotation (Digital Game-Based Platform)** *Materials:* Smartphones, tablets, or computers Internet access Kahoot / Quizizz / Blooket / Google Forms (timed quiz mode) Digital answer input system *Instructions:* 1. Upload mystery number patterns as timed quiz questions in an interactive platform. 2. Set each question to a strict 1-minute time limit per pattern.

<table>
<tr><td></td><td></td><td>3. Assign learners into teams or allow individual participation with team scoring.
4. Display each pattern digitally and allow learners to submit answers in real time.
5. Rotate questions automatically or manually per round.
6. Show instant feedback after each item to reinforce correct pattern recognition.
7. Review difficult items after the activity through class discussion.
8. Highlight strategies used by high-performing groups for pattern identification.

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.</td></tr>
<tr><td rowspan="2">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td>Activity B.1
Exploring Key Concepts: The Secret of the Multiplicative Pattern

Instructions:
1. Examine the given sequence where each term is formed by multiplying the previous term by a constant ratio r.
2. Complete the missing entries in the table of exploration.
3. Analyze the pattern formed by the terms.
4. Use the guide questions to identify and express the general rule of the sequence.
Table of Exploration
<table>
<tr><td>Term Position ($\boldsymbol{n}$)</td><td>Term ($\boldsymbol{T_n}$)</td></tr>
<tr><td>1</td><td>a</td></tr>
<tr><td>2</td><td>ar</td></tr>
<tr><td>3</td><td>ar^2</td></tr>
<tr><td>4</td><td>ar^3</td></tr>
<tr><td>5</td><td></td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td></td></tr>
<tr><td>8</td><td></td></tr>
<tr><td>9</td><td></td></tr>
<tr><td>n</td><td></td></tr>
</table></td><td>Activity B.1
Exploring Key Concepts: The Secret of the Multiplicative Pattern

Strategy 1. Guided Discovery Learning (Inductive Pattern Investigation)

Materials:
Activity sheet or worksheet
Pen or pencil
Calculator (optional)
Visual table/chart of the sequence

Instructions:
1. Present the given sequence where each term is generated by multiplying the previous term by a constant ratio r.
2. Instruct learners to complete the table of values up to the nth term.
3. Guide learners to carefully observe how each term is formed from the previous one.
4. Ask learners to identify the pattern in the exponents of r.
5. Let learners answer the guide questions to derive the rule of the sequence.
6. Facilitate discussion to connect observations to the general formula of a geometric sequence.
7. Emphasize how patterns in the table lead to the expression $T_n = ar^{n-1}$.</td></tr>
</table>

	Process Questions: 1. What pattern do you observe as you move from one term to the next? 2. How is each term generated from the previous term? 3. What are the expressions for the 5th, 6th, and 7th terms based on the pattern? 4. What do you think is the expression for the 10th term? Explain how you obtained it. 5. Can you determine a general formula for the nth term of the sequence? 6. How is this pattern different from a sequence where terms are formed by addition?	**Strategy 2: Pattern Visualization (Dynamic Digital Table Exploration)** *Materials:* Smartphones, tablets, or computers Internet access Google Sheets / Excel / Desmos / GeoGebra / interactive digital table tool Digital worksheet or guided response form *Instructions:* 1. Provide learners with a pre-made digital table of the geometric sequence. 2. Allow learners to input values of a and r and observe automatic generation of terms. 3. Guide learners to explore how changing values of r affects the sequence pattern. 4. Instruct learners to complete missing entries for higher terms (5th to nth) digitally. 5. Encourage learners to highlight the pattern in exponents using color coding or annotations. 6. Facilitate sharing of observations through screen sharing or printed outputs. 7. Conclude by reinforcing the derivation of the general formula $T_n = ar^{n-1}$.
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding: Discovering Patterns Through Repeated Multiplication** *Instructions* 1. Perform the tasks given and participate actively in the discussion. 2. Observe the given number patterns carefully. 3. Determine how each term is formed from the preceding term. 4. Identify the fixed multiplier or common ratio of the sequence. 5. Complete the missing terms in the sequence. 6. Use the pattern to derive the formula for finding the nth term. 7. Apply the formula to solve for specified terms in the sequence.	Activity B.2. **Deepening Conceptual Understanding: Discovering Patterns Through Repeated Multiplication** Strategy 1**. Guided Discovery and Concept Development (Pattern Exploration)** *Materials:* Activity sheet or worksheet Pen or pencil Calculator (optional) Visual table/chart of number patterns *Instructions:* 1. Present learners with number patterns arranged in a visual table.

	Geometric Sequence and Series **Geometric Sequence** is a special type of sequence where each term after the first is obtained by multiplying the preceding term by a fixed non-zero number. The fixed multiplier is called the common ratio, denoted by r. It is called the common ratio because it is the ratio of any two consecutive terms in the sequence. $$r = \frac{a_{n+1}}{a_n}$$ The formula in calculating the nth term in a geometric sequence is $$a_n = a_1 r^{n-1}$$ where: a_n = the last nth term a_1 = first term r = common ratio n = the position of the term To calculate the nth term of a geometric sequence, let's follow the steps: 1. Identify the value of the first term. 2. Find the value of the common ratio. 3. Apply the formula in calculating the nth term. Example 1. Find the 5th term of a geometric sequence where the first term is 5 and the common ratio is 3. Solution: a_1 = 5 r = 3 n = 5 a_n = ? $a_5 = 5(3)^{5-1}$ $= 5(3)^4$ $= 5(81)$ $a_5 = 405$ Therefore, 405 is the value of the 5th term in the sequence. Example 2. Find the 10th term of the geometric sequence: 4, 12, 36, … Solution:	2. Instruct learners to carefully observe how each term is formed from the previous term. 3. Guide learners to identify the constant multiplier (common ratio) in each sequence. 4. Ask learners to complete missing terms in the given patterns. 5. Facilitate discussion on how repeated multiplication forms the structure of the sequence. 6. Guide learners in deriving the general formula $a_n = a_1 r^{n-1}$. 7. Allow learners to apply the formula to solve for specific terms. 8. Connect findings to the concept of geometric sequences and series. **Strategy 2: Interactive Pattern Exploration (Digital Simulation and Table Manipulation)** *Materials:* Smartphones, tablets, or computers Internet access Google Sheets / Excel / Desmos / GeoGebra / interactive sequence simulator Digital worksheet or online form *Instructions:* 1. Provide learners with a digital table of geometric sequences. 2. Allow learners to input values for a_1 and r and observe automatic generation of terms. 3. Guide learners to manipulate values and observe how patterns change dynamically. 4. Instruct learners to complete missing terms in the digital sequence. 5. Use highlighting or annotation tools to emphasize the role of exponents in forming the pattern. 6. Facilitate sharing of observations through screen sharing or class presentation. 7. Reinforce understanding of the formula $a_n = a_1 r^{n-1}$ through digital verification. 8. Extend learning by exploring how geometric series sums change with different values of r. *Process Questions:* 1. What pattern did you observe in the given sequence? 2. How can you determine the common ratio between consecutive terms? 3. Why is the common ratio important in forming the sequence?

	a_1 = 4 r = 3 n = 10 a_n = ? $a_{10} = 4(3)^{10-1}$ $= 4(3)^9$ $= 4(19683)$ $a_{10} = 78732$ Example 3. The 4th term of a geometric sequence is 64, and the 9th term is 486. Find (a) the common ratio, (b) the first term, and (c) the 7th term. Solution: From a_4: $64 = a_1 r^{4-1}$ $16 = a_1 r^3$ (Equation 1) From a_9: $486 = a_1 r^{9-1}$ $486 = a_1 r^8$ (Equation 2) Divide the equation 2 by the equation 1: Solving for the common ratio (r). $\frac{486}{64} = \frac{a_1 r^8}{a_1 r^3}$ $\frac{243}{32} = r^5$ $\frac{3}{2} = r$ Substitute $r = 3/2$ in equation 2: Solving for the first term (a_1) $64 = a_1 \left(\frac{3}{2}\right)^3$ $\frac{512}{27} = a_1$ Solve for the 7th term: Solution: $a_1 = \frac{512}{27}$ $r = \frac{3}{2}$ n = 7 a_n = ?	4. How does repeated multiplication help generate the next terms? 5. How can the formula $a_n = a_1 r^{n-1}$help in finding distant terms in the sequence? 6. In what real-life situations can repeated multiplication patterns be observed?

	$a_7 = \frac{512}{27}\left(\frac{3}{2}\right)^{7-1}$ $= \frac{512}{27}\left(\frac{3}{2}\right)^{6}$ $=216$ Example 4. A local farmer named Mang Pedro started raising native chickens. In his first month, he had 3 chickens. Every month, the number of chickens tripled as each chicken hatched more chicks. The number of chickens each month follows a geometric sequence. Problem: 1. How many chickens does Mang Pedro have by the 5th month? 2. How many chickens does he have by the 8th month? 3. Write the general formula to find the number of chickens in the nth month. Solutions: Given: First term $a_1 = 3$ Common ratio r = 3 1. 5th month $a_5 = 3\ (3)^{5-1}$ $= 3\ (3)^4$ $= 3\ (81)$ $a_5 = 243$ chickens 2. 8th month $a_8 = 3\ (3)^{8-1}$ $= 3\ (3)^7$ $= 3\ (2187)$ $a_8 = 6561$ chickens 3. General Formula $a_n = 3\ (3)^{n-1}$ $a_n = 3^n$ **Geometric Series** Review of terms: 1. First Term (a_1): This is the very first term of the sequence. It's the starting value from which all other terms are derived by multiplication with the common ratio.	

	2. Common Ratio (r): This is the constant factor by which each term in the sequence is multiplied to get the next term. It is the ratio of all consecutive terms in the series. 4. S_n: This is the sum of the first n terms of a geometric sequence. To derive the formula for the sum of the first n terms of a geometric sequence. A geometric sequence has: First term: a_1 Common ratio: r Number of terms: n When r ≠ 1, let: $S_n = a_1 + a_1r + a_1r^2 + a_1r^3 + \cdots + a_1r^{n-1}$ eq. (1) Now, multiply both sides of equation (1) by r: $rS_n = a_1r + a_1r^2 + a_1r^3 + \cdots + a_1r^n$ eq. (2) Next, subtract equation (2) from equation (1): $S_n = a_1 + a_1r + a_1r^2 + a_1r^3 + \cdots + a_1r^{n-1}$ $-$ $rS_n = a_1r + a_1r^2 + a_1r^3 + \cdots + a_1r^n$ $S_n - r\,S_n = a_1 - a_1r^n$ Extract S_n as a common factor on the left-hand side of the equation and a_1 on the right-hand side. $S_n(1-r) = a_1(1-r^n)$ Now, divide both sides 1 – r. $S_n = \frac{a_1(1-r^n)}{(1-r)}$ This gives us a formula for a finite geometric series with n terms. What happens if the series is infinite? This means that n becomes very large. If we look at the expression on the right side of the equation, the part affected by n is r^n. If r is "large" ($r > 1$ or $r < -1$), r^n also becomes large and we don't get a real number value for S_n. If r is "small" ($-1 < r < 1$), then r^n becomes very small for large values of n.	

We can therefore say that as the number of terms go to infinity ($n \to \infty$), the values of r^n become very small ($r^n \to 0$). Which means that the numerator in the expression for S_n will go to $a_1(1-0) = a_1$.

Therefore, if $-1 < r < 1$, the sum of an infinite geometric series is

$$\boldsymbol{S = \frac{a_1}{1-r}}$$

Example 1. Find the sum of the first five terms of the geometric series: 2 + 6 + 18 + 54 + …

Solution:
a_1 = 2
r = 3
n = 5
S_n = ?

$$S_5 = 2\left(\frac{1-3^5}{1-3}\right)$$
$$S_5 = 2\left(\frac{1-243}{1-3}\right)$$
$$S_5 = 2\left(\frac{-242}{-2}\right)$$
$$S_5 = 2\,(121)$$
$$S_5 = 242$$

Example 2. Consider the geometric series:10 + 5 + 2.5 + 1.25 + … Find the sum of the infinite series.

Solution:
a_1 = 10
r = $\frac{1}{2}$
S = ?

$$S_n = \frac{10}{1-\frac{1}{2}}$$
$$S_n = \frac{10}{\frac{1}{2}}$$
$$S_n = 10 \times 2$$
$$S_n = 20$$

Example 3. Mang Tonyo owns a small sari-sari store in the barangay. One day, he decided to start saving coins in an

	alkansya (piggy bank). On the first day, he puts ₱20. Each following day, he doubles the amount he saves from the previous day. He plans to continue this for 7 days. How much total money will Mang Tonyo have saved in the alkansya after 7 days? Solution: Let a_n = The money Mang Tonyo will save in the alkansya on the nth day. $a_1 = 20$ $r = 2$ $n = 7$ Use the Geometric Series Formula: $S_7 = a_1 \frac{1-r^n}{1-r}$ $S_7 = 20\left(\frac{1-2^7}{1-2}\right)$ $S_7 = 20\left(\frac{1-128}{1-2}\right)$ $S_7 = 20\left(\frac{-127}{-1}\right)$ $S_7 = 20(127)$ $S_7 = ₱2540$ Therefore, Mang Tonyo will save ₱2540 in 7 days.	
	B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity B.3. **Practicing Learned Skills: Strengthening Skills in Geometric Sequences and Series** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Strategy 1: Guided Problem-Solving Practice (Structured Individual/Pair Work)** *Instructions:* 1. Provide learners with the set of geometric sequence and series problems. 2. Instruct learners to solve each problem step-by-step and show complete solutions. 3. Guide learners to first identify given values (a_1, r, n, or S_n). 4. Ask learners to select the appropriate formula before solving. 5. Require learners to simplify answers and clearly label final responses. 6. Encourage peer checking or pair comparison of solutions before submission. 7. Facilitate brief discussion on common errors and correct methods after completion. **Strategy 2: Step-by-Step Digital Problem Solving (Interactive Guided Practice)** *Instructions:* 1. Upload the problems into an interactive digital platform with guided steps per item. 2. Break each problem into parts (identify givens, formula selection, computation, final answer). 3. Require learners to input intermediate steps, not just final answers.	

	4. Provide instant feedback or hints for incorrect responses where possible. 5. Allow learners to retry items based on feedback for mastery learning. 6. Monitor learner progress through the platform dashboard. 7. Discuss common misconceptions after completion using anonymized class results.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections: Smart Budgeting Through Growth Patterns** *Instructions:* 1. Assume you start with ₱10 mobile load on Day 1. 2. Each day, your load doubles for 5 days. 3. Complete a table showing the load amount for Day 1 to Day 5. 4. Use a geometric sequence to determine: a. The load amount on Day 5. b. The total load accumulated over 5 days. 5. Analyze the results and reflect on the sustainability of the pattern. 6. Discuss your findings with a partner or group and compare insights. *Scenario Summary* You are given ₱10 mobile load today. Each day, your load doubles to ensure enough data and communication needs for online learning and social media use. Your goal is to determine whether this habit is sustainable over a 5-day period. *Processing Questions:* 1. What pattern did you observe in the daily increase of your load? 2. How does doubling each day relate to a geometric sequence? 3. What is the significance of identifying the common ratio in this situation? 4. Was the total load over 5 days realistic or excessive? Why? 5. What real-life challenges could arise from exponential growth in spending? 6. How would you modify the pattern to make the load usage more sustainable?	Activity C.1. **Making Real-World Connections: Smart Budgeting Through Growth Patterns** **Strategy 1: Real-Life Problem-Based Learning (Collaborative Financial Modeling)** *Materials:* Activity sheet or worksheet Pen or pencil Calculator (optional) Table for daily load tracking *Instructions:* 1. Present the real-life scenario of a ₱10 mobile load that doubles daily for 5 days. *Scenario Summary* You are given ₱10 mobile load today. Each day, your load doubles to ensure enough data and communication needs for online learning and social media use. Your goal is to determine whether this habit is sustainable over a 5-day period. 2. Instruct learners to complete a table showing the load amount from Day 1 to Day 5. 3. Guide learners to identify the sequence as geometric and determine the common ratio. 4. Ask learners to compute: • Load amount on Day 5 • Total load accumulated over 5 days 5. Encourage learners to analyze whether the pattern is realistic or sustainable. 6. Facilitate pair or group discussion to compare solutions and interpretations. 7. Synthesize discussion by connecting findings to real-life budgeting decisions. **Strategy 2: Financial Simulation (Interactive Spreadsheet Modeling)** *Materials:*

		Smartphones, tablets, or computers Internet access Google Sheets / Excel / Desmos Finance simulation tool Digital table template for exponential growth *Instructions:* 1. Provide learners with a pre-designed digital spreadsheet for the load doubling scenario. *Scenario Summary* You are given ₱10 mobile load today. Each day, your load doubles to ensure enough data and communication needs for online learning and social media use. Your goal is to determine whether this habit is sustainable over a 5-day period. 2. Instruct learners to input the initial value (₱10) and apply a formula to simulate daily doubling. 3. Allow learners to observe automatic computation of values from Day 1 to Day 5. 4. Guide learners to compute total accumulation using built-in sum functions. 5. Encourage learners to adjust values (e.g., change doubling to +₱10 daily) and compare results. 6. Facilitate discussion on how different growth models affect sustainability. 7. Highlight how exponential growth behaves differently from linear growth in budgeting contexts.
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson: Mapping Relationships in Growth Patterns and Sums** *Instructions:* 1. Write the central concept in the middle of your paper or digital canvas: *"Geometric Sequences and Series"* 2. Draw branches from the center leading to two main concepts: a. Geometric Sequence b. Geometric Series 3. Under *Geometric Sequence*, create sub-branches for: a. First Term (a) b. Common Ratio (r) c. General Term Formula 4. Under *Geometric Series*, create sub-branches for: a. Finite Series b. Infinite Series (if applicable)	Activity C.2. **Wrapping Up the Lesson: Mapping Relationships in Growth Patterns and Sums** **Strategy 1: Concept Mapping (Collaborative Visual Learning)** *Materials:* Bond paper or cartolina Colored pens or markers Ruler (optional for layout design) Reference notes or module *Instructions:* 1. Write the central concept ***"Geometric Sequences and Series"*** at the center of the output. 2. Draw two main branches leading to: a. Geometric Sequence b. Geometric Series

	5. Add examples and real-life applications on side branches such as: a. Bacterial growth b. Savings accounts with interest c. Doubling cellphone load or population growth 6. Use arrows, colors, and labels to show relationships and connections between ideas. 7. Present and explain your concept map to the class, highlighting how each concept is connected. *Process Questions:* 1. How does a geometric sequence differ from a geometric series? 2. What role does the common ratio (r) play in a geometric sequence? 3. How do the first term (a) and common ratio (r) affect the pattern of a geometric sequence? 4. What is the difference between finite and infinite geometric series? 5. What real-life situations can be modeled using geometric sequences and series? 6. How does concept mapping help you understand mathematical relationships better?	3. Expand ***Geometric Sequence*** with sub-branches for: a. First Term (a) b. Common Ratio (r) c. General Term Formula 4. Expand ***Geometric Series*** with sub-branches for: a. Finite Series b. Infinite Series (if applicable) 5. Add real-life examples such as bacterial growth, savings with interest, and population growth. 6. Use colors, arrows, and labels to show relationships clearly. 7. Present and explain the concept map, emphasizing how ideas are connected. **Strategy 2: Digital Concept Mapping** *Materials:* Laptop, tablet, or smartphone Internet access Canva / MindMeister / Coggle / Google Slides Digital template or blank canvas *Instructions:* 1. Provide learners with access to a digital concept-mapping tool (e.g., Canva or MindMeister). 2. Assign learners or groups to create a digital concept map using the same structure as the paper-based version. 3. Instruct learners to insert nodes for key concepts and connect them using arrows or linking phrases. 4. Encourage inclusion of visuals, icons, or images to represent real-life applications. 5. Allow learners to present their digital concept maps via screen sharing or class projection. 6. Facilitate comparison of outputs to highlight similarities and differences in conceptual organization. 7. Provide feedback focusing on clarity of relationships and correctness of mathematical concepts.
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. **Assessing Learning Outcomes: Evaluating Understanding of Growth Patterns and Series** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Strategy 1: Traditional Paper-and-Pencil Assessment** *Instructions:* 1. Distribute the assessment worksheet to all learners.	

	2. Instruct learners to carefully read all questions before answering. 3. For ***Part I***, select the letter of the correct answer. 4. For ***Part II***, solve each problem step-by-step and show complete solutions. 5. For ***Part III***, write a 3–5 sentence reflective essay based on the prompt. 6. Remind learners to label answers clearly and organize solutions properly. 7. Allow time for review and checking of answers before submission. 8. Collect outputs for evaluation based on accuracy, completeness, and reasoning. **Strategy 2: Digital Assessment Online Quiz and Submission Platform.** *Instructions:* 1. Upload the multiple-choice and problem-solving items into an online assessment platform. 2. Configure Part I for auto-checked responses (if available). 3. Provide spaces or upload options for Part II solutions and Part III reflection. 4. Distribute access via link or QR code. 5. Set a time limit for completion and ensure clear submission instructions. 6. Monitor progress in real time through the platform dashboard. 7. Review responses after submission and provide feedback highlighting common errors and correct approaches. 8. Use results to identify learners needing remediation or enrichment.
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4. **Extending and Reinforcing Learning: Growth Patterns and Series** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. **Strategy 1: Differentiated Guided Practice (Remediation and Enhancement Approach)** *Instructions:* 1. Distribute the worksheet and explain the two parts: ***Remediation*** and ***Enhancement***. 2. Instruct learners to carefully read each problem and identify whether it involves finding the common ratio, nth term, or sum of a series. 3. For the ***Remediation section***, guide learners to review basic concepts before solving each item step-by-step. 4. For the ***Enhancement section***, encourage learners to apply higher-order thinking and deeper problem-solving strategies. 5. Require learners to show complete and organized solutions, including formulas and computations. 6. Remind learners to verify answers for accuracy before submission. 7. Facilitate a short discussion after completion to highlight correct methods and common errors. **Strategy 2: Adaptive Practice (Interactive Quiz with Tiered Difficulty)** *Instructions:* 1. Upload remediation and enhancement problems into an online quiz platform. 2. Organize items into two sections: ***Basic (Remediation)*** and ***Advanced (Enhancement).*** 3. Provide learners with access via link or QR code. 4. Enable instant feedback for remediation items to support correction of misconceptions. 5. Allow learners to progress to enhancement tasks after completing basic items. 6. Monitor responses in real time to identify learners needing additional support. 7. Conduct a brief debriefing session focusing on strategies used in solving complex items.

III. CONTENT	Lesson 2.5. Applications of Sequences and Series in Financial Mathematics: Loans, Mortgages, and Investment Growth	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. apply arithmetic and geometric sequences and series in solving financial problems involving periodic loan payments, mortgages, and investment growth; 2. demonstrate appreciation of responsible financial decision-making in managing loans, mortgages, and investments; and 3. create a digital financial poster using EdTech tools (Canva/PowerPoint/Google Slides) presenting solutions and interpretations of a real-life financial situation involving loans or investments.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness: My Future Financial Plan** *Instructions*: Imagine that you have already graduated from college and started working. You are now planning for your future and considering important financial decisions. Choose **ONE situation** below: 1. applying for a housing loan 2. buying a car through installment 3. saving money for business 4. investing money in a savings account After choosing one situation, answer the following guide questions: 1. Why did you make this financial decision? 2. What monthly payments or savings do you think are needed? 3. Do you think the payments or savings will stay the same or increase over time? 4. How can mathematics help you manage your finances wisely? 5. What pattern do you observe in loan payments and savings? 6. How do sequences and series help in financial decision-making?	**A.1. Activating Prior Knowledge** **Facilitation Guide** 1. Introduce the activity by asking learners to imagine their future financial life after graduation. 2. Present the four financial scenarios and allow learners to choose one. 3. Guide learners in answering the reflection questions individually. 4. Facilitate Think-Pair-Share or small group discussion. 5. Encourage learners to explain reasoning based on real-life experiences or observations. 6. Guide discussion toward identifying patterns in payments and savings. 7. Emphasize the connection between financial patterns and arithmetic/geometric sequences. 8. Summarize key insights before transitioning to the formal lesson. **Teacher's Note:** Focus discussion on repeated payments (installments) and growth patterns (savings/investments). Avoid deep computation at this stage to maintain alignment with the lesson's exploratory nature.
	A.2. Establishing the Purpose of the Lesson	
	Activity A.1: **Appreciating Lesson Relevance: Smart Borrowing or Smart Saving?** *Instructions*: Read and analyze the two financial situations below. Then answer the guide questions that follow.	Activity A.1: **Appreciating Lesson Relevance: Smart Borrowing or Smart Saving?** **Teacher's Facilitation Guide** 1. Present both financial situations clearly 2. Guide learners in comparing patterns 3. Encourage reasoning-based discussion

	Situation A: Loan Payment Maria wants to buy a motorcycle through installment. She will pay ₱4,000 every month for 3 years. **Situation B: Investment Growth** John deposits ₱4,000 every month into a savings account that earns 4% annual interest. ***Processing Questions:*** 1. Which situation involves repeated payments? 2. Which situation involves investment growth? 3. What mathematical pattern can be observed in each situation? 4. How can sequences and series help solve these financial situations? 5. Which financial decision do you think is more beneficial in the long run? Explain your answer.	4. Highlight arithmetic vs geometric representations 5. Emphasize real-life financial decision-making
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Analyzing Financial Growth Patterns** *Instructions*: Analyze the given examples and make generalizations. Example 1. **Arithmetic Sequence in Savings** Carlo saves ₱2,000 during the first month and increases his monthly savings by ₱500 every month. *Guide Questions:* 1. What is the first term? 2. What is the common difference? 3. How much will Carlo save during the 6th month? *Solution:* $a_1 = 2{,}000$ $d = 500$ $n = 6$ $a_n = a_1 + (n-1)\,d$ $a_6 = 2{,}000 + (6-1)\,(500)$ $a_6 = 2{,}000 + 2{,}500$ $a_6 = ₱4{,}500$ *Final Answer:* Carlo will save ₱4,500 during the 6th month. Example 2. **Geometric Sequence in Investment** Angela invests ₱2,000 in an account earning 5% annual interest compounded yearly.	Activity B.1. **Exploring Key Concepts: Analyzing Financial Growth Patterns** **Teacher's Facilitation Guide** 1. Present examples step-by-step 2. Guide learners in identifying sequence types 3. Explain formulas clearly 4. Encourage explanation of solutions 5. Connect math to financial literacy

Guide Questions:

1. What is the common ratio?
2. What type of sequence is involved?
3. How much will the investment become after 3 years?

Solution:

$r = 1 + 0.05$
$n = 3$
$a_1 = 2000 \text{ x } 1.05$

Sequence:	Compound Interest:
$a_3 = a_1 r^{n-1}$ $a_3 = 2100(1.05)^{3-1}$ $a_3 = 2{,}315.25$	A = $P(1+r)^t$ A = $2{,}000(1.05)^3$ A = 2,315.25

$a_1 = 2100$

Final Answer: Angela's investment will grow to ₱2,315.25 after 3 years.

Key Concept Reminder:

- Savings with fixed increase → Arithmetic sequence (constant difference)
- Investment with compounding → Geometric sequence (constant ratio)

B.2. Discussing the Concept

Activity B.2. **Deepening Conceptual Understanding**

Instructions: Financial situations involving loans, mortgages, savings, and investments can be solved using arithmetic and geometric sequences and series. Analyze the examples below and participate actively in the discussion.

Applying Sequences and Series in Financial Mathematics

Key Concept Reminder: Arithmetic sequence involves a constant difference (d), while geometric sequence involves a constant ratio (r).

Example 1. Arithmetic Sequence in Savings
Carlo saves ₱2,000 during the first month and increases his monthly savings by ₱500 every month.

Activity B.2. **Deepening Conceptual Understanding**

Facilitation Guide

1. Present financial scenarios involving savings, loans, and investments clearly
2. Guide learners in identifying key information in each problem
3. Facilitate discussion using guided questions
4. Encourage learners to explain their reasoning and solutions
5. Highlight the difference between arithmetic and geometric sequences
6. Connect mathematical concepts to real-life financial decision-making
7. Summarize key concepts before moving to practice activities

Guide Questions:

1. What is the first term?
2. What is the common difference?
3. How much will Carlo save during the 6th month?

Solution:

Given: $a_1 = 2{,}000 \qquad d = 500 \qquad n = 6$

Use the arithmetic sequence formula:

$$a_n = a_1 + (n-1)d$$

Substitute the values:

$a_6 = 2{,}000 + (6-1)\ (500)$
$a_6 = 2{,}000 + 2{,}500$
$a_6 = 4{,}500$

Final Answer: Carlo will save ₱4,500 during the 6th month.

Example 2. **Geometric Sequence in Investment**
Angela invests ₱10,000 in an account earning 5% annual interest compounded yearly.

*Guide Questions***:**

1. What type of sequence is involved?
2. What is the common ratio?
3. How much will the investment become after 3 years?

Solution:

Given:

$a_1 = 1 + 0.5$
$a_1 = 1.05$
$n = 3$
$a_0 = 10{,}000$
$a_1 = 10{,}000\ x\ 1.05$
$a_1 = 10{,}500$

Sequence:
$a_3 = a_1 r^{n-1}$
$a_3 = 10{,}500(1.05)^{3-1}$
$a_3 = 11{,}576.25$

Compound Interest:
$A = P(1+r)^t$
$A = 10{,}000(1.05)^3$
$A = 10{,}000(1.157625)$
$A =$ ₱11,576.25

Final Answer:

Angela's investment will grow to ₱11,576.25 after 3 years.

Teacher's Note:
Guide learners in identifying patterns in financial situations. Emphasize the difference between arithmetic and geometric sequences and ensure that learners can relate mathematical results to real-life financial decisions.

	Example 3. **Periodic Loan Payment** A family pays ₱15,000 monthly for a housing loan for 5 years. Guide Questions: 1. What financial situation is presented? 2. What mathematical patterns are involved? 3. How much will the family pay after 5 years? *Solutions:* Given: $a_1 = 15{,}000$ $\mathrm{d} = 15{,}000$ $n = 5\mathrm{x}12$ $n = 60$ Total payment: Monthly Payment = ₱15,000 Number of Months = 5(12) = 605 Total Payment: 15,000 × 60 = ₱900,000 *Final Answer:* The family will pay a total of ₱900,000 after 5 years. Example 4. **Accumulated Savings through Periodic Deposits** A student deposits ₱2,000 every month into a savings account for 12 months without withdrawing money. The account does not yet include interest. *Guide Questions***:** 1. What financial situation is presented? 2. What mathematical patterns are involved? 3. How much total money will the student accumulate after 12 months? **Solution:** Given: $a_1 = 2{,}000$ $d = 2{,}000$ $\mathrm{n} = 12$	

Use the arithmetic sequence formula:

$$a_n = a_1 + (n-1)d$$

Sequence:	Total Accumulated Value = Monthly Deposit × Number of Months
a_{12} = 2,000 + (12−1) (2,000) a_{12} = 2,000 + 22,000 a_{12} = ₱24,000	Total Amount = 2,000 × 12 Total Amount = ₱24,000

Final Answer: The student will accumulate ₱24,000 after 12 months.

This situation shows repeated equal deposits over time. The **accumulated value** follows a **series** because the **deposits are continuously added**. This concept is commonly used in savings plans, investment programs, and retirement funds.

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

B.3. Practicing Learned Skills: Financial Problem-Solving Practice

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested stratY.

Instructions for Teachers / Facilitation Guide

1. Present practice problems clearly and systematically
2. Guide learners in identifying given values and required solutions
3. Demonstrate proper use of formulas when necessary
4. Encourage learners to show complete solutions
5. Provide immediate feedback and correction
6. Reinforce correct mathematical procedures
7. Connect answers to real-life financial situations

Teacher's Note:
Focus on accuracy and understanding of concepts. Encourage learners to explain their solutions and relate answers to real-life financial decisions.

C. Demonstrating Knowledge and Skills

C.1. Finding Practical Application

Activity C.1.
Making Real-World Connection: Financial Decisions in Real Life

Instructions:

1. Using authentic financial documents such as:
    a. credit card statements,
    b. loan advertisements,
    c. mortgage computation sheets,
    d. online banking investment rates,

Activity C.1.
Making Real-World Connection: Financial Decisions in Real Life

Facilitation Guide

1. Provide authentic financial documents or samples
2. Present the Rubric.
3. Guide learners in identifying sequence types
4. Assist learners in solving financial problems correctly
5. Monitor creation of digital outputs

	e. lease agreements, or f. e-loan payment conditions, 2. Analyze how arithmetic and geometric sequences are applied in real-life financial situations. 3. After analyzing the document, complete the following tasks: a. Identify the financial situation presented. b. Determine whether the situation involves an arithmetic or geometric sequence. c. Explain the mathematical pattern observed. d. Solve the related financial problem using the appropriate formula. e. Interpret the result and explain how it can help people make wise financial decisions. **Output:** Create a DIGITAL FINANCIAL POSTER using Canva, PowerPoint, Google Slides, or other available EdTech tools. The poster must include: 1. Title of the Financial Situation 2. Authentic Financial Data 3. Sequence or Series Used 4. Complete Solution 5. Financial Interpretation 6. Recommendation or Advice *Processing Questions:* 1. What type of sequence is shown in the financial document (arithmetic or geometric)? 2. What key values or patterns helped you identify the sequence type? 3. What does your final answer mean in terms of the financial situation?	6. Encourage creativity and accuracy 7. Facilitate presentation and discussion of outputs ***Teacher's Note:*** Ensure learners use realistic financial data and correctly interpret results. Emphasize understanding over computation alone.
	C.2. Making Generalization	
	Activity C.2. **Wrapping up the Lesson: From Patterns to Principles** ***Instructions:*** 1. Based on the previous activity (C.1 Financial Decisions in Real Life), review the different financial situations analyzed. 2. Identify common patterns observed in arithmetic and geometric sequences. 3. Answer the following guide questions:	Activity C.2. **Wrapping up the Lesson: From Patterns to Principles** **Facilitation Guide** 1. Review prior lessons before generalization 2. Guide learners in identifying patterns 3. Correct misconceptions about sequence types 4. Assist learners in organizing concept maps 5. Encourage explanation in learners' own words

	a. What makes a sequence arithmetic? b. What makes a sequence geometric? c. How do these sequences appear in financial contexts such as loans, savings, or investments? d. What formula(s) are commonly used in solving these situations? e. How can recognizing these patterns help in making better financial decisions? 4. Create a **concept map, summary table, or infographic** that shows your generalization about arithmetic and geometric sequences in real-life financial situations. 5. Present your output in class or submit digitally using Canva, PowerPoint, or Google Slides. *Processing Questions:* 1. What pattern do you observe in loan payments and savings? 2. How do sequences and series help with financial decision-making?	***Teacher's Note:*** Ensure learners understand the difference between arithmetic and geometric sequences before generalizing concepts.
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. **Assessing learning Outcomes** Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy. **Facilitation Guide** 1. Administer assessment clearly 2. Provide immediate feedback 3. Clarify misconceptions 4. Encourage explanation of answers 5. Use results for remediation or enrichment	
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.4: **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy. **Facilitation Guide** 1. Present remediation tasks before enrichment activity 2. Guide learners in identifying patterns in financial situations 3. Emphasize keywords such as monthly, increase, and interest rate 4. Provide step-by-step support for struggling learners 5. Encourage higher-order thinking for enrichment tasks 6. Facilitate discussion and comparison of answers 7. Provide immediate feedback and clarification of misconceptions	

V. ASSESSMENT	**To evaluate learners' success in attaining the intended learning competencies, the assessment tools and strategies provided on the link in the table of contents can be utilized to measure understanding, skills, and application of concepts**
VI. REFLECTION	**To assess and evaluate the effectiveness of the instruction, as well as to identify challenges and plan for improvements in this unit, teachers are encouraged to answer the reflective questions provided in the link indicated in the table of contents**

Unit 3. CONVERSION OF MEASUREMEMNT

I. LEARNING GOALS	
Content Standard	The learners demonstrate knowledge and understanding of measurement and conversion.
Performance Standard	By the end of the term, the learners are able to design and present a practical measurement or conversion solution with a concrete or visual model. *Contextualized Performance Standards:* *By the end of the term, the learners are able to design and present a practical solution to a disaster-related problem in their respective barangay. Solution must include a concrete visual model, like a sketch, blueprint, layout, or diagram, and must show correct measurements, units, conversions, and scale.*
Learning Competencies	The learners… 1. determine and apply the appropriate metric units for various contexts such as units for small and large quantities and scientific measurements. 2. convert measurements with different units in the same system and between different systems. 3. determine the surface area of three-dimensional objects such as prisms, pyramids, cylinders, cones, spheres and combinations of these. 4. calculate the volume of prisms, pyramids, cylinders, cones, spheres and combinations of these. 5. Use a scale to interpret and compare distances on maps, blueprints, and sketches. 6. solve problems involving conversion of currencies. 7. apply time conversions in various real-world scenarios such as travel planning, project management, and daily routine schedules for personal and business transactions. 8. apply temperature conversions to real-world scenarios such as recipe adjustments, weather reports, scientific experiments, storage conditions, and energy efficiency.
II. REFERENCES and MATERIALS	
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Websites	CK-12 Foundation. "Surface Area of Solids." Accessed May 7, 2025. https://www.ck12.org/geometry/surface-area/. Khan Academy. "Surface Area." Accessed May 7, 2025. https://www.khanacademy.org/math/geometry/hs-geo-solids.

	Math is Fun. "Surface Area of 3D Shapes." Accessed May 7, 2025. https://www.mathsisfun.com/geometry/surface-area.html.*SI Units*. (2025, July 22). NIST: National Institute of Standards and Technology. https://www.nist.gov/pml/owm/metric-si/si-units#Base_and_Derived_Units
Video Lessons	DepEd TV. "Mathematics 6: Surface Area of Solid Figures." YouTube video, February 12, 2021. https://www.youtube.com/watch?v=3LtA3Xz8RGo. Engineering notation." n.d. All Rights Reserved, Copyright (C) CASIO COMPUTER CO., LTD. https://support.casio.com/global/en/calc/manual/fx-82CW_85CW_350CW_en/changing_calculation_result_format/ engineering_notation.html. Libretexts. 2020. "1.2.2: Scale Drawings and Maps." Mathematics LibreTexts. August 15, 2020. https://math.libretexts.org/Bookshelves/PreAlgebra/Pre-Algebra_I_(Illustrative_Mathematics_-_Grade_7)/01%3A_Scale_Drawings/1.02%3A_New_Page/1.2.2%3A_Scale_Drawings_and_Maps. Khan Academy. "Surface Area of Prisms, Cylinders, Cones, and Spheres." YouTube playlist. Accessed May 7, 2025. https://www.youtube.com/playlist?list=PLSQl0a2vh4HCZHJ7PGeJjZlEf82m7XB-f. Math Antics. "Surface Area." YouTube video, August 3, 2017. https://www.youtube.com/watch?v=7nZQzHfL6CU.
Materials and EdTech	• Calculators • Visual aids (3D shapes) or posters of 3D shapes/PowerPoint presentation • Worksheets (printed or digital) • Task cards/ Station Cards • Rulers, tape measures, and grid papers • Manila Papers or Cartolina • LCD Projector or TV (if using video lessons) • Application Software/ Digital Tools (e.g GeoGebra, Desmos, Unit Conversion, Canva, Google Drawings, PowerPoint)
AI Declaration	AI tools were used to assist in generating activity ideas, refining instructions, organizing content, creating visual prompts and images, and improving the clarity of this Senior High School lesson exemplar. All AI-assisted outputs were reviewed, revised, and validated to ensure accuracy, relevance, appropriateness, and alignment with the curriculum and intended learning competencies.
III. CONTENT	**Lesson 3.1. Quantities of Different Magnitudes: Choosing Appropriate Units and Applying Scientific Notation**
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. identify the appropriate metric units for measuring small and large quantities; 2. apply scientific notation to express small or large numbers and vice versa; and **3.** solve real-life problems by applying the appropriate metric units for small and large quantities and scientific measurements.

V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness** Option 1**. Explore and Guess It Right!** *Instructions:* 1. Work with your assigned group. 2. Go to your assigned starting station. 3. At each station, observe the picture cards or read the quantities provided. 4. Identify the most appropriate unit of measure for each quantity.	Activity A.1**. Leveling Learners Readiness** Facilitation Guide: Select the option that best matches the available resources and learning environment. Option 1. **Explore and Guess It Right!** 1. Prepare five measurement stations: Stretch (length and distance), Balance (mass), Pour (volume), Chill (temperature), and Tick (time).

5. Write your answers on the activity sheet.
6. You will have 1 minute to complete each station.
7. When the teacher gives the signal, move to the next station.
8. Continue until your group has completed all five stations.

Quantities	Appropriate Unit of Measure
Station 1: Stretch	
Height of the building	
Width of the classroom	
Length of a pencil	
Distance from Manila to Albay	
Station 2: Chill	
Body temperature of a classmate	
Temperature of Hot Coffee	
Station 3: Pour	
Volume of water in a pail	
Volume of a liquid in a feeding bottle	
Volume of water in a tank	
Station 4: Balance	
Mass of a book	
Mass of a needle	
Mass of a cow	
Station 5: Tick	
Time it takes to walk down the hallway	
Time it takes to finish the Scavenger Hunt	
Time it takes to travel from Sagada to Manila	

Option 2**. Fastest Hunter**
Instructions:
Match each quantity with the most appropriate unit of measure from the Unit Bank. Write the corresponding unit beside each quantity. Complete the activity as accurately and quickly as possible.

2. Place picture cards or word cards at each station and provide learners with the activity sheet.
3. Organize learners into groups and assign a starting station.
4. Allow groups to rotate through the stations, giving approximately one minute per station.
5. Conduct checking and discussion after all groups have completed the activity.

Option 2. **Fastest Hunter**
1. Distribute printed copies or display the activity using available classroom technology.
2. Instruct learners to match each quantity with the most appropriate unit from the Unit Bank.
3. Allow learners to work individually, in pairs, or in groups.
4. Conduct checking through peer checking or teacher-led discussion and ask selected learners to justify their answers.

Option 3. **Metric Quest**
1. Access the Metric Quest digital activity through the provided QR code or activity link.
https://tinyurl.com/GMMetricQuest
2. Select the preferred mode of implementation based on the available resources and classroom needs:
   a. **Teacher-Paced Mode** for a facilitator-controlled challenge with a live leaderboard.
   b. **Student-Paced Mode** for self-paced completion by learners.
3. Generate and provide the session code, join link, or QR code to learners.
4. Instruct learners to enter their names and complete the digital challenge using available devices.
5. Discuss the results and invite selected learners to explain their answers.

For **all options**, emphasize that choosing the appropriate unit depends on:
1. what is being measured;

Quantity	Appropriate Unit of Measure
Diameter of a Philippine one-peso coin	_____
Length of a pencil	_____
Height of a building	_____
Distance from Manila to Albay	_____
Mass of a medicine tablet	_____
Mass of a book	_____
Mass of a cow	_____
Volume of a bottle of water	_____
Volume of liquid in a medicine dropper	_____
Body temperature of a healthy person	_____

Unit Bank

millimeter (mm)	milligram (mg)	liter (L)
centimeter (cm)	gram (g)	milliliter (mL)
meter (m)	kilogram (kg)	degree Celsius (°C)
kilometer (km)	hour (h)	Kelvin (K)

Option 3. **Metric Quest**

Instructions:

1. Scan the QR code or open the Wayground activity link.
2. Enter your name when prompted.
3. Read each quantity carefully.
4. Choose the most appropriate unit of measure from the given choices.
5. Complete all items.
6. Check your score and leaderboard ranking after completing the challenge.

Choose the BEST UNIT FOR:

1. Diameter of a Philippine one-peso coin

kilometer (km)	millimeter (mm)	centimeter (cm)

2. Length of a pencil

millimeter (mm)	kilometer (km)	centimeter (cm)

3. Height of a building

meter (m)	millimeter (mm)	kilometer (km)

2. the size or magnitude of the quantity; and
3. the real-life context in which the measurement is used.

Use learners' responses to identify misconceptions and reinforce the importance of appropriate units of measure as a foundation for metric conversions, scientific notation, and the Measurement Inventory for the Community Innovation Advocacy Pitch.

4. Distance from Manila to Albay

kilometer (km)	centimeter (cm)	gram (g)

5. Weight of a medicine tablet

kilogram (kg)	milligram (mg)	meter (m)

6. Weight of a book

gram (g)	kilometer (km)	degree Celsius (°C)

7. Sprint competition timer

hours (h)	minutes (min)	seconds (s)

8. Volume of a bottle of water

liter (L)	millimeter (mm)	gram (g)

9. Volume of medicine in a dropper

liter (L)	kilometer (km)	milliliter (mL)

10. Temperature of water

degree Celsius (°C)	liter (L)	degrees (°)

Processing Questions:

1. How did you determine the most appropriate unit of measure for each quantity?
2. Why is it important to choose an appropriate unit of measure when describing real-life quantities?
3. How does the size of an object or quantity influence the unit used to measure it?

A.2. Establishing the Purpose of the Lesson

Activity A. 2. **Appreciating Lesson Relevance**

Option 1. **Disaster Preparedness Resource Gallery**

Instructions:

1. Work with your group.
2. Examine the assigned set of barangay disaster-preparedness resource visuals, labels, or measurement displays:
   Group 1. https://canva.link/mgallery1
   Group 2. https://canva.link/mgallery2
   Group 3. https://canva.link/mgallery3
   Group 4. https://canva.link/mgallery4
3. For each item, identify the measurement shown, the unit used, and the quantity being measured.
4. Record your answers in the table provided.
5. Present your findings in the class.

Activity A.2. **Appreciating Lesson Relevance**

Facilitation Guide:

Select the option that best matches the available resources and learning environment:

Option 1. Disaster Preparedness Resource Gallery

Instructions:

1. Divide the class into four groups.
2. Provide the assigned gallery link to each group for viewing, printing, or reproduction of the activity materials.
3. Instruct learners to examine the assigned disaster-preparedness visuals, labels, and measurement displays.
4. Ask learners to identify the measurement shown, the unit used, and the quantity being measured, and record their answers in the table provided.

Item	Measurement Shown	Unit Used	Quantity Being Measured
Ex. Water container	20 L	Liter (L)	Volume/ Capacity

Option 2. **Barangay Disaster Procurement and Planning Activity**
Instructions
1. Work in your assigned group.
2. Examine the provided barangay disaster-preparedness procurement list, which includes resources for:
   - Rescue and Response
   - Sanitation and Water Safety
   - Monitoring and Detection
   - Transportation and Logistics
3. For each item, identify and record:
   a. The **measurement shown** (e.g., capacity, weight, flow rate, pore size)
   b. The **unit used** (e.g., L, kg, µm, t, m^3)
   c. The **quantity being measured** (e.g., volume, mass, length, concentration)
4. Discuss why this measurement is important for disaster planning and procurement.
5. Identify items that require metric ton (t) measurements and explain why this unit is critical.
6. Present your findings to the class and suggest how accurate measurements affect barangay preparedness and response.

Item	**Measurement Shown**	**Unit Used**	**Quantity Being Measured**
Ex. Relief rice pack	5 kg	Kilogram (kg)	Mass

5. Facilitate group reporting and discussion of findings.

Option 2. **Barangay Disaster Procurement and Planning Activity**
1. Divide the class into four groups.
2. Provide the activity materials using the following link for viewing, printing, or reproduction:
   https://tinyurl.com/ActivityA2-Option2
3. Instruct learners to examine the listed items carefully.
4. Ask learners to identify the measurement shown, the unit used, and the quantity being measured, and record their answers in the table provided.
5. Facilitate group reporting and discussion of findings.

For **both options**, use the processing questions to guide reflection. Emphasize that different quantities require different units depending on their size, purpose, and context, and highlight the importance of accurate measurements in disaster preparedness and community innovation planning.
Processing Questions:
1. How does selecting the correct unit affect the accuracy of measurements in disaster preparedness?
2. Why might some quantities be expressed in larger or smaller units, and how does this influence planning decisions?
3. In what ways does understanding measurement magnitudes help organize resources effectively?
4. What patterns can be observed in the types of measurements commonly used in disaster preparedness, and why are they significant?

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.

B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Why Not Use Only One Unit?**	Activity B.1 **Exploring Key Concepts: Why Not Use Only One Unit?**

Instructions:
Study the following measurements.

Quantity	Measurement
Distance from Manila to Albay	350 km
Length of a pencil	15 cm
Thickness of a laminating film	125 µm
Diameter of SARS-CoV-2	100 nm

Processing Questions:
1. What units are used in the measurements shown?
2. Why do you think different units are used instead of using only meters?
3. What difficulties might arise if all measurements were expressed using only one unit?

Facilitation Guide
1. Present the activity through printed materials, presentation slides, or a digital display.
2. Instruct learners to examine the quantities and the units used in each measurement.
3. Allow 2–3 minutes for learners to study the examples individually or within their groups.
4. Encourage learners to identify the units used and observe how they vary across different quantities.
5. Facilitate a discussion using the processing questions.
6. Guide learners toward the realization that metric prefixes allow measurements to be expressed more conveniently according to the size of the quantity being measured.
7. Conclude by connecting the activity to the discussion of metric prefixes and their role in expressing very large and very small measurements.

B.2. Discussing the Concept

Activity B.2. **Deepening Conceptual Understanding**
Part I**. Metric Units and Metric Prefixes**
Metric units are standardized units of measurement used in science, mathematics, engineering, medicine, and daily life. The modern metric system used worldwide is called the International System of Units (SI). The SI system establishes standard base units for measuring different physical quantities such as length, mass, time, and temperature. The metric system is based on powers of 10, making measurement conversions easier and more systematic.
The seven SI base units include:

Quantity	SI Base Unit	Symbol
1 Length	meter	m
2 Mass	kilogram	kg
3 Time	second	s
4 Temperature	kelvin	K
5 Electric current	ampere	A
6 Amount of substance	mole	mol
7 Luminous intensity	candela	cd

Quantity	Common Metric Units
Length	centimeter (cm), kilometer (km), millimeter (mm)
Mass	gram (g), milligram (mg), metric ton (t)

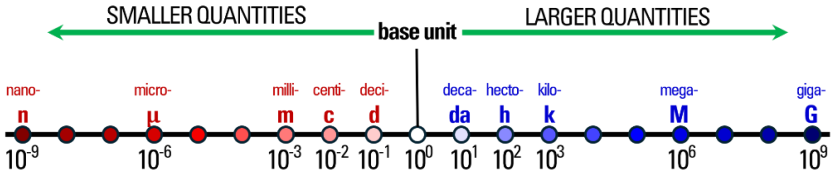
Activity B.2. **Deepening Conceptual Understanding**
Facilitation Guide:
Part I. **Metric Units & Prefixes**
1. Discuss learners' prior experiences and identify SI base units.
Processing Questions:
   a. Which of the SI base units are you most familiar with? Where do you commonly encounter these units in your daily life?
   b. Which of these units do you rarely encounter? Why do you think that is the case?
   c. Aside from the seven SI base units, what other metric units do you often encounter in your daily life?
2. Explore metric prefixes and their powers of ten.
3. Have learners complete Check Your Understanding collaboratively.

✔ **Check Your Understanding!**
Instructions: Identify the most appropriate metric unit for each quantity. Justify your answer.
a. Distance between two major cities
b. Amount of syrup in a medicine cup
c. Thickness of a single-strand hair
d. Electrical power rating of a refrigerator
e. Weight limit indicated on a bridge warning sign

4. Discuss answers immediately to clarify misconceptions.

Volume	liter (L), milliliter (mL)
Time	minute (min), hour (h)
Temperature	degree Celsius (°C)
Electricity	watt (W), kilowatt (kW)

Many of the units we encounter in daily life, such as kilometer, centimeter, milliliter, kilogram, and kilowatt, contain additional parts attached to the unit. These additional parts are called metric prefixes. **Metric prefixes** help describe quantities that are much smaller or much larger than the base unit. Let us examine the metric prefix scale.



Part II. **Scientific Notation**

Metric prefixes help us describe quantities that are much smaller or much larger than a unit. For example, the thickness of a hair may be measured in micrometers, while the distance between cities may be measured in kilometers.

However, some measurements are so small or so large that writing them using ordinary numbers can become lengthy and prone to errors.

To express very small and very large numbers in a shorter and more manageable form, mathematicians and scientists use scientific notation.

Scientific notation is a mathematical method used to express very large or very small numbers in a shorter and more manageable form. It is written as:

$$m \times 10^{n}$$

where:
m is a coefficient greater than or equal to 1 but less than 10, and
n is an integer exponent indicating the power of 10.

Converting Standard Form to Scientific Notation

Example 1.
A virus has a diameter of 0.00000006 meter. Express the measurement in scientific notation.

5. Conduct check-in assessment by facilitating the processing questions:

Processing Questions:
   a. Why do you think metric prefixes are attached to base units instead of creating completely different units for very small or very large quantities?
   b. Based on the metric prefix scale, what do you notice about the kinds of quantities that use prefixes such as milli-, micro-, and nano- compared to those that use kilo-, mega-, and giga-?

Part II. **Scientific Notation**

6. Demonstrate conversion between standard form and scientific notation.
7. Have learners complete Check Your Understanding collaboratively.

✔ **Check Your Understanding!**

Measurement	Scientific Notation	Appropriate Metric Unit
Ex: 0.0000000012 meter	1.2×10^{-9} m	nanometer (nm)
0.0000034 meter		
0.00000091 gram		
52,000 liters		
7,800,000 watts		

8. Discuss results and address misconceptions about exponents, decimal movement, or unit selection.
9. Conduct check-in assessment by facilitating the processing questions:

Processing Questions:
   a. Aside from the movement of the decimal point, how can you determine whether the exponent in scientific notation should be positive or negative?
   b. How are metric prefixes related to the powers of 10 used in scientific notation?
   c. How does scientific notation help make very large or very small quantities easier to read, write, and compare?

Part III**. Scientific Calculator**

10. Ensure that learners have access to a scientific calculator. If resources are limited, organize learners into small groups and provide at least one calculator per group.
11. Present the Scientific Calculator Tutorial using the QR code or hyperlink provided.

Guide Questions:

1. In 0.00000006, where is the decimal point and how should it be moved so that the resulting number is greater than or equal to 1 but less than 10?
2. How many places was the decimal point moved, and in what direction was it moved?
3. How is the number of decimal movements related to the exponent in scientific notation?
4. How can the number be written in scientific notation?
5. What would be a more appropriate metric unit for expressing the diameter of the virus? Explain your answer.

$$0.\underbrace{0}_{1}\underbrace{0}_{2}\underbrace{0}_{3}\underbrace{0}_{4}\underbrace{0}_{5}\underbrace{0}_{6}\underbrace{0}_{7}\underbrace{6}_{8} = 6 \times 10^{-8} \text{ meters}$$

Appropriate metric unit: nanometer (nm), because the diameter of the virus is represented by 10^{-8} meter, which is close to the nano-prefix (10^{-9}). Using nanometers makes the measurement easier to express as 60 nm.

Example 2.

A fully loaded truck has a mass of **12,000,000 grams**. Express the mass in scientific notation.

Guide Questions:

1. How was the decimal point moved so that the coefficient became greater than or equal to 1 but less than 10?
2. How many places was the decimal point moved?
3. What relationship do you observe between the decimal movement and the exponent?
4. How can the number be written in scientific notation?
5. What would be a more appropriate metric unit for expressing the mass of the loaded truck? Explain your answer.

$$1\underbrace{2}_{7}\underbrace{,}\underbrace{0}_{6}\underbrace{0}_{5}\underbrace{0}_{4}\underbrace{,}\underbrace{0}_{3}\underbrace{0}_{2}\underbrace{0}_{1} = 1.2 \times 10^{7}\text{g}$$

Appropriate metric unit: **metric ton** (t) or megagram (Mg), because the mass of the loaded truck is 1.2×10^{7}grams, which is close to the mega- prefix (10^{6}). Thus, the measurement can be expressed more conveniently as 12 metric tons (12 Mg).

To convert a number to scientific notation:

1. Move the decimal point to form a number greater than or equal to 1 but less than 10.
2. Count the number of places the decimal point was moved.
3. If the decimal point was moved to the left, the exponent

12. Allow learners to perform the demonstrated procedures using their own calculator or their group calculator.
13. Facilitate the processing questions and allow learners to compare the functions and displays of different calculator models.

Processing Questions:

a. Are all the steps shown in the video applicable to your calculator? If not, which step(s) were different or unavailable?
b. What alternative key or function does your calculator use to perform the same operation?
c. Despite differences in calculator models, were you able to obtain the same results? Why or why not?
d. Why is it important to become familiar with the features and functions of your own calculator when working with scientific notation?

14. Have learners use the calculator to verify their answers in the Check Your Understanding activities.

✔ **Check Your Understanding!**

Measurement	Standard Form	Appropriate Metric Unit
4.8×10^{-9} meter		
2.5×10^{-6} ampere		
6.3×10^{6} grams		
9.2×10^{9} watts		

✔ **Check Your Understanding!**

Use a scientific calculator to verify your answers in the Check Your Understanding activities in Part II. Compare the calculator output with your manual computations and determine whether the results are the same.

15. Discuss the results and address any misconceptions related to scientific notation, calculator functions, or calculator displays.

is positive.

4. If the decimal point was moved to the right, the exponent is negative.

Converting Scientific Notation to Standard Form

Example 1.

A scientific calculator displays the result of a computation as:

$$8.192 \times 10^{13}$$

Express the number in standard form.

Guide Questions:

1. In 8.192×10^{13}, what does the exponent indicate about the size of the quantity?
2. Where is the decimal point initially placed in the coefficient in 8.192?
3. How many places should the decimal point be moved, and in what direction should it be moved?
4. How is the exponent related to the movement of the decimal point?
5. How can the number be written in standard form?

$$\mathbf{8.192} \times 10^{13} = \mathbf{8.1\,9\,2\,0\,0\,0\,0\,0\,0\,0\,0\,0}$$

$$= \mathbf{81,920,000,000,000}$$

Example 2.

A laboratory report shows that a blood sample contains:

$$4.7 \times 10^{-9} \text{ gram/mL}$$

of a certain hormone. Express the measurement in standard form.

Guide Questions:

1. In 4.7×10^{-9}, what does the exponent indicate about the size of the quantity?
2. Where is the decimal point initially placed in the coefficient 4.7?
3. How many places should the decimal point be moved, and in what direction should it be moved?
4. How is the exponent related to the movement of the decimal point?
5. How can the number be written in standard form?

$$\mathbf{4.7} \times \mathbf{10^{-9}} = \mathbf{0.0\,0\,0\,0\,0\,0\,0\,0\,4\,7}$$

$$= \mathbf{0.0000000047}$$

To convert scientific notation to standard form:

1. Identify the exponent.

2. Move the decimal point to the right if the exponent is positive.
3. Move the decimal point to the left if the exponent is negative.
4. Write the resulting number.

Part III. **Exploring Scientific Notation Using a Scientific Calculator**

Scientific calculators can also be used to represent very large or very small numbers in scientific notation. It is traditionally represented in E notation, where E means "× 10 raised to the power of."

For example:

0.00000006 = 6E−8

12,000,000 = 1.2E7

This is commonly used in spreadsheets and some digital calculators to represent very large or very small numbers.

However, many modern scientific calculators display numbers using Natural Display, which shows scientific notation using ×10 rather than E. For example:

0.00000006 may appear as 6×10^{-8}

12,000,000 may appear as 1.2×10^{7}

Both formats represent the same values. Understanding E notation helps learners interpret spreadsheet outputs, older digital displays, and other computational devices, while Natural Display shows how many modern scientific calculators present scientific notation in a format that closely resembles standard mathematical notation.

Watch the video tutorial and observe how the calculator displays numbers in scientific notation using the link and QR provided.

https://tinyurl.com/SciCalTutorial

Standard Form to Scientific Notation

1. To convert a number in standard form to scientific notation using a scientific calculator:
2. Press SHIFT then MODE (SETUP).
3. Select SCI mode.

	4. Choose the desired number of significant digits. 5. Enter the number. 6. Press =. 7. Read the results in scientific notation. **Scientific Notation to Standard Form** To convert a number in scientific notation to standard form using a scientific calculator: 1. Return the calculator to NORM mode. 2. Enter the coefficient. 3. Press $\times 10^x$ or EXP, depending on the calculator model. 4. Enter the exponent. 5. Press =. 6. If the answer appears as a fraction or another form, press S⇔D to display the decimal value.	
	B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity B.3. Practicing Learned Skills **Facilitation Guide:** Strategy 1. **Think-Pair-Solve-Share** 1. Distribute the learning task to all learners. 2. Allow learners to solve an item independently (Think). 3. Pair learners and ask them to discuss and solve the next item together (Pair and Solve). 4. Invite selected pairs to share their answers and explain their reasoning to the class (Share). 5. Use visual aids such as posters, slides, or digital displays to present the tasks when appropriate. Strategy 2. **Game-Based: Measure It Right Challenge** 1. Access the Measure It Right Challenge through the provided QR code or activity link. 2. Ensure that learners enter their name and section before starting the activity. 3. Allow learners to complete all parts of the challenge individually using available devices. 4. Monitor learner progress and provide assistance when necessary. 5. Instruct learners to review their score, achievement badge, and feedback upon completion. 6. Require learners to submit a screenshot of their results as proof of completion. 7. Facilitate a brief discussion of selected items, common misconceptions, and solution strategies.	https://tinyurl.com/GMMeasureItRight
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections** **Practical Applications of Scientific Measurement** *Instructions*: Read and analyze each scenario and answer the questions. *Practical Application* 1.	Activity C.1. **Making Real-World Connections** **Facilitation Guide**: 1. Present the practical application scenarios through printed materials, slides, or a digital display. 2. Ask learners to analyze each situation and answer the questions individually or in pairs.

A barangay is planning a rainwater harvesting system to help address water shortages during periods of drought. The proposed storage tank can hold 15,000 liters of water. If this capacity will be included in the design specifications, would it be more appropriate to express it as 15,000 L or 15 kl? Explain your answer.

Practical Application 2.
During a La Niña season, a farmer uses a filtration system to help manage excess water in an irrigation channel and protect agricultural crops from flooding. The filter contains pores with an average diameter of 0.000002 meter. If this measurement is included in the technical specifications of the filtration system, how can it be expressed more efficiently? Write the measurement in scientific notation and identify a more appropriate metric unit that may be used. Explain your answer.

3. Encourage learners to justify their answers using concepts of appropriate metric units and scientific notation.
4. Facilitate a class discussion and allow selected learners to explain their reasoning.
5. Guide learners in evaluating how the choice of units and numerical representations affects the clarity, accuracy, and practicality of communicating measurements.
6. Emphasize that appropriate units and scientific notation help make measurements easier to interpret and apply in real-world situations.

Processing Questions
1. How did the context of each situation help you decide on the most appropriate unit or representation of the measurement?
2. Why is it important to communicate measurements using units and formats that are easy for the intended audience to understand?
3. How do metric prefixes and scientific notation help make very large or very small measurements easier to interpret and communicate?

C.2. Making Generalization

Activity C.2.**Wrapping Up the Lesson: I Learned, I Wonder**
Instructions:
1. Choose a format for presenting your reflection (e.g., folded paper, graphic organizer, infographic, poster, slide, or another teacher-approved format).
2. Include a section labeled "I Learned…" and list three important ideas you learned from today's lesson.
3. Include a section labeled "I Wonder…" and list two to three questions, insights, or reflections you still have about the lesson.
4. Be prepared to share your responses with the class.

Activity C.2. **Wrapping Up the Lesson: I Learned, I Wonder**
Facilitation Guide
1. Explain the purpose of the activity and the reflection of format options.
2. Allow 3–5 minutes for learners to complete their reflections individually or in pairs.
3. Encourage learners to justify their answers and insights using concepts of metric units and scientific notation.
4. Invite learners to present their reflections in the format they chose.
5. Facilitate discussion, clarify misconceptions, and address common questions.
6. Conclude by summarizing key concepts and emphasizing the importance of appropriate units and scientific notation for communicating measurements effectively.

C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.3. **Assessing Learning Outcomes**

Facilitation Guide:
1. Present the activity to learners using printed materials, slides, or digital display.

2. Allow learners to answer the items individually or in pairs.
3. Encourage learners to justify their choices of units and explain their reasoning for scientific notation.
4. Monitor responses and provide clarification as needed.
5. Facilitate a discussion of common misconceptions and highlight strategies for selecting appropriate units and using scientific notation effectively.
6. Conclude by connecting the activity to real-life applications and emphasizing the practicality of proper measurement representation.

C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.4. **Extending and Reinforcing Learning**

Facilitation Guide:

Remediation: Reinforcement Tasks

1. Encourage learners to review common metric units before answering.
2. Guide learners in identifying patterns in decimal movement when converting between standard form and scientific notation.
3. Prompt learners to explain their reasoning rather than focusing solely on obtaining correct answers.
4. Monitor misconceptions involving exponent signs, decimal placement, and the selection of appropriate metric units.
5. Provide corrective feedback through questioning and guided practice.
6. Allow learners to review and revise their responses after discussing common errors.
7. When implemented remotely, direct learners to access the digital reinforcement task using the provided QR code or activity link.

https://tinyurl.com/GMReinforcementTask

Enrichment: Measurement in My Future Career

1. Encourage learners to select a career, business, or field that genuinely interests them.
2. Guide learners in identifying measurements commonly used in the selected field.
3. Remind learners to identify the quantity being measured before selecting the appropriate metric unit.
4. Encourage learners to justify why each unit is suitable for the measurement context.
5. Assist learners in locating examples involving very large or very small quantities.
6. Prompt learners to explain why scientific notation is useful in the selected situation.
7. Allow learners to use reliable print or digital sources for research.
8. Encourage learners to communicate their work through a one-page infographic, poster, slide, or other teacher-approved format.
9. During sharing sessions, ask learners to explain how measurement contributes to decision-making, safety, efficiency, quality control, or problem-solving within the chosen field.

III. CONTENT	**Lesson 3.2. Unit Conversion Within and Across Systems**
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. differentiate the metric and English systems of measurement, including their units for length, mass, volume, time and temperature; 2. convert measurements between different units within the metric and within English system; 3. convert measurements from the metric system to the English system and vice versa;

	4. solve practical problems involving unit conversions, such as cooking recipes, travel distances, and scientific experiments.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	

Activity A.1. **Leveling Learners Readiness**
Option 1. **Sort It Out!**
Instructions:
1. Form your assigned group.
2. Get the set of unit cards from your teacher.
3. Read each unit card carefully.
4. Classify each unit as either Metric or Nonmetric.
5. Place each unit card in the appropriate column.
6. After sorting all the unit cards, review your group's answers and make any necessary revisions.
7. Be ready to explain why you placed each unit in its column.

Unit Cards

meter	micrometer	milligram	inch
kilometer	ounce	liter	foot
centimeter	gram	milliliter	yard
millimeter	kilogram	degree Celsius	mile
pound	quart	degree Fahrenheit	gallon

Metric System	Nonmetric System

Option 2. **Spot the Intruders**
Instructions:
1. Work with a partner.
2. Examine each set of units.
3. Identify the unit that does not belong with the others.
4. Encircle the intruder in each set.
5. Discuss your answers with your partner.
6. Be prepared to explain your choices.

Set A
meter • kilometer • centimeter • inch
Set B
gram • kilogram • milligram • pound

Activity A.1. **Leveling Learner Readiness**
Facilitation Guide:
1. Use Option 1: Sort It Out! when group work and printed unit cards are possible.
2. Use Option 2: Spot the Intruders when space, time, or materials are limited.
3. Use Option 3: Metric Catch! when devices and internet access are available.
4. Let learners explain their classifications before giving the correct answers.
5. Use the processing questions to lead learners to the term English System of Measurement.
6. Transition by asking how measurements from two different systems can be compared.

Processing Questions:
1. What similarities and differences did you observe among the units presented?
2. What characteristics helped you identify whether a unit belongs to the Metric System or not?
3. What do you think is the name of the system to which the nonmetric units belong?

	Set C liter • milliliter • gallon • micrometer **Set D** degree Celsius • kilometer • millimeter • degree Fahrenheit **Set E** nanometer • micrometer • millimeter • yard Option 3. **Metric Catch!** *Instructions:* 1. Access the game by scanning the QR code or entering the link: https://tinyurl.com/GMMetricCatch 2. Enter your name and section. 3. Click Start Game. 4. Objects with unit labels will fall from the top of the screen. 5. Move the basket left or right to catch the objects labeled with metric units. 6. Avoid catching objects labeled with nonmetric units. 7. Each correct catch adds points to your score. 8. Continue playing until the timer runs out. 9. Review your final score and results after the game ends. 10. Be prepared to share your observations about the metric and nonmetric units that appear in the game.	
	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. **Appreciating Lesson Relevance** *Instructions*: 1. Read the situation carefully. 2. Discuss the question with your group. 3. Record your answer and reasoning. 4. Be prepared to share your ideas with the class. Option 1. **The Fabric Dilemma** Two fabric suppliers offer the same type of fabric at the same price. **Supplier A**: ₱120 per meter **Supplier B**: ₱120 per yard **Question:** Which supplier offers more fabric for the same price?	Activity A. 2. **Appreciating Lesson Relevance** **Facilitation Guide** 1. Guide learners to focus on reasoning, not just guessing. 2. Encourage group discussion for Options 1 and 2; pair work is sufficient for Option 3. 3. Prompt learners to explain why comparing measurements with different units can be difficult. 4. Highlight how unit conversion is essential in making accurate, informed decisions. 5. Connect the scenarios to everyday life to increase relevance and engagement. 6. After the activity, facilitate reflection using the processing questions to lead into the study of metric and English systems

<table>
<tr>
<td></td>
<td>Option 2. Online Shopping
A family wants to buy a television that will fit on a cabinet that is 100 centimeters wide. An online store lists the television's width as 43 inches. Will the television fit on the cabinet?
Option 3. The Recipe Puzzle
A recipe requires 4 cups of milk. While shopping, only a carton labeled 1 liter is available. Will the 1-liter carton provide enough milk for the recipe?</td>
<td>and unit conversion.

Processing Questions:
1. What challenge was encountered when comparing measurements expressed using different units?
2. How do different units affect decision-making in everyday situations?
3. Why is it important to understand and convert measurements before making decisions?

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.</td>
</tr>
<tr>
<td rowspan="2">B. Instituting New Knowledge</td>
<td colspan="2">B.1. Presenting Examples</td>
</tr>
<tr>
<td>Activity B.1. Exploring Key Concepts
Option 1. “Which is Bigger?" Showdown
Instructions:
1. Observe each pair of measurements displayed.
2. Determine which measurement is larger.
3. Keep the answer private until the cue “Show your answer” is given.
4. When the cue is given:
• Place the right hand on the left shoulder if the measurement on the left is larger.
• Place the left hand on the right shoulder if the measurement on the right is larger.
5. Hold the gesture until instructed to lower it.
6. Be prepared to justify the answer when called.
<table>
<tr><th>Left Side</th><th>vs.</th><th>Right Side</th></tr>
<tr><td>1 kilometer</td><td>vs.</td><td>1 mile</td></tr>
<tr><td>1 liter</td><td>vs.</td><td>1 gallon</td></tr>
<tr><td>1 centimeter</td><td>vs.</td><td>1 inch</td></tr>
<tr><td>1 kilogram</td><td>vs.</td><td>1 pound</td></tr>
<tr><td>1 meter</td><td>vs.</td><td>1 yard</td></tr>
</table>
</td>
<td>Activity B.1. Exploring Key Concepts
Facilitation Guide
1. Display one pair of measurements at a time to avoid students copying each other.
2. Ensure learners decide quietly before giving the cue to show their answer.
3. Use clear gestures:
• Right hand on left shoulder → left measurement is larger.
• Left hand on right shoulder → right measurement is larger.
4. Hold gestures until all responses are visible.
5. After each pair, briefly discuss reasoning without revealing the correct answer yet.
6. After all pairs are completed, facilitate a discussion guided by the processing questions to lead learners toward identifying the two measurement systems and the challenges in comparing different units.
7. Highlight the distinction between the Metric System (base-10 structure) and the English System (varied conversion factors).
8. Emphasize that recognizing the system of a unit is a prerequisite to accurate measurement comparison and conversion.</td>
</tr>
</table>

Option 2. **Bigger or Smaller?**

Instructions:

1. Access the activity by scanning the QR code or entering the link provided.
   https://tinyurl.com/GMBiggerorSmaller
2. Enter your name and section.
3. Examine each pair of measurements displayed on the screen.
4. Predict which measurement is larger.
5. Review the results after each round.
6. Continue until all pairs have been completed.
7. Review your final score and observations at the end of the activity.

Processing Questions:

1. Which pairs of measurements were easy to compare? Which pairs were difficult? Why?
2. Based on the units shown, what are the two systems of measurement represented?
3. What challenge was encountered when comparing measurements expressed using different units?
4. What must be done to compare measurements accurately when different units are used?

Metric System vs. English System

The previous activity showed that some measurements were easier to compare than others. The difficulty arose because the measurements belonged to two different systems of measurement.

The **Metric System** is a standardized system of measurement based on powers of ten. It is widely used around the world, including in the Philippines. Common metric units include meter, kilometer, centimeter, gram, kilogram, liter, milliliter, and degree Celsius.

The **English System** of Measurement is another system used in some countries, particularly the United States. Common English units include inch, foot, yard, mile, ounce, pound, gallon, quart, and degree Fahrenheit.

The Metric System uses a base-10 structure, making conversions systematic. In contrast, the English System uses varying conversion factors between units.

Because measurements may be expressed using different systems, conversion is necessary to compare and communicate measurements accurately.

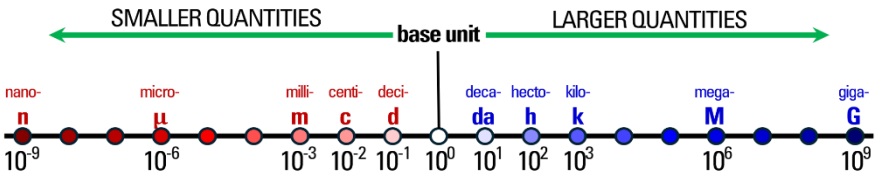
B.2. Discussing the Concept

Activity B.2. **Deepening Conceptual Understanding**

Part I. **Converting Metric Units**

The Metric System is based on powers of ten. This means that units are related by multiples or fractions of ten, making conversions systematic and consistent.

Recall the metric prefix scale:



The metric prefix scale can be used to convert measurements within the Metric System. Since the Metric System is based on powers of ten, each prefix represents a value that is ten times larger or ten times smaller than the adjacent prefix.

Example. Convert 4.5 kilometers to centimeters.

Solution:

Given unit: kilometers; desired unit: centimeters

Conversions: $1\text{ km} = 10^3\text{m}$; $1\text{ cm} = 10^{-2}\text{m}$

First conversion factor | Second conversion factor

$$4.5\text{ km}\left(\frac{10^3\text{m}}{1\text{ km}}\right)\left(\frac{1\text{cm}}{10^{-2}\text{m}}\right)$$

$$4.5\text{ km}\left(\frac{10^3\text{m}}{1\text{ km}}\right)\left(\frac{1\text{cm}}{10^{-2}\text{m}}\right) = \frac{4.5(10^3)\text{cm}}{10^{-2}} = 4.5(10^5)\text{cm} = 450{,}000\text{ cm}$$

Part II. Converting English Units

The English System uses conversion relationships that do not follow powers of ten. As a result, conversion equivalences must be identified before appropriate conversion factors can be written.

Activity B.2. **Deepening Conceptual Understanding**

This activity consists of three parts:

- **Part I:** Converting Metric Units
- **Part II:** Converting English Units
- **Part III:** Converting Between Metric and English Systems, including temperature

Part I. **Converting Metric Units**

Facilitation Guide:

1. Display the Metric Prefix Scale for reference.
2. Ask guide questions progressively: given unit → desired unit → first conversion factor → subsequent factors.

Guide Questions:

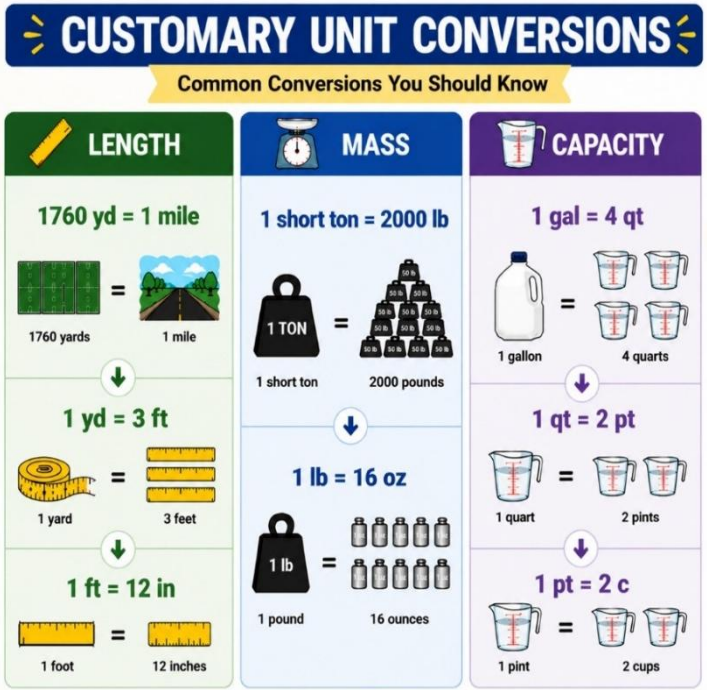
a. What is the given unit?
b. What is the desired unit?
c. Using the metric prefix scale, what conversion can be written to relate the given unit to the desired unit?
d. What conversion factor can be used to cancel the given unit kilometer?
e. Why is the first conversion factor written as $\frac{10^3\text{m}}{1\text{km}}$ and not $\frac{1\text{km}}{10^3\text{m}}$?
f. What conversion factor can be used to cancel the remaining unit meter?
g. After all cancellations, what unit remains?
h. Why does multiplying by conversion factors not change the actual measurement?

3. Emphasize that multiplying by a conversion factor = multiplying by 1; units change but quantity remains.
4. Encourage learners to identify given and desired units before applying conversion factors.
5. Highlight unit cancellation: given unit disappears, desired unit remains.
6. After worked examples, learners attempt Check Your Understanding problems step by step.

✔ **Check Your Understanding!**

Convert each measurement to the indicated unit. Show the complete solution using conversion factors.

a. Convert 7.2 kilometers to millimeters.
b. Convert 450 milligrams to kilograms.
c. Convert 0.85 megameters to centimeters.
d. Convert 3.5 milliliters to kiloliters.



Example: Convert 2.5 gallons to cups

Solution:

Given unit: gallons; desired unit: cups

Conversions: 1 gal = 4qt; 1 qt = 2pt; 1 pt = 2c

First conversion factor | Second conversion factor | Third conversion factor

$$2.5\text{ gal}\left(\frac{4\text{ qt}}{1\text{ gal}}\right)\left(\frac{2\text{ pt}}{1\text{ qt}}\right)\left(\frac{2\ c}{1\text{ pt}}\right)$$

$$2.5\text{ gal}\left(\frac{4\text{ qt}}{1\text{ gal}}\right)\left(\frac{2\text{ pt}}{1\text{ qt}}\right)\left(\frac{2\ c}{1\text{ pt}}\right)=\frac{2.5(4)(2)(2)c}{1(1)(1)}$$
$$= 40\ c$$

Part III. **Converting Between the Metric and English Systems**

Measurements are not always expressed using the same system of units. In many situations, measurements given in the Metric System must be converted to the English System, or vice versa. To perform these conversions, appropriate conversion equivalences are used to form conversion factors. These conversion factors allow the given unit

e. Convert 2.4 gigagrams to micrograms

7. Monitor for misconceptions: wrong multiplication/division, confusing prefixes, incorrect unit cancellation.

Part II. **Converting English Units**

Facilitation Guide:

1. Show the English conversion table (length, mass, capacity).
2. Guide learners to identify given and desired units first.

Guide Questions:

a. What is the given unit?
b. What is the desired unit?
c. Which conversion factor cancels gallons?
d. After applying the first conversion factor, what unit remains?
e. Which conversion factor cancels quarts?
f. Which conversion factor cancels pints?
g. After all cancellations, what unit remains?
h. Why is it important to follow the correct sequence of conversion factors when converting between multiple units?

3. Emphasize correct sequence of conversion factors to cancel units properly.
4. Reinforce that each factor = 1, only units change.
5. Monitor common errors: reversed numerator/denominator, skipped steps, wrong sequencing.
6. Provide Check Your Understanding exercises for independent practice.

✔ **Check Your Understanding!**

Convert the following using the conversion table:

a. 3 quarts → pints
b. 7 pints → cups
c. 2 gallons → quarts
d. 16 ounces → pounds
e. 2 short tons → pounds

Part III. **Converting Between the Metric and English Systems**

Facilitation Guide

1. Discuss that some measurements require cross-system conversion.
2. Present base equivalences (e.g., 1 in = 2.54 cm, 1 oz = 28.35 g, 1 fl oz = 29.57 mL).
3. Guide learners to identify given and desired units, derive intermediate conversions, and apply sequential factors.

to be canceled and replaced with the desired unit while preserving the value of the measurement.

The table below shows common English-to-Metric conversion equivalences. Some values are standard base equivalences, while others can be derived from these bases using sequential conversions.

Example: Determine the Metric equivalent of 1 foot.

Solution: Given unit : foot (ft) ; desired unit: centimeter (cm)

Conversions: 1 ft = 12 in ; 1 in=2.54 cm

First conversion factor | Second conversion factor

$$1\text{ ft}\left(\frac{12\text{ in}}{1\text{ ft}}\right)\left(\frac{2.54\text{ cm}}{1\text{ in}}\right)$$

$$1\cancel{\text{ft}}\left(\frac{12\cancel{\text{in}}}{1\cancel{\text{ft}}}\right)\left(\frac{2.54\text{ cm}}{1\cancel{\text{in}}}\right)=\frac{12(2.54)\text{cm}}{1(1)}$$

$$= 30.48\text{ cm}$$

Steps in Converting Between and Across Metric and English Systems:

1. Identify the given unit and desired unit.
2. Write the needed conversion equivalences.
3. Write the conversion factors.
4. Multiply the given measurement by the conversion factors.
5. Cancel the units and simplify the numerical parts.

English-to-Metric Special Case: Temperature Conversion (°C ↔ °F)

English-to-Metric conversions involved **length, mass, and capacity**, where the conversion could be achieved using **multiplicative conversion factors**. Temperature is a **special case** because the scales do not start at the same zero point (0°C ≠ 0°F) and the relationship between units includes both a **multiplication factor and an offset**.

Guide Questions:

a. What is the given unit?
b. What is the desired unit?
c. What conversion can be used to relate feet to inches?
d. What conversion can be used to relate inches to centimeters?
e. Which conversion factor cancels the given unit foot?
f. After applying the first conversion factor, what unit remains?
g. Which conversion factor cancels the remaining unit inch?
h. After all cancellations, what unit remains?
i. How can base conversion equivalences be used to derive other conversions in the table?

4. Emphasize unit cancellation at each step and systematic calculation.
5. Temperature conversion requires offset + scaling factor: °C = (°F – 32) × 5/9.
6. Monitor learners for correct sequencing, intermediate units, and final unit accuracy.

✔ **Check Your Understanding!**

Complete the English-to-Metric conversion table by determining the missing Metric equivalents. Show the necessary conversions and calculations for each answer

COMMON CONVERSIONS

ENGLISH TO METRIC

QUANTITY	ENGLISH (US CUSTOMARY)	METRIC (SI)
LENGTH	1 inch (in)	2.54 centimeters (cm)
	1 foot (ft)	____ centimeters (cm)
	1 yard (yd)	____ meters (m)
	1 mile (mi)	____ kilometers (km)
MASS (WEIGHT)	1 ounce (oz)	28.35 grams (g)
	1 pound (lb)	____ kilograms (kg)
	1 short ton (2000 lb)	____ kilograms (kg)
CAPACITY (VOLUME)	1 fluid ounce (fl oz)	29.57 milliliters (mL)
	1 cup (c)	____ milliliters (mL)
	1 pint (pt)	____ milliliters (mL)
	1 quart (qt)	____ liters (L)
	1 gallon (gal)	____ liters (L)

QUANTITY	ENGLISH (US CUSTOMARY)	METRIC (SI)
LENGTH	1 inch (in)	2.54 centimeters (cm)
	1 foot (ft)	____ centimeters (cm)
	1 yard (yd)	____ meters (m)
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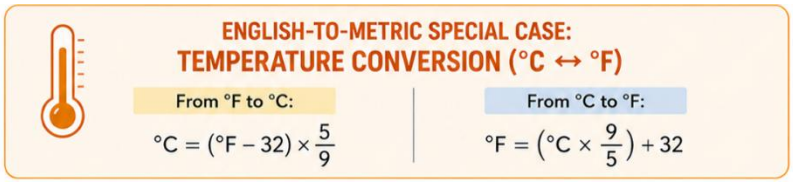
	1 pint (pt)	____ milliliters (mL)
	1 quart (qt)	____ liters (L)
	1 gallon (gal)	____ liters (L)

English-to-Metric Special Case: Temperature Conversion

Facilitation Guide:

1. Emphasize that unlike standard English-to-Metric conversions (length, mass, capacity), **temperature cannot be converted by a simple multiplication factor alone**.



This formula shows that unlike length or mass, temperature conversion requires:

1. Adjusting for the difference in starting points of the scales.
2. Applying a multiplication factor to account for the scale difference.

Example: Convert 95°F to °C

Solution: $°C = (°F - 32) \times \frac{5}{9}$

$= (63)\left(\frac{5}{9}\right)$

$°C = 35$

Answer: 95°F = 35°C

2. Highlight that the formula accounts for:
   a. The difference in zero points between scales (e.g., 0°C ≠ 0°F).
   b. The scaling factor between the sizes of units (9/5 or 5/9).
3. Walk learners through the worked example step by step:
   a. Identify the **given unit** (°F) and **desired unit** (°C).
   b. Subtract 32 from the Fahrenheit value to adjust for the offset.
   c. Multiply by 5/9 to apply the scale factor.
   d. Show the resulting Celsius temperature.
4. Ask the **guide questions progressively** as the example is being solved to engage learners in reasoning.

Guide Questions:

1. What is the **given unit** and the **desired unit**?
2. Which formula should be used for this conversion?
3. What is the first step in the calculation?
4. What is the final value in the desired unit?

5. After the example, let learners practice the **Check Your Understanding** conversions to reinforce the method.

✔ **Check Your Understanding!**

Convert each temperature to the indicated unit.

1. 68°F → °C
2. 86°F → °C
3. 20°C → °F
4. 30°C → °F
5. 100°C → °F

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3.**Practicing Learned Skills: The Great Conversion Escape Challenge**

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy.

Facilitation Guide

1. Organize learners into groups of 3–5 members.
2. Provide access to the conversion table and necessary references.
3. Allow calculators for arithmetic and scientific notation but prohibit conversion applications.
4. Require learners to show complete solutions and unit cancellations.
5. Remind learners that all problems in a station must be solved before determining the Clue Digit.
6. Verify the Final Escape Code and facilitate discussion of errors when codes differ.
7. Use the activity to reinforce scientific notation, unit cancellation, temperature conversion, and cross-system conversion skills.

C.1. Finding Practical Application

C. Demonstrating Knowledge and Skills	Activity C.1. **Making Real-World Connections** **Digital Tool Spotlight: Verifying Conversions with a Unit Converter** The previous activity required the manual application of unit conversion skills across a variety of situations. In many real-world settings, digital tools are also used to verify measurements and reduce computational errors when making decisions. One example is a **unit converter**, which is available on many smartphones, calculators, and websites. A unit converter can quickly convert measurements from one unit to another and serve as a tool for checking the accuracy of manual computations. Many smartphones available include a built-in unit converter, often integrated into the calculator application. When available, this feature may be used to verify conversion results. Online tools, such as **UnitConverters.net** (https://www.unitconverters.net/), may also be used as an alternative. Before using a unit converter, it is important to identify: • the quantity being measured (e.g., length, mass, volume, temperature, time); • the given measurement value and unit; and • the desired unit. *Example:* Convert 6 feet to meters. Using the Unit Converter 1. **Identify the quantity** to convert (e.g., Length, Temperature, Area, Volume, Weight, or Time). 2. **Select the given unit** from the drop-down menu on the left. 3. **Select the desired unit** from the drop-down menu on the right. 4. **Enter the measurement value** for the given unit in the input box. 5. The converter will automatically display the converted value in the desired unit. Now, apply the same process in the following real-world scenarios. 1. Complete the manual calculations first for each scenario. 2. Afterward, use the unit converter (phone-based or online, e.g., UnitConverters.net) to verify your results. 3. Compare the digital results with your manual computations and note any differences.	Activity C.1. **Making Real-World Connections** *Facilitation Guide:* 1. Demonstrate the use of a unit converter before presenting the scenarios. 2. Emphasize that manual calculations must be completed before using digital verification tools. 3. Guide learners in identifying the quantity, given measurement value and unit, and desired unit before using the converter. 4. Allow the use of calculators, conversion tables, and unit converters for verification. 5. Require learners to show complete solutions and justify decisions using converted measurements. 6. Facilitate discussion on how conversion accuracy affects decision-making in real-life situations. 7. Accept minor rounding differences resulting from different conversion tools. *Processing Questions:* 1. How did converting units help you complete the tasks in each scenario? 2. What problems could occur if measurements are not converted accurately in cooking, production, or construction? 3. Why is it important to be able to convert between different systems of measurement in real-life situations?

	4. Ensure all measurements, units, and reasoning are clearly recorded. **Scenario 1. Cooking from an International Recipe** A French recipe requires 1.2 liters of vegetable broth. You only have measuring cups at home. **Tasks:** 1. Convert 1.2 liters into cups. 2. Determine whether 5 cups is enough to prepare the recipe. 3. Explain how accurate conversions help avoid mistakes in cooking. **Scenario 2. Dress Production** Maria's garment workshop received an order for 200 dresses. Each dress requires 2.5 yards of fabric. Her supplier sells fabric in meters. Maria wants to add 10% extra fabric to account for cutting waste. **Tasks:** 1. Calculate the total fabric needed in yards. 2. Convert this amount to meters. 3. Include the 10% extra allowance. 4. Recommend how many meters Maria should order and explain why this matters for her production. **Scenario 3. Carpentry Measurement Challenge** A carpenter is building a small bookshelf. The design specifies the board length as 6 feet, but the boards are sold in meters at the hardware store. **Tasks:** 1. Convert 6 feet into meters. 2. Determine the minimum board length he should buy. 3. Explain why accurate conversion is important when purchasing materials and planning a construction project.	
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson** **Option 1. Crossing the Conversion Bridge** *Instructions:* 1. Take a sheet of paper and divide it into two sections: **"I Learned…"** and **"I Still Need to Learn…"** 2. On the **"I Learned…"** side, write **three key ideas** you learned about: • converting between units within the metric system; • converting between metric and English units; and • using conversion factors correctly.	Activity C.2. **Wrapping Up the Lesson** Option 1. **Crossing the Conversion Bridge (Reflection)** 1. Learners divide a sheet into **"I Learned…"** and **"I Still Need to Learn…"** sections. 2. Encourage writing specific insights and lingering questions. 3. Have learners share highlights with a partner or group. 4. Use responses to clarify common misconceptions.

3. On the **"I Still Need to Learn..."** side, write **two to three questions** you still have about unit conversions.
4. Share your responses with a partner or small group.

Option 2. **Unit Conversion Concept Map: Across Systems**
Instructions:
1. Draw a large circle in the center of your paper and label it **"Unit Conversion."**
2. Create branches for:
   - **Metric Units** such as millimeter, centimeter, meter, kilometer, gram, and liter; and
   - **English Units** such as inch, foot, yard, mile, pound, ounce, cup, pint, quart, and gallon.
3. Add sub-branches showing:
   - conversions within the metric system; and
   - conversions between metric and English units.
4. Include real-life applications such as cooking, dress production, carpentry, travel, science, or shopping.
5. Work in pairs or small groups to complete the concept map, then compare your key takeaways with the class.

Option 2. **Unit Conversion Concept Map: Across Systems (Concept Mapping)**
1. Learners create a concept map linking **metric and English units,** conversions within systems, and real-life applications.
2. Encourage including examples from cooking, dress production, carpentry, or travel.
3. Compare maps in pairs or groups to discuss different approaches and highlight key concepts.
4. Emphasize connections among units, conversion factors, and practical applications.

For both options:
1. Use learner responses to assess conceptual understanding and identify misconceptions.
2. Reinforce the importance of accurate unit conversions in solving real-world problems and future measurement-related tasks.

C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.3. **Assessing Learning Outcomes**

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy.

Facilitation Guide:
1. Explain that the activity serves as an assessment of learners' understanding of unit conversions across different measurement systems.
2. Remind learners to show complete solutions and include correct units in all answers.
3. Encourage learners to identify the given unit, desired unit, and appropriate conversion factor before solving.
4. Allow the use of calculators for arithmetic computations, if permitted.
5. Monitor learners' application of conversion factors, unit cancellation, and temperature conversion formulas.
6. Use the processing questions to facilitate reflection on the role of measurement conversion in real-world situations. Review common errors and misconceptions after checking the assessment.

C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.4. **Extending and Reinforcing Learning**
Facilitation Guide:
Conversion Quest
1. Present stations one at a time and do not allow progression until all problems are correct.
2. Encourage learners to show stepwise calculations.
3. Use hints to scaffold learners who struggle.
4. Collect and verify letter clues before moving on.
5. Celebrate completion of the hidden word to motivate learners.

Unit Conversion in Real Life

1. Encourage learners to select scenarios relevant to their interests or strand.
2. Ensure students demonstrate stepwise calculations and correct units.
3. Highlight reasoning and consequences of errors to reinforce the importance of accurate conversions.
4. Presenting to the class promotes communication skills and peer learning.

III. CONTENT

Lesson 3.3. Determining the Surface Area of Three-Dimensional Objects

IV. OBJECTIVES

At the end of the lesson, learners should be able to:

1. identify the basic 3D figures such as prisms, pyramids, cylinders, cones, and spheres and their different parts using blueprints and models;
2. select and apply the appropriate surface area formula for each type of solid;
3. compute the surface area of individual 3D objects accurately using given measurements; and
4. solve real-life problems involving surface area of 3D objects or solid figures and their combinations.

V. PROCEDURES

LEARNERS ACTIVITIES	ANNOTATION FOR TEACHERS

A. Activating Prior Knowledge

A.1. Eliciting Prior Knowledge

Activity A.1. **Leveling Learners Readiness:Warm-Up Discussion**

Before learning how to determine the surface area of three-dimensional objects, let us first review mathematical concepts that will help you understand how the total outer covering of solid figures is determined and applied in practical situations.

Part 1. Area Review Using Grids

Instructions:

1. Study the worksheet or digital slide containing five two-dimensional figures drawn on square grids.
2. Each square on the grid represents **1 square unit**.
3. For each figure:
   a. Determine its area by counting the squares or by applying the appropriate area formula.
   b. Record the computed area in the column labeled **Number of Square Units**.
   c. Write the formula used in the computation.
   d. Identify a three-dimensional solid figure in which the shape may appear as a face or base.
4. Compare your answers with a partner.
5. Be prepared to explain how the area of two-dimensional figures relates to the surface area of three-dimensional objects.

Shapes on the Grid Worksheet:

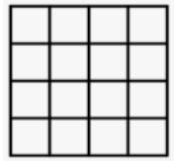
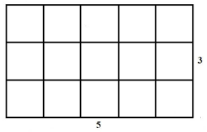
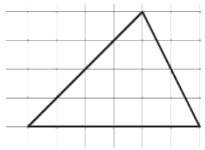
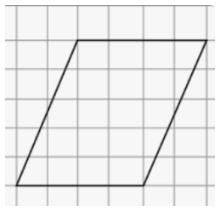
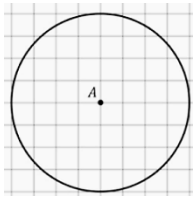
2D Shape	Illustration	Number of Square Units	Formula for Area	Possible 3D Solid Figure

Activity A.1. **Leveling Learners Readiness:Warm-Up Discussion**

This activity is intended to activate learners' prior knowledge of two-dimensional and three-dimensional geometry in preparation for the lesson on determining the surface area of solid figures. Through the review of area concepts and the identification of real-life three-dimensional objects, learners are provided opportunities to recall prerequisite mathematical knowledge and connect previously learned concepts to the current lesson. The activity supports conceptual understanding by helping learners recognize the relationship between the area of two-dimensional figures and the total outer surface of three-dimensional objects.

To facilitate this activity, the teacher should organize collaborative learning opportunities, provide appropriate visual references or concrete models, and guide learners in identifying the geometric properties of solid figures, including faces, edges, vertices, flat surfaces, and curved surfaces. The teacher should monitor learner participation, address misconceptions promptly, and encourage accurate mathematical communication during discussions and group tasks. Emphasis should be placed on relating learners' observations to the mathematical concepts required for determining surface area.

The teacher may integrate educational technology (EdTech) tools such as interactive presentation slides, digital geometry applications, virtual three-dimensional models, or classroom response platforms to support visualization and learner engagement. These tools may be used to present geometric figures, demonstrate surface characteristics, facilitate collaborative discussions, and provide immediate feedback, thereby strengthening learners' conceptual

Square				
Rectangle				
Triangle				
Parallelogram				
Circle				

Part 2: 3D Object Hunt and Surface Scan

Instructions:

1. Form groups of five members.
2. Observe objects in the classroom or think of real-life objects commonly encountered in daily life that resemble three-dimensional geometric solids.
3. Identify five (5) real-life objects that resemble three-dimensional solids and complete the table.
4. For each object, indicate:
    a. the real-life object;

readiness for the formal discussion and application of surface area formulas.

Processing Questions:

1. Which two-dimensional shapes appeared as parts of the three-dimensional objects you identified?
2. What differences did you observe between flat faces and curved surfaces?
3. What measurements are needed to determine the surface area of solid figures?
4. If you know the area of each face or surface of an object, how can you determine its total outer covering?
5. Why is understanding surface area important in real-life situations such as packaging, construction, or product design?

b. the geometric solid it resembles;
c. whether the object has flat surfaces, curved surfaces, or both;
d. the estimated number of faces or surfaces;
e. the measurements needed to determine its surface area.

- Discuss your responses with your group members.
- Be prepared to explain how the identified measurements help in determining the surface area of the object.
- Use the template for each group to fill out.

Real-Life Object	Geometric Shape	Surface Type (Flat/ Curved/ Both)	Estimated Number of Surfaces	Measurements Needed to Determine Surface Area
Example: Shoe Box	Rectangular Prism	Flat only	6	Length, height, width
Ice Cream Cone	Cone	Curved, flat	2	Radius, slant height

Note: If needed, you may use large-print materials.

A.2. Establishing the Purpose of the Lesson

Activity A.2.

Appreciating Lesson Relevance: Cover It Up! Why Surface Area Matters

Understanding the surface area of three-dimensional objects is important in many real-life situations involving design, packaging, construction, and manufacturing. In this activity, you will examine practical examples where determining the total outer covering of an object is necessary.

Instructions:

1. Observe the given images, models, or product packages representing real-life three-dimensional objects such as shipping boxes, beverage cans, food containers, water tanks, packaging materials, or architectural structures.
2. Identify the geometric solid figure that each object resembles (e.g., prism, pyramid, cylinder, cone, or sphere).
3. Complete the observation table by identifying the geometric shape represented and its possible real-life use. Use your observations to think about the parts or surfaces that may need to be measured and why determining the surface area of the object may be important.

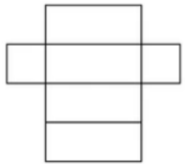
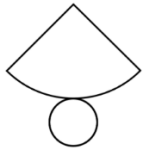
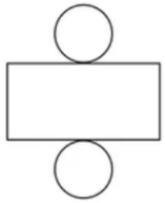
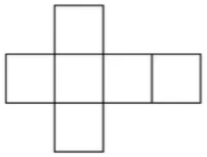
Activity A.2: Appreciating Learning Relevance

This activity establishes the relevance of the lesson by helping learners connect the concept of surface area to practical and professional contexts where understanding the structure of three-dimensional objects is essential. Through the analysis of blueprints, nets, and real-life object representations, learners develop spatial reasoning and recognize that identifying the faces and surfaces of solid figures is necessary before determining their total outer covering. This helps learners appreciate the practical application of geometry in fields such as architecture, engineering, construction, packaging, and product design.

To facilitate this activity, the teacher should provide clear visual representations of blueprints, nets, or real-life objects and model how to analyze one example before learners begin the task. Learners should be guided to examine the shapes, identify structural features, and relate these to corresponding three-dimensional figures and real-life applications. The teacher should monitor learner participation, encourage collaborative discussion, address misconceptions, and emphasize the connection between recognizing object structure and selecting appropriate mathematical strategies for surface area.

4. Discuss your responses with a partner or group.
5. Be prepared to present your observations and explain how the concept of surface area applies to the given situations.

Matching Table (Learner's Worksheet):

Blueprint #	Sketch of the 3D Shape	Name of the 3D Shape	Real-life Use
1. 		Rectangular Prism	
2. 			
3. 			
4.			
5. 			

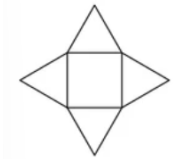
Educational technology (EdTech) tools such as interactive presentation slides, virtual geometry applications, digital nets, or three-dimensional modeling tools may be integrated to enhance visualization and learner engagement. These resources can support learners in exploring geometric figures from different perspectives, manipulating virtual models, and strengthening their understanding of how two-dimensional representations relate to three-dimensional objects and real-world applications.

Accept other reasonable answers provided learners justify their choice by referring to the size, dimensions, or amount of exposed surface area of the object.

Processing Questions:

1. What features of the object, image, model, or net helped you identify the three-dimensional figure?
2. How do two-dimensional representations help you understand the structure of three-dimensional objects?
3. Why is it important to identify the faces and surfaces of a solid figure before determining its surface area?
4. Which geometric figure was the easiest or most challenging to identify? Explain your answer.
5. How can understanding three-dimensional object representations be useful in real-life fields such as architecture, engineering, or product design?

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.

	6.  Among the objects shown, which do you think would require the greatest amount of material to cover? Explain your answer. **Note:** If needed, you may use large-print materials. If drawing or writing is difficult, you may explain your solution orally or present it in another teacher-approved format.	
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Surface Area Escape Challenge** Objective: Determine the surface area of different three-dimensional solid figures by analyzing their surfaces and completing guided examples. *Materials:* 1. Surface Area Maze Worksheet 2. Formula Reference Card 3. Calculator 4. Pencil *Instructions:* 1. Work with a partner or in a small group. 2. Study each three-dimensional solid figure carefully. 3. For each room in the maze: a. Identify the solid figure and the measurements needed. b. Select the appropriate surface area formula. c. Solve the problem independently. d. Choose the correct exit door based on your answer. e. Proceed to the next room or return if your answer is incorrect. 4. Continue until all six rooms are completed. 5. Be prepared to explain your answers during the class discussion. Surface Area Formula Reference Card Three-Dimensional Solid Figure | Surface Area Formula Cube | $SA = 6s^2$	Activity B.1. **Exploring Key Concepts: Surface Area Escape Challenge** This activity introduces learners to the process of determining the surface area of three-dimensional solid figures through guided examples presented in an engaging maze format. By examining the given formulas and substitutions, then completing the missing solution steps, learners develop an understanding of how appropriate surface area formulas are selected and applied to different solid figures such as cubes, cylinders, cones, rectangular prisms, and spheres. The guided structure provides scaffolded support that helps learners focus on understanding the computation process while building confidence in solving surface area problems. To facilitate this activity, the teacher should briefly review the surface area formulas included in the Formula Reference Card and model one sample problem before learners begin the maze. Learners may work in pairs or small groups to encourage discussion, collaborative reasoning, and peer support. As learners progress through the activity, the teacher should monitor participation, provide immediate feedback, and clarify misconceptions related to formula selection, substitution, and computation. Emphasis should be placed on helping learners recognize the relationship between the dimensions of a solid figure and the corresponding formula used to determine its surface area. Educational technology (EdTech) tools such as interactive presentation slides, virtual geometry applications, or digital classroom quizzes may be integrated to enhance learner engagement and visualization. These tools can support guided problem solving,

Cylinder	$SA = 2\pi r^2 + 2\pi rh$
Rectangular Prism	$SA = 2lw + 2lh + 2wh$
Cone	$SA = \pi r^2 + \pi rs$
Sphere	$SA = 4\pi r^2$
Square Pyramid	$SA = b^2 + 2bs$

Surface Area Maze Worksheet

Room	Situation and Given Information	Guided Example (Complete the Solution)	Exit Doors
1. Cube Chamber	A gift box is shaped like a cube with an edge length of 7 cm.	Formula: $SA = 6s^2$ Substitution: $SA = 6(7^2)$ Solution: $SA = 6(49)$ $SA =$ _____ Final Answer: _____	☐A. 196 cm² ☐B. 294 cm²
2. Cylinder Tunnel	A soda can has a radius of 5 cm and a height of 10 cm.	Formula: $SA = 2\pi r^2 + 2\pi rh$ Substitution: $SA = 2(3.14)(5^2) + 2(3.14)(5)(10)$ Solution: $SA =$ _____ + _____ $SA =$ _____ Final Answer: _____	☐A. 471 cm² ☐B. 314 cm²
3. Cone Corner	An ice cream cone has a radius of 4 cm and a slant height of 9 cm.	Formula: $SA = \pi r^2 + \pi rs$ Substitution: $SA = (3.14)(4^2) + (3.14)(4)(9)$ Solution: $SA =$ _____ + _____ $SA =$ _____ Final Answer: _____	☐A. 113.04 cm² ☐B. 163.28 cm²
4. Prism Passage	A rectangular shipping box has a length of 12 cm, width of 8 cm, and height of 6 cm.	Formula: $SA = 2lw + 2lh + 2wh$ Substitution: $SA = 2(12 \cdot 8) + 2(12 \cdot 6) + 2(8 \cdot 6)$ Solution: $SA =$ _____ + _____ + _____ $SA =$ _____ Final Answer: _____	☐A. 432 cm² ☐B. 336 cm²

provide instant feedback, and strengthen learners' conceptual understanding of surface area through interactive exploration.

1. As the dimensions increased, the surface area also increased because larger measurements result in larger faces or surfaces.
2. Answers may vary. Learners may find the cube easiest because it uses only one measurement, while the cylinder, cone, or pyramid may be more challenging due to multiple measurements and formulas.
3. Identifying the faces, surfaces, and dimensions of a solid figure helped determine which formula was appropriate for calculating its surface area.
4. Determining surface area helps estimate the amount of material needed to cover, paint, package, or construct an object accurately and efficiently.

Processing Questions:

Let learners discuss their answers with partner or group.

1. What measurements were needed to determine the surface area of each solid figure?
2. Which formula used the greatest number of measurements?
3. Which solid figure required a slant height? Why?
4. How did the dimensions affect the surface area of each figure?
5. Which room was the easiest or most challenging to complete? Explain your answer.
6. How did identifying the characteristics of each solid figure help you choose the correct surface area formula?
7. How can determining surface area help in real-life situations such as packaging, painting, construction, and product design?

5. Pyramid Peak	A pyramid-shaped roof has a base edge of 8 cm and slant height of 5 cm.	Formula: $SA = b^2 + 2bs$ Substitution: $SA = 8^2 + 2(8)(5)$ Solution: $SA =$ ____ + _____SA = _____ Final Answer: _____	☐A. 144 cm² ☐B. 104 cm²
6. Sphere Dome 1.	A decorative ball has a radius of 7 cm.	Formula: $SA = 4\pi r^2$ Substitution: $SA = 4(3.14)(7^2)$ Solution: $SA = 4(3.14)(49)$ $SA =$ _____ Final Answer: _____	☐A. 307.72 cm² ☐B. 615.44 cm²

B.2. Discussing the Concept

Activity B.2. Deepening Conceptual Understanding

Understanding Surface Area of Three-Dimensional Objects

Surface area is the total area of all the outer faces and surfaces of a three-dimensional object. Determining surface area helps estimate the amount of material needed to cover, package, construct, or manufacture an object. To determine the surface area of a solid figure, it is important to identify its faces or surfaces and the measurements needed to find their areas. Since solid figures have different characteristics, each has a corresponding surface area formula.

Imagine unfolding a solid figure into a flat pattern called a net. Each part of the net represents a face or surface of the solid. By finding the area of each face and adding them together, we obtain the total surface area of the object. Surface area formulas are simply shortcuts that help us add the areas of all faces efficiently.

A. Rectangular Prism

A rectangular prism has six rectangular faces. Opposite faces are congruent, and the total surface area is the sum of the areas of all six faces.

Formula: $SA = 2lw + 2lh + 2wh$

Measurements Needed: length (l), width (w), height (h)

Example: A packaging engineer is developing a protective container for transporting laboratory equipment. The container measures 30 cm long, 20 cm wide, and 10 cm high. How much packaging material is needed to construct the container?

Solution:

Given: l = 30 cm, w = 20 cm, h = 10 cm

$SA = 2(30)(20) + 2(30)(10) + 2(20)(10)$

Activity B.2. **Deepening Conceptual Understanding**

This activity develops learners' understanding of the surface area of common three-dimensional figures by examining their faces or surfaces, identifying the measurements needed, and applying the appropriate formulas. Contextualized examples from engineering, manufacturing, agriculture, and architecture help learners relate mathematical concepts to real-world applications. Through guided examples and independent practice, learners strengthen their ability to determine the surface area of different three-dimensional objects, which directly supports the learning competency.

Digital presentation tools, interactive simulations, or 3D modeling applications (e.g., GeoGebra 3D, PowerPoint 3D Models, or online geometry visualizers) may be used to help learners visualize the faces, surfaces, and dimensions of solid figures and explore how changes in measurements affect surface area.

Summary of Surface Area Formulas

Solid Figure	Faces/Surfaces	Measurements Needed	Surface Area Formula
Cube	6 square faces	Edge length (s)	$SA = 6s^2$
Rectangular Prism	6 rectangular faces	Length (l), Width (w), Height (h)	$SA = 2lw + 2lh + 2wh$
Cylinder	2 circular bases and 1 curved surface	Radius (r), Height (h)	$SA = 2\pi r^2 + 2\pi rh$

$SA = 1200 + 600 + 400$
$SA = 2{,}200\ cm^2$
The engineer needs 2,200 cm² of packaging material.

B. Cube
A cube has six congruent square faces. Since all faces are equal, the area of one face is multiplied by six.

Formula: $SA = 6s^2$
Measurement Needed: edge length (s)

Example: A manufacturing company produces cube-shaped modular storage units with an edge length of 12 cm for organizing electronic components. Determine the amount of material needed to cover one storage unit.

Solution:
Given: s = 12 cm
$SA = 6(12^2)$
$SA = 6(144)$
$SA = 864\ cm^2$
The storage unit requires 864 cm² of covering material.

C. Cylinder
A cylinder has two circular bases and one curved surface. Its surface area includes the areas of both circular bases and the curved surface.

Formula: $SA = 2\pi r^2 + 2\pi rh$
Measurements Needed: radius (r), height (h)
Example: A municipal water district plans to install a cylindrical storage tank with a radius of 3 m and a height of 7 m. Determine the amount of metal sheet required to construct the tank.

Solution:
Given: r = 3 m, h = 7 m
$SA = 2\pi(3^2) + 2\pi(3)(7)$
$SA = 18\pi + 42\pi$
$SA = 60\pi$
$SA \approx 188.50\ m^2$
Approximately 188.50 m² of metal sheet is needed.

D. Cone
A cone has one circular base and one curved surface. The slant height is used to determine the area of the curved surface.

Formula: $SA = \pi r^2 + \pi rs$

Cone	1 circular base and 1 curved surface	Radius (r), Slant Height (s)	$SA = \pi r^2 + \pi rs$
Sphere	1 continuous curved surface	Radius (r)	$SA = 4\pi r^2$
Square Pyramid	1 square base and 4 triangular faces	Base Edge Length (b), Slant Height (s)	$SA = b^2 + 2bs$

Processing Questions:
1. What is surface area, and how is it related to the faces or surfaces of a solid figure?
2. What measurements are needed to determine the surface area of each solid figure?
3. Which solid figures have both flat and curved surfaces? Which solid figure has only a curved surface?
4. Why is slant height used in finding the surface area of a cone and a square pyramid?
5. How does identifying the characteristics of a solid figure help in selecting the appropriate surface area formula?
6. How can surface area calculations be useful in packaging, manufacturing, engineering, and construction?
7. Why is it important to determine the surface area of an object before constructing, packaging, or covering it?

	Measurements Needed: radius (r), slant height (s) Example: An agricultural facility designs a conical hopper used to transfer grain into storage bins. The hopper has a radius of 0.5 m and a slant height of 1.3 m. Determine the amount of metal sheet needed to construct the hopper. Solution: Given: r = 0.5 m, s = 1.3 m $SA = \pi(0.5^2) + \pi(0.5)(1.3)$ $SA = 0.25\pi + 0.65\pi$ $SA = 0.90\pi$ $SA \approx 2.83\, m^2$ Approximately 2.83 m² of metal sheet is needed to construct the hopper. **E. Sphere** A sphere has one continuous curved surface and no flat faces. Its surface area depends only on its radius. Formula: $SA = 4\pi r^2$ Measurement Needed: radius (r) Example: An engineering firm designs a spherical storage vessel with a radius of 1.2 m for a laboratory prototype. Determine the surface area of the vessel. Solution: Given: r = 1.2 m SA = 4π(1.2²) SA = 5.76π SA ≈ 18.10 m² The spherical storage vessel has a surface area of approximately 18.10 m². F. Square Pyramid A square pyramid has one square base and four triangular faces. Its surface area is the sum of the area of the base and the areas of the triangular faces. Formula: $SA = b^2 + 2bs$ Measurements Needed: base edge length (b), slant height (s) Example: An architectural firm designs a pyramid-shaped roof for a gazebo in a commercial park. The roof has a square base measuring 8 m on each side and a slant height of 6 m. Determine the amount of roofing material needed to cover the gazebo roof.	

Solution:
Given: b = 8 m, s = 6 m

$$SA = 8^2 + 2(8)(6)$$
$$SA = 64 + 96$$
$$SA = 160\,m^2$$

The gazebo roof requires 160 m² of glass.

Surface area calculations are commonly used by engineers, architects, industrial designers, manufacturers, and construction professionals to estimate materials, reduce waste, and improve efficiency in designing products and structures

Guided Practice

1. Analyze each situation. Identify the solid figure represented, determine the measurements needed, select the appropriate surface area formula, and compute the surface area. Show your complete solution and include the correct unit in your final answer.
2. A company is manufacturing cube-shaped storage modules with an edge length of 15 cm. Determine the amount of material needed to cover one module.
3. A packaging engineer is designing a transport container measuring 40 cm long, 25 cm wide, and 15 cm high. Determine the amount of material needed to construct the container.
4. An industrial fuel tank has a diameter of 8 m and a height of 10 m. Determine the amount of metal sheet required to construct the tank.
5. A conical rice grain hopper has a diameter of 1.2 m and a slant height of 1.4 m. Determine the amount of metal sheet needed to construct the hopper.
6. A spherical storage vessel has a diameter of 2 m. Determine its surface area.
7. A pyramid-shaped roof has a square base measuring 10 m on each side and a slant height of 8 m. Determine the amount of glass needed to cover the roof.

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3. **Practicing Learned Skills**

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy..

This activity provides learners with opportunities to independently apply their understanding of surface area through an authentic design scenario. By determining the surface area of structures commonly found in construction, architecture, and engineering projects, learners strengthen their ability to identify solid figures, select appropriate formulas, perform accurate computations, and interpret results in meaningful contexts. The activity directly supports the competency of determining the surface area of three-dimensional objects and their combinations.

Learners may use GeoGebra 3D, virtual manipulatives, or 3D modeling applications to visualize structures, explore dimensions, and verify surface area computations.

Reminder
The Surface Area Design Challenge Rubric shall be used upon completion of the activity to assess learners' mastery of determining the surface area of three-dimensional objects. The rubric evaluates learners' ability to identify solid figures, apply appropriate formulas, perform accurate computations, justify design decisions, and communicate solutions clearly.
Teacher's Note: Use the rubric in the Teacher's Notes as a formative assessment tool to identify learners who may require remediation or enrichment before proceeding to the next learning activity.

C. Demonstrating Knowledge and Skills

C.1. Finding Practical Application (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.1.
Making Real-World Connections: Surface Area Planning Challenge
Objective: Apply surface area concepts to estimate the materials needed for a proposed structure.
Scenario: Your group has been hired as part of a design team for a community project. Before construction begins, the project manager needs an estimate of the materials required to cover different parts of the structure.
Using your knowledge of surface area, determine the amount of material needed for each component and complete the activity worksheet.
Materials
- Calculator
- Ruler
- Grid paper
- Activity Worksheet

Instructions
1. Study the proposed structure and its dimensions.
2. Determine the surface area of each component.
3. Complete the activity worksheet.
4. Discuss your findings with your group.

Proposed Structure
A community information center consists of the following components:

Component	Shape	Dimensions
Main Building	Rectangular Prism	Length = 10 m, Width = 8 m, Height = 4 m
Roof	Square Pyramid	Base Edge = 8 m, Slant Height = 5 m
Water Tank	Cylinder	Radius = 1.5 m, Height = 4 m

Activity C.1.
Making Real-World Connections: Surface Area Planning Challenge
This activity provides learners with an opportunity to apply their understanding of surface area in a practical and meaningful context. By estimating the amount of construction material needed for the different components of a proposed community information center, learners connect mathematical concepts to authentic situations encountered in architecture, engineering, and construction. The activity develops learners' abilities to identify the dimensions of three-dimensional figures, select and apply appropriate surface area formulas, perform accurate computations, and interpret results to support planning and decision-making.
The activity also promotes collaboration, critical thinking, problem-solving, and mathematical communication as learners work together to complete the activity worksheet and discuss their findings. Through the processing questions, learners reflect on the importance of accurate measurement and estimation in minimizing material waste, controlling construction costs, and recognizing the practical applications of surface area in various industries.
Educational technology is integrated by encouraging learners to use digital calculators, GeoGebra 3D, virtual manipulatives, spreadsheet applications, or other appropriate digital tools to model three-dimensional figures, organize data, and verify surface area computations. These technologies enhance visualization, improve computational accuracy, and support the responsible use of digital resources in solving mathematical problems.
The activity also strengthens mathematical literacy by engaging learners in interpreting a real-world scenario, identifying relevant information, selecting appropriate formulas, and communicating solutions using correct mathematical language, symbols, and units of measurement. By explaining their reasoning and justifying their answers, learners develop the ability to express mathematical ideas clearly and apply them to authentic situations.
Reminder

Activity Worksheet

Component	Surface Area	Material Needed
Main Building		
Roof		
Water Tank		

Use the rubric in the Teacher's Notes as a formative assessment tool to evaluate learners' understanding of surface area concepts, accuracy of computations, mathematical communication, and ability to apply mathematics to authentic situations and make informed decisions based on computed results.

Processing Questions

1. Which component requires the greatest amount of material? Explain your answer.
2. How can accurate surface area calculations help reduce material waste in construction projects?
3. Why is determining surface area important when estimating construction materials and costs?
4. Aside from construction, what other fields or industries use surface area calculations? Give examples

C.2. Making Generalization

Activity C.2. **Wrapping Up the Lesson**

Option 1. **What I Learned, What I Wonder**

Instructions:

1. Reflect on what you have learned about the surface area of three-dimensional objects.
2. Complete the statements below using your own ideas and experiences.
   a. I realized that
   _____
   _____
   b. I found it challenging when
   _____
   _____
   c. I wonder why/how
   _____
   _____
   d. Next time, I want to
   _____
   _____
3. Be honest and thoughtful in your responses.
4. Be prepared to share your insights with the class.

Option 2. **Map the Math! – Surface Area Concept Web**

Instructions:

1. Write "Surface Area of Three-Dimensional Objects" at the center of your paper.
2. Draw branches for the following solid figures:
   a. Rectangular Prism
   b. Cube
   c. Cylinder

Activity C.2. **Wrapping Up the Lesson**

This activity provides learners with opportunities to synthesize and reflect on the key concepts learned about the surface area of three-dimensional objects. Through reflective writing, concept mapping, or an exit ticket, learners consolidate their understanding of the characteristics, measurements, formulas, and real-life applications of various solid figures. These activities encourage learners to organize ideas, connect concepts, and articulate their understanding of surface area in meaningful ways.

The teacher may select the option most appropriate to the learners' needs, learning preferences, and available class time. Learners should be encouraged to explain their thinking, make connections among concepts, and relate mathematical ideas to practical situations encountered in everyday life and professional fields.

Digital concept-mapping tools (e.g., Canva Whiteboard, MindMeister, or Padlet), interactive exit tickets (e.g., Google Forms, Mentimeter, or Kahoot!), and collaborative online discussion platforms may be used to facilitate reflection, visualize relationships among concepts, and provide immediate feedback on learners' understanding

Note to the Teacher: Select one option that is most appropriate for the learners' needs, learning preferences, and available class time.

d. Cone
e. Sphere
f. Square Pyramid

3. For each solid figure, include:
   a. A simple sketch
   b. The surface area formula
   c. The faces or surfaces of the figure
   d. The measurements needed to determine its surface area
   e. An example of a real-life object
4. Use arrows, labels, colors, or symbols to show connections among the figures and their characteristics.
5. Share your concept web with a partner or small group.

Option 3: Exit Ticket on Surface Area
Instructions: Answer the following questions independently.

1. Concept Check
   Which of the following solid figures has only a curved surface?
   a. Cube
   b. Cylinder
   c. Sphere
   d. Rectangular Prism
2. Application
   A cube-shaped storage container has an edge length of 4 cm. Determine the amount of material needed to cover the entire container. Show your solution.
   Formula Used: _____
   Solution:
   Final Answer: _____ cm^2
3. Reflection
   One important thing I learned about surface area today is:
   _____
   _____
   _____

C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.3. **Assessing Learning Outcomes**

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy.

This assessment measures learners' understanding of the surface area of three-dimensional objects through a variety of tasks that assess conceptual knowledge, procedural fluency, problem-solving, and real-life application. Learners demonstrate their ability to identify appropriate formulas, perform accurate computations, solve contextualized problems, and explain the practical significance of surface area.

The assessment provides evidence of learners' mastery of the competency and helps identify areas that may require further intervention or enrichment.

	Digital assessment tools such as Google Forms, Microsoft Forms, Quizizz, Kahoot!, or learning management systems may be used to administer selected assessment tasks, provide immediate feedback, and monitor learner performance.
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4. **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy. These activities provide opportunities for learners to strengthen or extend their understanding of surface area based on their learning needs. The remediation activities focus on reinforcing prerequisite concepts, formula application, visualization of solid figures, and connections to real-life situations. The enhancement activities challenge learners to apply surface area concepts in more complex, open-ended, and authentic tasks involving design, modeling, and problem solving. Through these activities, learners continue to develop mathematical reasoning, creativity, and the ability to apply surface area concepts in meaningful contexts. Interactive geometry applications, virtual manipulatives, GeoGebra 3D, digital drawing tools, presentation software, and collaborative online platforms may be used to visualize solid figures, create designs, explore composite structures, and present outputs. These tools support learner engagement and deepen conceptual understanding through interactive exploration and real-world application.

III. CONTENT	**Lesson 3.4. Calculating the Volume of Prisms, Pyramids, Cylinders, Cones, Spheres and Combinations of These.**	
IV. OBJECTIVES	By the end of the lesson, learners will be able to: 1. identify the required measurements (e.g., base area, height, radius, and diameter) needed to determine the volume of a given solid figure; 2. select and apply the appropriate volume formula for prisms, pyramids, cylinders, cones, and spheres; and 3. solve routine, contextualized, and real-life problems involving the volume of individual and composite solid figures, and express answers using the appropriate cubic units.	
V. PROCEDURES	**ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness: Volume Match-Up Relay** Objective: Recall the formulas and measurements used to calculate the volume of common three-dimensional solids. *Materials:* ● Shape Cards ● Formula Cards ● Problem Cards ● Answer Cards ● Calculator ● Recording Sheet	Activity A.1. **Leveling Learners Readiness: Volume Match-Up Relay** . Before the activity, prepare one set of Shape Cards, Formula Cards, Problem Cards, and Answer Cards for each group. The Shape Cards may include illustrations of a rectangular prism, cylinder, cone, square pyramid, and sphere, while the Formula Cards contain their corresponding volume formulas. (Refer to Teachers Notes). Organize learners into groups of four to five members and distribute the card sets. Instruct learners to match each shape with its corresponding formula, solve the given problem, and identify the correct answer. As learners work, monitor participation, encourage collaborative discussion, and provide guidance when necessary. Use the processing questions to clarify misconceptions and reinforce key concepts before

Instructions:

1. Form groups of 4–5 members.
2. Each group will receive a set of Shape Cards, Formula Cards, Problem Cards, and Answer Cards.
3. Match each Shape Card with its corresponding Formula Card.
4. Solve the Problem Card using the matched formula.
5. Find the correct Answer Card and match it with the completed set.
6. Record your final matches on the Recording Sheet.
7. Check out your work. If you find an error or a better solution, revise your answer and briefly explain the change.
8. Submit your completed work to the teacher for checking.
9. The first group to correctly complete all matches wins.

Recording Sheet

Shape	Formula	Computed Volume

proceeding to the lesson proper. To enhance engagement and provide immediate feedback, digital tools such as Kahoot!, Quizizz, Google Slides, or PowerPoint may be used to present the solid figures, formulas, and correct answers. This activity prepares learners for the lesson by recalling the concepts, formulas, and measurements needed to calculate the volume of solid figures.

Processing Questions:

1. What measurements are needed to calculate the volume of each solid figure?
2. How did you determine the correct formula for each solid figure? What common features did you observe among the volume formulas?
3. Which solid figure or formula was the most challenging to identify? Why?
4. Why is it important to use the correct formula when calculating volume?

A.2. Establishing the Purpose of the Lesson

Activity A.2.

Appreciating Learning Relevance: Volume in Real Life

Objective: Recognize the importance of volume in solving real-life problems involving storage, capacity, and design.

Materials:

1. Activity Cards
2. Activity Sheet
3. Pen or pencil

Instructions:

1. Form groups of 4–5 members.
2. Each group will receive one Activity Card.
3. Read and discuss the given scenario.
4. Complete the required task on the Activity Sheet.
5. Prepare a brief explanation of your group's responses.
6. Share your answers with the class.

Option 1. **Capacity Challenge**

Scenario: A family plans to buy a water tank for storing water during the dry season.

Activity A.2.

Appreciating Learning Relevance: Volume in Real Life

This activity helps learners appreciate the relevance of volume through differentiated real-life scenarios involving storage, transportation, and design. By engaging learners in situations of varying complexity, the activity accommodates different readiness levels while guiding all learners toward the same understanding of volume as a practical and useful mathematical concept.

Before the activity, prepare and distribute the Activity Cards (***Refer to the Teacher's Notes***) according to learners' readiness levels. Groups may be assigned scenarios based on learners' readiness levels or selected randomly. Option 1 provides guided support through a familiar household context, Option 2 focuses on practical applications in packaging and transportation, and Option 3 offers a more complex problem involving planning and design. Allow groups sufficient time to discuss the scenario and complete the Activity Sheet.

As learners share their responses, facilitate a discussion highlighting the common need to determine the amount of space an object occupies, or a container can hold. Encourage learners to connect the scenarios to their own experiences and future careers. To enhance

	Task: Discuss the following questions: 1. What information is needed before buying the tank? 2. Why is it important to know how much water the tank can hold? 3. How can volume help the family choose the appropriate tank? Option 2. **Packing and Storage Challenge** **Scenario:** A delivery company needs to transport boxes of products using a storage truck. **Task:** Discuss the following questions: 1. How can the company determine if all the boxes will fit inside the truck? 2. What information is needed to estimate the available space? 3. Why is volume important in packaging and transportation? Option 3. **Design and Construction Challenge** **Scenario:** The school plans to install a rainwater collection tank for gardening and cleaning purposes. **Task:** Discuss the following questions: 1. What information is needed before constructing the tank? 2. How can the tank's capacity be determined? 3. Why is volume important in designing structures and managing resources? These situations demonstrate the need to determine the amount of space occupied by or contained within objects, which leads to the study of volume.	engagement and provide immediate feedback, digital tools such as Google Slides, Canva, Mentimeter, Padlet, Kahoot!, or Quizizz may be used to present the scenarios and collect learners' responses. This activity establishes a meaningful purpose for learning volume and prepares learners for the formal discussion of volume formulas and their applications. For learners needing support, provide a formula organizer, partially completed sample solutions, and guided activities that focus on one solid figure at a time. For advanced learners, ask them to compare the volumes of two figures with related dimensions, compute percentage differences, or justify why one solid has a larger capacity than another. For learners needing visual or spatial support, use labeled 3D models, nets, manipulatives, or printed formula cards that match the different solid figures. Processing Questions: 1. What common idea was present in all three scenarios? 2. How does volume help people make decisions in everyday life? 3. What information is usually needed to determine volume? 4. What problems can result from inaccurate volume estimates? 5. Why is it important to learn how to calculate the volume of solid figures? ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Understanding Volume** Objectives: Develop conceptual understanding of volume as the amount of three-dimensional space occupied by an object, prior to introducing specific formulas. *Instructions:* 1. Observe different three-dimensional objects (e.g., a box, bottle, and cone-shaped cup). 2. Estimate which object can hold the most and explain your reasoning. 3. Participate in the guided discussion on the concept of volume. 4. Compare volume and surface area and identify their differences. 5. Discuss and answer the following questions: a. What do we mean by *volume*? b. How can volume be measured? c. What happens to the volume when the height of an object changes?	Activity B.1. **Exploring Key Concepts: Understanding Volume** This activity helps learners develop a basic understanding of volume as the amount of space occupied by a three-dimensional object. Through observation and discussion, learners are encouraged to relate volume to the capacity of familiar objects and containers. Before the activity, prepare actual objects or visual representations of common three-dimensional solids such as a box, bottle, ball, and cone-shaped cup. Encourage learners to observe the objects carefully and justify their responses during the discussion. Guide learners in distinguishing volume from surface area by emphasizing that volume refers to the space inside an object, while surface area refers to the area covering its exterior. To enhance visualization and engagement, digital tools such as PowerPoint, Google Slides, Canva, or interactive simulations may be used. This activity provides the conceptual foundation needed for understanding and applying volume formulas in the succeeding lesson activities.

d. What happens to the volume when the size of the base changes?

6. Share your responses and insights during the class discussion.

Processing Questions:

1. Which object appears to have the greatest volume? Explain your answer.
2. Which object appears to have the smallest volume? Explain your answer.
3. How would you describe volume based on your observations?
4. Why is volume often associated with the capacity of a container?
5. How can an understanding of volume be useful in everyday situations?

B.2. Discussing the Concept

Activity B.2. Deepening Conceptual Understanding

Activity B.2: Exploring Volume Formulas of Solid Figures

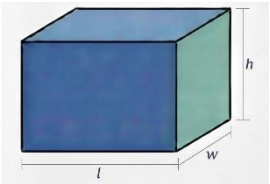
Objective: Recall and use appropriate formulas for finding the volume of prisms, pyramids, cylinders, cones, and spheres.

Instructions

1. Examine the models, diagrams, and formulas presented.
2. Identify the measurements needed to calculate volume.
3. Analyze how each formula is used to determine volume.
4. Complete the guided examples and practice activities.
5. Record important concepts and formulas discussed during the lesson.

A. Volume of Prisms

A prism is a three-dimensional solid with two congruent and parallel bases. The volume of a prism is determined by multiplying the area of its base by its height. Thus, the volume depends on both the size of the base and the distance between the two bases.



Source: Canva. "Canva AI Thread." Accessed May 30, 2026.

What measurements are needed to determine the volume of a prism? Why are these measurements important?

Example: A shipping company uses a rectangular storage crate with a length of 8 cm, width of 5 cm, and height of 4 cm. Determine the volume of the crate.

Activity B.2. Deepening Conceptual Understanding

This activity deepens learners' understanding of the formulas used to calculate the volume of prisms, cylinders, pyramids, cones, and spheres by examining their components, applications, and relationships. Through guided demonstrations and discussions, learners examine the dimensions required for each solid figure and learn how these measurements are used in volume calculations.

Begin by presenting a model or diagram of a solid figure and demonstrating the appropriate volume formula using a worked example. Guide learners in identifying the given measurements, substituting values into the formula, and performing the necessary computations. Encourage learners to compare formulas and recognize patterns among different solid figures.

As the discussion progresses, ask guiding questions to check understanding and address misconceptions. Encourage learners to record formulas, key concepts, and sample solutions in a formula organizer for future reference. To enhance visualization and engagement, digital tools such as PowerPoint, GeoGebra, Canva, or interactive 3D models may be used. This activity prepares learners to apply volume formulas independently in solving routine and real-life problems.

Formula Summary Table

Solid Figure	Volume Formula	Required Measurements
Prism	$V = Bh$	Base area, height
Cylinder	$V = \pi r^2 h$	Radius, height
Pyramid	$V = \frac{1}{3}Bh$	Base area, height
Cone	$V = \frac{1}{3}\pi r^2 h$	Radius, height
Sphere	$V = \frac{4}{3}\pi r^3$	Radius

$$Base\ Area\ =\ lw$$
$$Base\ Area\ =\ 8(5) = 40\ cm^2$$

$$Volume\ =\ Bh$$
$$Volume\ =\ 40(4) = 160\ cm^3$$

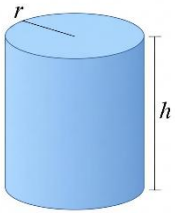
Guided Practice

A storage box has a length of 6 cm, width of 4 cm, and height of 5 cm.

a. What measurements are given?
b. What formula should be used?
c. What is the volume of the storage box?

B. Volume of Cylinders

A cylinder is a solid figure with two congruent circular bases connected by a curved surface. Similar to a prism, its volume is obtained by multiplying the area of the base by its height. Since the base is circular, the area of the base is represented by πr^2.



Source: Canva. "Canva AI Thread." Accessed May 30, 2026.

How is the formula for a cylinder similar to the formula for a prism?

Example: A cylindrical water container has a radius of 3 cm and a height of 10 cm. Determine its volume.

$$Volume\ =\ 3.14(3)^2(10)$$
$$Volume\ \approx\ 282.6\ cm^3$$

Guided Practice

A cylindrical fuel tank has a radius of 2 cm and a height of 8 cm.

a. What measurements are given?
b. What formula should be used?
c. What is the volume of the fuel tank?

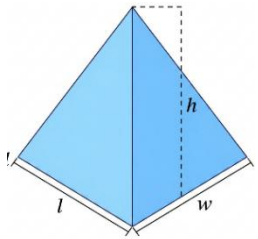
C. Volume of Pyramids

A pyramid is a solid figure with a polygonal base and triangular faces that meet at a common vertex. The volume of a pyramid is

Processing Questions:

1. What measurements are required to determine the volume of each solid figure?
2. How are the formulas for prisms and cylinders related?
3. Why do the formulas for pyramids and cones contain the factor $\frac{1}{3}$?
4. How does the radius influence the volume of cylinders, cones, and spheres?
5. Why is it important to identify the appropriate formula before solving a volume problem?

one-third of the volume of a prism having the same base area and height.



Source: Canva. "Canva AI Thread." Accessed May 30, 2026.

Why is the volume of a pyramid less than the volume of a prism with the same base area and height?

Example: A pyramid-shaped monument has a base area of 36 cm² and a height of 9 cm. Determine its volume.

$$Volume = \frac{1}{3}(36)(9)$$
$$Volume = 108\ cm^3$$

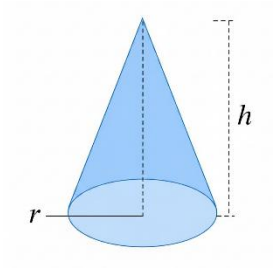
Guided Practice

A pyramid-shaped display stand has a base area of 25 cm² and a height of 12 cm.

a. What measurements are given?
b. What formula should be used?
c. What is the volume of the display stand?

D. Volume of Cones

A cone is a solid figure with a circular base and a vertex. Like a pyramid, the volume of a cone is one-third of the volume of a cylinder with the same base area and height.



Source: Canva. "Canva AI Thread." Accessed May 30, 2026.

How is the formula for a cone related to the formula for a cylinder?

Example: An ice cream cone has a radius of 3 cm and a height of 9 cm. Determine its volume.

$$Volume = \frac{1}{3}(3.14)(3)^2(9)$$
$$Volume \approx 84.78\ cm^3$$

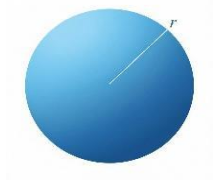
Guided Practice

A traffic cone has a radius of 2 cm and a height of 6 cm.

a. What measurements are given?
b. What formula should be used?
c. What is the volume of the cone?

E. Volume of Spheres

A sphere is a perfectly round three-dimensional figure in which all points on its surface are equidistant from its center. Its volume depends solely on its radius.



Source: Canva. "Canva AI Thread." Accessed May 30, 2026.

Why is the radius the only measurement needed to determine the volume of a sphere?

Example: A basketball has a radius of 3 cm. Determine its volume.

$$Volume = \frac{4}{3}(3.14)(3)^3$$
$$Volume \approx 113.04\ cm^3$$

Guided Practice

A rubber ball has a radius of 2 cm.

a. What measurement is given?
b. What formula should be used?
c. What is the volume of the ball?

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3. **Practicing Learned Skills**

Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy.

This activity develops learners' procedural fluency in calculating the volume of prisms, cylinders, cones, pyramids, and spheres through structured and contextualized practice tasks. The station format enables learners to focus on one solid figure at a time while reinforcing the correct selection and application of volume formulas. The problem situations provide meaningful applications of volume in architecture, engineering, manufacturing, public infrastructure, and environmental systems.

	Before the activity, prepare station cards containing the problem situations and corresponding illustrations of the solid figures. Organize learners into small groups and assign a fixed amount of time for each station. Encourage learners to identify the given measurements, select the appropriate formula, perform accurate computations, and express answers using correct units of measure. As learners rotate through the stations, monitor participation, provide immediate feedback, and address misconceptions related to formula selection, substitution, and computation. After the activity, facilitate a discussion of the solutions and processing questions. Encourage learners to explain the strategies they used and compare different approaches to solving the problems. To enhance visualization and engagement, digital tools such as PowerPoint, GeoGebra, Canva, Google Slides, or interactive three-dimensional models may be used to present the station tasks and verify solutions. This activity prepares learners for more advanced applications involving composite solids and real-world problem-solving situations.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections: Design a Mini Storage Box** This activity allows you to use the concepts, volume formulas, and problem-solving skills you learned from the previous activities to design a practical mini storage box and apply mathematics to a real-life situation. Objective: Apply volume formulas to solve real-life problems involving three-dimensional solid figures. *Materials* • Activity Sheet • Graphing Paper • Ruler • Calculator • Pencil/Pen *Instructions*: 1. Form groups of 4–5 members. 2. Design a mini storage box that can be used to store school supplies, learning materials, or household items. 3. Choose an appropriate three-dimensional solid figure for your design. 4. Determine the dimensions of the box using the appropriate volume formula. 5. Show your complete solution and calculations. 6. Draw and label your design with its dimensions. 7. Compare your design and calculations with your group members. Review your work, and if you find an error or a better solution, revise your answer and briefly explain the change. 8. Explain why your design is suitable for its intended purpose. 9. Present your design to the class.	Activity C.1. **Making Real-World Connections: Design a Mini Storage Box** This activity provides learners with an opportunity to apply volume formulas in a practical and familiar context. By designing a mini storage box, learners use mathematical reasoning to select an appropriate solid figure, determine dimensions, calculate volume, and justify design decisions. The task encourages learners to connect mathematical concepts with everyday applications involving storage and packaging. Before the activity, discuss common storage containers used at home, in school, and in workplaces. Encourage learners to consider the purpose of their design and the amount of space needed to store specific items. As groups work, monitor participation, guide learners in selecting appropriate formulas, and provide feedback on their calculations and designs. After the presentations, facilitate a discussion on how volume calculations are used in fields such as packaging, product design, warehousing, manufacturing, and logistics. To enhance engagement and visualization, digital tools such as Canva, GeoGebra, Google Slides, PowerPoint, or simple 3D design applications may be used to create and present the storage box designs. This activity enables learners to apply their understanding of volume to solve authentic real-world problems. **Reminder:** The Mini Storage Box Design Rubric (Refer to Teacher's Notes) shall be used to assess learners' performance upon completion of the activity. *Processing Questions:* 1. How did your group determine the dimensions of the storage box?

Activity Sheet

Group Number: _____
Intended Use of the Storage Box: _____
Chosen Solid Figure: _____

Part A. **Design Planning**

1. What items will your storage box hold?
   _____
   _____
2. Why did your group choose this solid figure?
   _____
   _____

Part B. **Mathematical Solution**

Formula Used: _____

Given Dimensions: _____

Solution:
_____
_____
_____
_____
_____

Volume of the Storage Box: _____

Part C. **Design Sketch**

1. Draw your proposed storage box. You may draw it by hand or use a digital tool.
2. Label the dimensions of your design. Write the length, width, height, and any other measurements used in your calculations.
3. Make sure your sketch matches your computations. The dimensions shown in your drawing should be the same as those used in the previous parts of the activity.
4. Choose how you want to present your output. You may use any of the following:
   a. Hand-drawn sketch
   b. Infographic or digital illustration
   c. PowerPoint presentation
   d. Three-dimensional model or actual prototype

2. Why was the chosen solid figure appropriate for the intended use?
3. How did volume calculations help in designing the storage box?
4. What challenges did your group encounter while creating the design?
5. How can volume calculations be applied in packaging, storage, manufacturing, and product design?

	e. Short video or group presentation f. Any other teacher-approved format Part D. Design Justification Explain why your design is appropriate for storing selected items. _____ _____ _____	
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson** Option 1. **Volume Summary Circle** *Instructions*: 1. Form groups consisting of four to five members. 2. Review the concepts, formulas, and applications of volume discussed throughout the lesson. 3. Discuss the following questions within your group: a. What is volume, and what does it measure? b. What measurements are required to determine the volume of prisms, cylinders, pyramids, cones, and spheres? c. How are the formulas for prisms and cylinders related? d. How are the formulas for pyramids and cones related to those of prisms and cylinders? e. Why is it important to identify the appropriate formula and measurements before solving a volume problem? f. How can volume calculations be applied in real-life situations? 4. Based on your discussion, prepare a **Generalization Poster** that includes: a. A summary of the key concepts learned about volume; b. The volume formulas for prisms, cylinders, pyramids, cones, and spheres; c. General rules or patterns observed among the formulas; and d. One practical application of volume in everyday life or professional fields. 5. Present the Generalization Poster to the class. 6. Participate in the class discussion and identify the common conclusions drawn from the presentations. Option 2. **Exit Ticket – Volume Generalization** Type: Individual Written Output Instructions: 1. Write a brief generalization consisting of three to five sentences based on the concepts discussed in the lesson.	Activity C.2. **Wrapping Up the Lesson** This activity provides learners with an opportunity to synthesize and generalize the concepts learned about the volume of prisms, cylinders, pyramids, cones, and spheres. Through collaborative discussion and written generalization, learners identify relationships among volume formulas, recognize common patterns, and formulate key principles used in solving volume-related problems. For Option 1, facilitate group discussions and guide learners in identifying similarities, differences, and recurring patterns among the formulas. Encourage groups to prepare concise and accurate Generalization Posters that summarize the essential concepts, formulas, and applications discussed throughout the lesson. For Option 2, require learners to construct a written generalization that demonstrates their understanding of volume concepts and their applications. During the synthesis phase, consolidate learners' responses and emphasize that volume measures the amount of space occupied by a three-dimensional figure. Reinforce the importance of selecting the appropriate formula and measurements when solving volume problems and highlight the practical applications of volume in various fields. To support collaboration and presentation, digital tools such as Canva, Padlet, Google Slides, PowerPoint, or Jamboard may be utilized. This activity serves as the culmination of the lesson by helping learners organize, connect, and generalize their understanding of volume concepts before the assessment phase.

	2. Your response should include: a. The meaning of volume. b. The importance of identifying the correct formula and measurements when determining volume. c. One relationship or pattern observed among the volume formulas of prisms, cylinders, pyramids, cones, and spheres. d. One practical application of volume in everyday life or professional fields.	
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. **Assessing Learning Outcomes** Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy. This assessment evaluates learners' attainment of the lesson objectives by measuring their ability to identify appropriate volume formulas, perform accurate computations, and apply volume concepts in real-life situations. The assessment progresses from formula recognition to procedural calculations and culminates in contextualized application problems involving solid figures and composite solids. Before administering the assessment, remind learners to identify the given measurements, select the appropriate formula, and express answers using correct units. During the assessment, monitor learners' work and encourage them to show complete solutions. After checking the outputs, discuss common misconceptions related to formula selection, substitution, and computation. Assessment results may be used to identify learners who require remediation or enrichment activities. Digital platforms such as Google Forms, Microsoft Forms, Quizizz, or Kahoot! may be utilized to administer the assessment and provide immediate feedback.	
	C.4. Additional Activities	
	Activity C.4. **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This activity provides differentiated learning opportunities that address the varying needs of learners. The remediation tasks reinforce the identification of solid figures, selection of appropriate volume formulas, and accurate computation through guided and independent practice. These activities help learners strengthen foundational skills and build confidence in solving volume-related problems. The enrichment tasks extend learning by requiring learners to solve multistep and real-world problems involving storage, capacity, agriculture, and composite solids. These activities encourage mathematical reasoning, problem-solving, and the application of volume concepts in authentic contexts. The Design Challenge further develops creativity and decision-making through mathematical modeling. These activities may be assigned as classwork, homework, or supplementary learning tasks. Remediation should be provided to learners who need additional support in achieving mastery, while enrichment opportunities should be offered to learners who are ready to deepen and extend their understanding of volume concepts. For Design Challenge use the Rubric in the Teacher's Notes	
III. CONTENT	**Lesson 3.5. Scale and Distance: Interpreting Maps, Blueprints, and Sketches**	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. identify and read scales on maps, sketches, or blueprints; 2. measure distances accurately using available tools;	

	3. convert measurements from scale to actual distance; 4. compare distances between points or objects to make decisions or evaluations; and 5. construct a scaled sketch, blueprint, or layout using accurate measurements and scale.	
V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness** Option 1. **Scale or Not?** *Instructions*: 1. Work with a partner. 2. Examine the pairs of drawings provided. 3. For each pair, determine which drawing appears realistic and which appears distorted. 4. Discuss the reasons for your choices. 5. Record your answers and be prepared to share them with the class. Set of pictures available at: https://tinyurl.com/A1-ScaleorNot Activity Questions: 1. Which drawing in each pair appears more realistic? What observations support your answer? 2. Which parts of the distorted drawing seem too large, too small, too tall, too short, or out of proportion compared with the other parts? 3. What do the realistic drawings have in common regarding the sizes and proportions of their parts? Option 2. **Can You Spot the Perfect Match?** *Instructions:* 1. Work individually or with a partner. 2. Observe the set of original geometric figures (triangle, square, rectangle) provided. 3. Examine the other figures where some are scaled copies and some are not. 4. Drag, circle, or match the figures that are scaled copies of the original. 5. Compare the corresponding sides to check if all parts are proportional. 6. Explain what characteristics helped you decide which figures are scaled copies. 7. Share your answers and reasoning with the class. Interactive format is available at: https://tinyurl.com/A1-PerfectMatch	Activity A.1. **Leveling Learner Readiness** *Facilitation Guide*: 1. Provide students with the original set of geometric figures and a set of candidate figures. 2. Explain the task: identify which figures are scaled copies without yet using the term *scale*. 3. Allow students to work individually or in pairs to drag, circle, or match the figures. 4. Encourage students to compare corresponding sides and note proportionality. 5. Ask students to explain the characteristics that helped them decide. 6. Facilitate a class discussion to summarize patterns and introduce the term *scale* after observations. 7. Guide students to make connections to real-world applications such as maps, blueprints, or sketches. *Processing Questions* 1. What relationship did you observe between the original figure or object and its representation? 2. How does keeping parts proportional help make a representation accurate? 3. Why is it important for maps, blueprints, sketches, and layouts to maintain correct proportions?

Activity Questions:
1. What characteristics do the scaled copies share with the original figure?
2. How do the non-scaled figures differ from the original?
3. Why is it important to check that all sides and angles are proportional when identifying scaled copies?

A.2. Establishing the Purpose of the Lesson

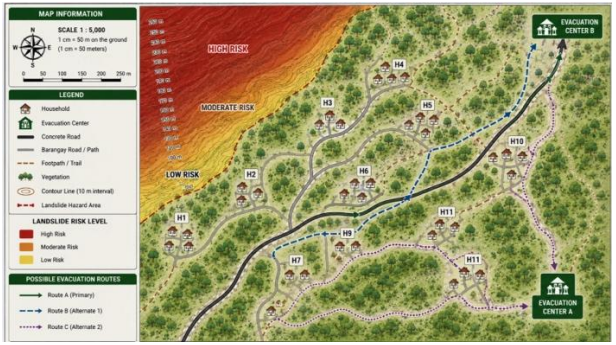
Activity A.2. **Appreciating Lesson Relevance**
Option 1. **Flood Evacuation Route Planning**
Scenario:
After several days of heavy rainfall, some roads in the barangay become flooded. Barangay officials need to identify the safest and most efficient evacuation route from residential areas to the evacuation center. A map of the barangay is available, but the distances shown are scaled representations.

Guide Questions:
1. How can we determine the actual distance between the residential area and the evacuation center?
2. How can scale help us compare different evacuation routes?
3. Why is accurate distance information important during emergencies?

Activity A.2. **Appreciating Lesson Relevance**
Facilitation Guide:
1. Select either **Option 1: Flood Evacuation Route Planning** or **Option 2: Landslide Risk and Evacuation Planning** based on the local context, community hazard profile, or learner experiences.
2. Present the selected scenario and allow learners to examine the provided map or scaled sketch.
3. If available, use an actual barangay map, evacuation map, hazard map, or community sketch. Otherwise, provide the sample map through the designated URL or QR code.
4. Ask learners to read the scenario and discuss the guide questions with their group.
5. Instruct learners to identify the scale, key locations, and possible evacuation routes shown on the map or sketch.
6. Facilitate a discussion using the processing questions to help learners connect scale, distance, and decision-making in disaster preparedness.
7. Encourage learners to share their observations and proposed solutions, emphasizing the importance of accurate distance measurements when planning evacuation routes.
8. Synthesize learner responses and relate them to the lesson using a scale to interpret and compare distances on maps, blueprints, and sketches.

Processing Questions:
1. What information is needed to determine the actual distance?
2. What does the scale tell us?

Option 2. **Landslide Risk and Evacuation Planning**
Scenario:
A barangay located near a hillside is vulnerable to landslides during prolonged rainfall. Community leaders need to determine which evacuation center is more accessible to affected households. A scaled sketch of the barangay showing roads, houses, and evacuation centers is available.



Guide Questions:
1. How can we determine the actual distance between households and evacuation centers?
2. How can scale help us compare possible evacuation routes?
3. Why is it important to consider distance when planning for landslide emergencies?

3. How can distances on a map, sketch, or blueprint represent real-world distances?
4. How can comparing distances help people make decisions?

After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.

B. Instituting New Knowledge

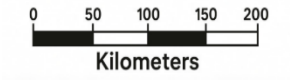
B.1. Presenting Examples

Activity B.1. Exploring Key Concepts: **How Far is It Really?**
Instructions:
1. Work with a partner.
2. Use the same map you examined in A.2.
3. Pick three different segments (e.g., Home to School, School to Evacuation Center, Home to Evacuation Center).
4. Measure the distance of each segment on the map using a ruler.
5. Using the given reference on the map (e.g., 1 cm represents 100 meters), calculate the real-world distance for each segment.
6. Record your map measurements, calculated distances, and observations in the table.
7. Share your findings and reasoning with the class.

Map Segment	Distance on Map	Real Distance (calculated)	Observations

Activity B.1. Exploring Key Concepts: **How Far is It Really?**
Facilitation Guide:
1. Use the same map or sketch previously examined in Activity A.2.
2. Organize learners into pairs or small groups.
3. Review the scenario and routes identified in the previous activity.
4. Instruct learners to measure selected route segments using a ruler.
5. Guide learners in using the given map reference (e.g., 1 cm represents 100 m) to determine actual distances.
6. Encourage learners to record their measurements and computations systematically.
7. Facilitate discussion using the processing questions.
8. Highlight the relationship between measurements on representation and real-world distances.
9. Connect learner responses to the concept of scale as a tool for representing large distances in a manageable form.

		Processing Questions 1. What information did you use from the map to determine the actual distances of the routes? 2. How does the reference on the map (e.g., 1 cm = 100 m) help you find the real distance? 3. Why is it important to understand the relationship between measurements on the map and real-world distances when planning evacuation routes or other routes?
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding** Part I. **Understanding Proportions and Scaled Drawings** A scale drawing is a drawing of an object or place that is larger or smaller than the actual object but keeps the same proportions. Maps, blueprints, floor plans, and sketches are common examples of scale drawings. For a drawing to be considered a scale drawing: • **Proportionality:** All parts must remain proportional. If one length is enlarged or reduced, all other lengths must be enlarged or reduced by the same amount. • **Relative Position:** Objects must keep their relative sizes and positions. For example, if a road is longer than another road in reality, it should also appear longer in the drawing. • **Correspondence:** Every part of the drawing must correspond to a real object or feature being represented. Part II. **Reading and Interpreting Scales** A scale tells us about the relationship between a measurement on a map, blueprint, sketch, or drawing, and the corresponding measurement in the real world. It allows large objects or distances to be represented in a manageable size while maintaining their proportions. Scales are commonly represented in three ways: 1. **Unit Scale**. A unit scale compares two different units of measurement. *Example:* 1 cm = 100 m This means that every 1 centimeter measured on the map represents 100 meters in the real world. 2. **Ratio Scale**. A ratio scale compares measurements using the same unit. *Example:* 1: 10,000 This means that 1 unit in the drawing represents 10,000 of the same units in reality. For example, 1 cm on the map represents 10,000 cm in the real world. 3. **Graphic Scale (Scale Bar)**. A graphic scale is a labeled line segment or bar drawn directly on the map or blueprint	Activity B.2. **Deepening Conceptual Understanding** *Facilitation Guide*: 1. Present the activity in four parts: Part I: Proportions and recognizing scaled drawings Part II: Reading and interpreting scales Part III: Applying scales to measure and compare distances Part IV: Determining the scale factor 2. For each part, guide students through examples and mini-exercises, prompting them to explain reasoning. **Check Your Understanding** Part I. c. Why is a map considered a scale drawing? d. Can a drawing still be considered a scale drawing if some parts are enlarged while others are not? Explain. e. Why is maintaining proportionality important in maps, blueprints, and sketches? Part III. A route measures 4 cm on the map and the scale is 1 cm = 100 m. What is the actual distance? Two routes are measured on a map: Route A = 5 cm, Route B = 8 cm. The scale is 1 cm = 100 m. a. What are the actual distances of both routes? b. How much distance is saved by choosing the shorter route? f. Route A is shorter but passes through a flooded area, while Route B is longer but safer. Which route would you recommend? Explain your reasoning. Part IV a. A classroom measures **4 cm** on a floor plan and **8 m** in reality. Determine the scale factor. b. A garden measures **5 cm** on a sketch and **25 m** in reality. Determine the scale factor.

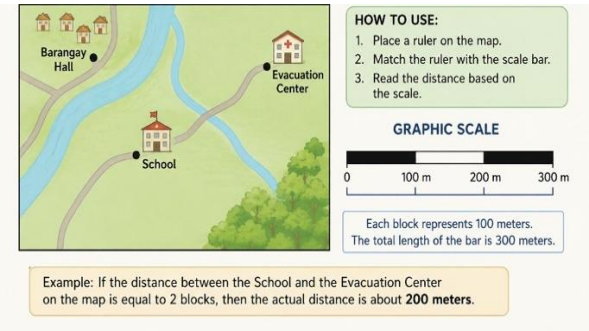
Example: 

Learners can measure with a ruler and use the graphic scale to estimate real distances, reducing the need for complex calculations.

Part III. **Applying Scale to Measure and Compare Distances**

1. **Multiplication for conversion:**
   - If you know the scale (e.g., 1 cm = 100 m), multiply the measured distance on the map by the scale factor to get the actual distance.
   - *Example:* $5\ \cancel{cm} \times \frac{100\ m}{1\ \cancel{cm}} = 500\ m$
2. **Proportional reasoning:**
   - For ratios (e.g., 1:10,000), multiply the map distance by the ratio to get the real-world distance.

     Example: 4 cm × $\frac{10000}{1}$= 40,000 cm = 400 m
3. **Using a ruler for direct measurement:**
   - For a graphic scale, measure the distance between two points on the map using a ruler.
   - Compare the measured distance with the scale bar to estimate the corresponding real-world distance.



Part IV. **Determining the Scale Factor**

Sometimes the scale of a drawing is not provided directly. In these situations, the scale factor can be determined by comparing a measurement on the drawing with its corresponding actual measurement.

The scale factor is the number by which measurements in the drawing are multiplied to obtain the actual measurements.

Formula:

$$\text{Scale Factor} = \frac{\text{Actual Distance}}{\text{Drawing Distance}}$$

c. A rectangular playground measures **6 cm by 4 cm** in a drawing and **30 m by 20 m** in reality. Determine the scale factor and explain how you know the drawing is proportional.

3. Encourage students to measure map segments, calculate distances, and analyze
   selection).
4. Use processing questions after each part to deepen understanding and check for HOTS thinking.

Processing Questions:

Part II.

a. How might the choice of scale (unit, ratio, or graphic) affect the accuracy and clarity of a map or blueprint?
b. If two maps of the same area use different scales, how would that change the way you interpret distances or compare routes?
c. What could happen if a scale is misread or misapplied when planning an evacuation route or construction project?

Part III.

a. How can you calculate the scale factor when you know a distance on the drawing and the corresponding actual distance?
b. Why is determining the scale factor important before measuring or creating scaled sketches and layouts?
c. How can errors in calculating the scale factor affect measurements and proportionality in a map, blueprint, or design?
d. In what ways can knowing the scale factor help you compare different drawings or plan a real-world project effectively?

Part IV.

a. Why is it necessary to express the drawing measurement and the actual measurement in the same unit before determining the scale factor?
b. How can the scale factor help you create an accurate scaled sketch, blueprint, or layout?
c. What problems might arise if the scale factor is determined incorrectly?
d. In what situations might you need to determine the scale factor instead of using a scale that is already given?

5. Provide feedback on calculations, proportional reasoning, and decision-making.

	Example 1. A road measures 2 cm on a map and represents 200 m in reality. Convert to the same unit: 200 m = 20,000 cm $$\text{Scale Factor} = \frac{20{,}000\ cm}{2\ cm} = \frac{10{,}000 cm}{}$$ Therefore, the scale factor is 10,000 and the scale can be written as: $$1:10{,}000$$ Example 2 A classroom measures 4 cm on a floor plan and 8 m in reality. Convert to the same unit: 8 m = 800 cm $$\text{Scale Factor} = \frac{800}{4} = 200$$ Therefore, the scale factor is 200 and the scale can be written as: $$1:200$$	
	B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity B.3: Practicing Learned Skills Facilitate the activity in the LAS. To enhance learner engagement, you may use the suggested strategy. *Facilitation Guide*: 1. Organize the activity into five parts (A–E) as listed: A: Identifying and reading scales B: Measuring distances accurately C: Converting measurements from scale to actual distance D: Comparing distances to make decisions E: Constructing scaled sketches or blueprints 2. Provide worksheets, maps, or sketches for Parts A–D and graph paper for Part E. 3. Demonstrate one example per part before learners attempt the exercises. 4. Encourage students to work individually or in pairs and explain their reasoning. 5. After each part, facilitate discussion and clarify misconceptions. 6. Collect sketches and calculations for formative assessment before the IPT.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections** Option 1. **Portable Emergency Kit Organizer** Families often waste time searching for supplies during emergencies. Design a portable emergency kit organizer that ensures quick retrieval of items and maximizes storage space while remaining lightweight and portable. Option 2. **Rainwater Collection System** During emergencies and water shortages, communities may need alternative sources of water for cleaning, sanitation, and other non-	Activity C.1. **Making Real-World Connections** *Facilitation Guide*: 1. Prior to this activity, ensure that learners have the needed materials on hand. For digital formats, ICT equipment should be available. For manual drawing, materials should be brought by the group beforehand. 2. Divide learners into small groups (3–5 members). 3. Present the three scenarios and allow each group to choose one. 4. Guide learners to examine the requirements of their chosen scenario and identify its major features.

	drinking purposes. Design a portable rainwater collection system that efficiently collects and stores rainwater while remaining easy to transport. Ensure the design promotes proper sanitation and reduces risk of contamination for safe use by children and community members. Option 3. **Typhoon-Resilient Farm Layout** During typhoons and periods of heavy rainfall, excess water can damage plants and make some garden areas difficult to use. Design a scaled farm layout that protects plants from excess water during typhoons while maximizing usable space and providing safe access for farmers and helpers. *Instructions:* 1. Work in small groups (3–5 learners). 2. Choose one (1) of the three scenarios provided. 3. Examine the requirements of your chosen scenario. 4. Determine the dimensions of your design and its major features, compartments, or areas. 5. Select an appropriate scale for your sketch, blueprint, or layout. 6. Construct a scaled sketch, blueprint, or layout of your proposed design using either: a. digital tools such as Microsoft PowerPoint, Google Slides, Canva, Google Drawings, GeoGebra, or similar applications; or b. manual drawing materials such as graphing paper, bond paper, rulers, pencils, and coloring materials. 7. Label all measurements and indicate the scale used. 8. Write a brief design justification explaining: a. how the design promotes accessibility, efficiency, or safety; b. how available space was maximized; and c. how does the design address the needs identified in the scenario. 9. Present your design to the class. **Step-by-Step Instructions for Digital Tools** **Tools:** Canva, Google Drawings, PowerPoint, GeoGebra 1. Open the application and create a new blank canvas or slide. 2. Insert shapes (rectangles, circles, polygons) torepresent compartments, plots, or features. 3. Use lines or arrows to show paths, routes, or movement. 4. Add text boxes for labeling dimensions, features, or scale. 5. Apply the chosen scale: measure real-world lengths and convert to drawing units. 6. Adjust shapes to reflect scaled distances accurately.	5. Assist learners in selecting an appropriate scale for their sketch, blueprint, or layout. 6. Instruct learners to construct a scaled sketch, blueprint, or layout using digital or manual tools. 7. Provide guidance on the use of digital tools (e.g., Canva, Google Drawings, PowerPoint, or GeoGebra) or manual drawing techniques as needed. 8. Ensure learners label all measurements and indicate the scale used. 9. Have learners write a brief design justification addressing accessibility, space utilization, and scenario requirements. 10. Have each group present their design to the class and facilitate discussion of the proposed solutions. Use the rubric provided in the Teacher's Notes for feedback.

	7. Save or export your final scaled sketch, blueprint, or layout. **Step-by-Step Instructions for Manual Drawing** **Tools:** Graphing paper, rulers, pencils, colored pencils 1. Choose graphing or bond paper to work on. 2. Draw the outline of your object or layout using a ruler. 3. Apply the chosen scale to convert real-world dimensions into drawing units. 4. Draw compartments, plots, or features to scale. 5. Label all measurements and features clearly. 6. Add any additional details (paths, access routes, or safe zones). 7. Review to ensure all components are proportional and readable.	
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson: Reflecting on the Use of Scale in Maps, Blueprints, and Sketches** Instructions 1. Remain in your groups from the previous activity. 2. Exchange outputs with another group. 3. Briefly examine the other group's design and identify: • One strength (e.g., effective use of scale, layout clarity, space efficiency) • One suggested improvement (e.g., measurement accuracy, proportion, labeling) 4. Present your evaluation to the class in 1–2 minutes per group. 5. The original group listens and may note ideas for improvement. 6. Complete the reflection template: **Reflection Template** **Observed Strength:** **Suggested Improvement:** **Key Takeaways / Generalizations about Scale:** 1. Scale helps _____ 2. Accurate measurements are important because _____ 3. Maps, blueprints, and sketches are useful for _____.	Activity C.2. **Wrapping Up the Lesson: Reflecting on the Use of Scale in Maps, Blueprints, and Sketches** *Facilitation Guide*: 1. Instruct each group to exchange outputs with another group. 2. Guide learners in examining the assigned scaled sketch, blueprint, or layout. 3. Ask each group to identify one strength and one suggested improvement for the assigned design. 4. Allow groups to present their evaluation to the class in one to two minutes. 5. Encourage the original group to listen and consider the feedback provided. 6. Facilitate a discussion on common strengths, challenges, and design considerations observed across the outputs. 7. Guide learners in completing the reflection template and formulating generalizations about the use of scale in maps, blueprints, and sketches. Synthesize the key concepts and connect them to real-world planning, design, and problem-solving situations.

C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity C.3. **Assessing Learning Outcomes**

Facilitate the activity in the LAS. Strictly follow the strictly follow the strategy provided.

Facilitation Guide

1. Organize learners according to their assigned IPT groups.
2. Ensure that learners have access to their Lesson 4.1 Key Measurements and Design Specifications and the materials needed for the activity.
3. Facilitate recall of the approved disaster-related innovation scenarios and clarify the assessment requirements.
4. Guide learners in reviewing their Lesson 4.1 outputs and Activity C.2 reflections, evaluated strengths and weaknesses, and generalizations.
5. Assist learners in identifying refinements to measurements and design ideas, ensuring improvements are based on proportional reasoning, not arbitrary placements.
6. Guide learners in selecting an appropriate scale that maintains proportionalities for all features in their sketch, blueprint, or layout.
7. Instruct learners to construct an initial scaled sketch, blueprint, or layout of their proposed innovation, applying proportional measurements consistently across all features.
8. Ensure learners clearly label all major features, measurements, dimensions, and the scale used.
9. Guide learners in converting selected scaled measurements to actual dimensions and comparing them to check for proportional accuracy and design feasibility.
10. Have learners write a brief design justification explaining how scale, measurements, and reflections informed their design decisions while maintaining proportionality.
11. Collect the completed visual models with scaling for assessment.
12. Allow groups to present their initial prototype designs and facilitate a brief discussion highlighting proportionality, accuracy, and design reasoning.

Expected Output

1. Initial scaled sketch, blueprint, or layout of the proposed innovation
2. Clearly labeled scale, measurements, dimensions, and major features/components
3. Measurement conversions from scaled measurements to actual dimensions
4. Brief design justification explaining design decisions and application of scale
5. Completed **Section IV. Visual Model with Scaling** of Appendix B – Prototype Development Plan

C.4. Additional Activities

Activity C.4. **Extending and Reinforcing Learning**

Facilitation Guide:

Remediation – Guided Prototype Design with Scaling

1. Identify learners who struggled in C.3 and provide targeted support.
2. Guide them to focus on one feature/component first to ensure proportionality and correct scale before revising the full design.
3. Provide scaffolding and demonstrations for scale, measurement, and labeling as needed (either manual or digital).
4. Check learners' proportionality and scale application before allowing them to continue to the remaining features.
5. Offer feedback and reinforcement throughout the process, focusing on accuracy, proportionality, and clarity.

	Expected Output Remediation – Guided Prototype Design with Scaling: • Corrected scaled sketch, blueprint, or layout (focusing initially on one component) • Labeled dimensions, features, and scale • Demonstrated proportionality for the redrawn feature **Enrichment – Prototype Adaptability Plan** 1. Group proficient learners and guide them in reviewing their initial prototype. 2. Facilitate discussions on adaptation scenarios (scale up/down, materials, budget, space, users, or environmental conditions). 3. Support learners in applying scale, proportionality, and measurement when modifying selected features. 4. Encourage learners to justify modifications and reflect on functionality, practicality, and safety. 5. Observe group discussions, provide formative feedback, and guide learners to think critically about design adaptability. *Expected Output* Enrichment – Prototype Adaptability Plan: • Revised scaled sketch, blueprint, or layout reflecting modifications for scaling up or down • Labeled updated features, dimensions, and scale • Computations showing how the scale was applied to adjust measurements • Brief justification explaining functionality, practicality, and responsiveness under the adaptation scenario
III. CONTENT	**Lesson 3.6. Solving Real-World Problems Involving Currency, Time, and Temperature Conversions**
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. identify the information and conversion factors needed for currency, time, and temperature conversions; 2. interpret exchange rates, time zones, and temperature scales in given situations; 3. perform currency, time, and temperature conversions using appropriate mathematical procedures; 4. solve problems involving currency, time, and temperature conversions in real-world contexts; and 5. apply currency, time, and temperature conversions to authentic situations such as travel planning, business transactions, project management, recipe adjustments, weather reports, scientific experiments, storage conditions, and energy efficiency.

V. PROCEDURES	**ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness** Let us recall what you already know about ratio, proportion, measurement scales, and time differences. These concepts will help you understand how travelers estimate distances using maps, convert currencies for budgeting, and adjust schedules across different countries. Option 1. Currency Exchange Readiness The committee has allocated P120,000 for the tour budget. The money exchange center charges a P500 service fee, and the exchange rate is 1 USD = P60.00. Determine the amount in US dollars that the committee will actually receive. Complete the Activity Sheet below.	Activity A.1. **Leveling Learners Readiness** This activity activates learners' prior knowledge of currency conversion, time zone conversion, and temperature conversion, which are essential mathematical concepts used in real-world travel and everyday situations. The activities also encourage learners to analyze practical situations involving budgeting, scheduling, and food preparation, helping them connect mathematical concepts with informed decision-making. Through contextualized travel committee scenarios, learners recall and apply previously learned concepts by converting currencies for budgeting, determining local times across countries, and converting temperatures for food preparation. These experiences prepare learners for more complex applications of measurement and conversion in the succeeding lessons.

	Activity Sheet (Refer to Teacher's Notes) Instructions: 1. Work with a partner. 2. Use the given exchange rate and travel allowance to determine the equivalent amount in US dollars. You may use the provided conversion chart or support sheet if needed. 3. Show your complete solution in the Activity Sheet. 4. Before submitting your work, check that you: a. used the correct information; b. chose the correct formula or operation; c. showed your complete solution; and d. wrote the correct unit and interpreted your answer correctly. Option 2. **Time Zone Readiness** You are part of a travel committee organizing an educational tour to Tokyo, Japan. As part of the planning process, your group needs to determine the corresponding local time in Tokyo to help finalize the tour itinerary. The Philippines follows $UTC + 8$, while Japan follows $UTC + 9$. The educational tour includes an online orientation that will last for 2 hours. If it starts at 7:00 AM in Manila, determine the local start time and end time in Tokyo. Complete the Activity Sheet below. **Worksheet: (Refer to Teacher's Note)** *Instructions:* 1. Work with a partner. 2. Use the given time zones and departure time to determine the corresponding local time in Tokyo. You may use the provided conversion chart or support sheet if needed. 3. Show your complete solution in the activity sheet. 4. Before submitting your work, check that you: a. used the correct information; b. chose the correct formula or operation; c. showed your complete solution; and d. wrote the correct unit and interpreted your answer correctly. Option 3. **Temperature Conversion Readiness** You are part of a travel committee preparing meals for an international youth camp. The recipe provided by the host country uses the Fahrenheit temperature scale, but the kitchen oven available uses the Celsius scale. Assume that the required baking temperature	The differentiated activity options provide flexibility in addressing learners' readiness levels and classroom contexts while promoting collaboration, mathematical reasoning, and problem-solving. Teachers may increase the level of challenge by introducing multi-step situations involving service charges, extended travel schedules, or combined temperature applications. Teachers may provide conversion charts, formula guides, and structured support sheets to scaffold learning for learners who require additional assistance, while extending learning through integrated and multi-step travel-related situations for advanced learners. Learners are encouraged to identify relevant information, apply appropriate mathematical procedures, interpret their answers, and explain the practical value of their solutions through guided discussion and reflection. To strengthen conceptual understanding and learner engagement, teachers may integrate educational technology tools such as online currency converters, interactive world clock applications, digital temperature conversion calculators, presentation slides, and collaborative digital worksheets, depending on the availability of resources and instructional context. For example, learners may compare actual exchange rates, examine time differences between countries using world clock applications, or use digital conversion tools to verify temperature equivalents. Learners may compare actual exchange rates, schedule international virtual meetings using world clock applications, analyze weather reports from different countries, and use digital conversion tools to verify their solutions. These technology-enhanced resources provide authentic learning experiences and help learners connect mathematical concepts with practical decision-making. During the processing stage, guide learners in recognizing the importance of identifying given information, selecting appropriate mathematical operations or formulas, and interpreting solutions within real-life contexts. Possible learner responses may include identifying the exchange rate and travel allowance needed for currency conversion, recognizing that Japan is one hour ahead of the Philippines when determining local time, and using the Fahrenheit-to-Celsius conversion formula to solve temperature problems. Learners may also explain that currency conversion supports travel budgeting, time zone conversion helps avoid scheduling conflicts, and temperature conversion ensures accurate food preparation, proper storage conditions, and energy efficiency. Encourage learners to cite

	is 350°F. The recipe requires baking at 350°F, but the food safety guide recommends that prepared food should be stored below 5°C. Convert the baking temperature to Celsius and explain why accurate temperature conversion is important for food preparation and storage. Complete the Activity Sheet below. **Worksheet: (Refer to Teacher's Notes)** *Instructions*: 1. Work with a partner. 2. Use the given temperature and the appropriate conversion formula to determine the equivalent temperature in degrees Celsius. You may use the provided conversion chart or support sheet if needed. 3. Show your complete solution in the Activity Sheet. 4. Before submitting your work, check that you: a. used the correct information; b. chose the correct formula or operation; c. showed your complete solution; and d. wrote the correct unit and interpreted your answer correctly.	other real-life applications such as weather forecasting, scientific investigations, refrigeration, and international communication. *Processing Questions*: Option 1. 1. What information was needed to solve the problem? 2. Why is division used in converting Philippine pesos to US dollars? 3. Why is currency conversion important in planning international travel? 4. Why should travelers check exchange rates before traveling? 5. The exchange rate changes from ₱60 to ₱58.50 per USD. How will this affect the travel budget? Option 2. 1. What information was needed to solve the problem? 2. How did you determine the time difference between the two countries? 3. Why is time zone conversion important in international travel planning? 4. What scheduling problems may occur if time zone differences are ignored? 5. How could incorrect time zone conversion affect international meetings or travel schedules? Option 3. 1. What information was needed to solve the problem? 2. Why is temperature conversion important when following international recipes? 3. How can accurate temperature conversion help maintain proper storage conditions and energy efficiency? 4. In what other real-life situations is temperature conversion useful? 5. Why is estimation useful before performing an exact temperature conversion? This activity serves as a meaningful bridge between learners' prior knowledge and the lesson's intended learning outcomes by helping them connect mathematical concepts with authentic travel and everyday situations

	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. **Appreciating Lesson Relevance: Planning Your Dream International Trip** Travel provides opportunities to explore different places, cultures, and experiences around the world. However, international travel also requires informed decision-making involving currency conversion, time differences, budgeting, and travel scheduling. In this activity, you will examine famous tourist destinations and identify important travel-related information that connects real-life travel situations to today's mathematical lesson. *Instructions*: 1. Observe the images of ten famous tourist attractions from different countries shown below. For each image, identify the name of the tourist attraction. **(Images, refer to Teacher's Notes)** 2. Determine the country where each tourist attraction is located and identify its official currency. 3. Choose one country from the identified destinations that you would most like to visit. 4. Identify the average temperature of your chosen country and convert it to another temperature scale. Explain how this information can help travelers prepare for their trip. 5. Explain one travel consideration related to using the official currency of your chosen country. 6. Be prepared to explain the reasons for your choice, considering personal interest, travel appeal, or practical considerations. 7. Reflect on how information about currency, time zones, and temperature can help travelers make informed decisions about budgeting, scheduling, and travel preparation.	Activity A. 2. **Appreciating Lesson Relevance: Planning Your Dream International Trip** This activity establishes the relevance and purpose of the lesson by helping learners recognize the practical applications of mathematics in authentic travel situations. Through the exploration of famous tourist destinations, their corresponding countries, currencies, and temperatures, learners connect prior knowledge with real-world contexts that require mathematical thinking and informed decision-making. At this stage, the activity focuses on helping learners appreciate how mathematical concepts support travel planning, budgeting, scheduling, and preparation rather than requiring extensive computations. Guide learners in recognizing the importance of information such as exchange rates, time differences, and weather conditions in making practical travel decisions. To enhance engagement and contextual understanding, teachers may use printed images, presentation slides, interactive multimedia, or digital learning platforms. Educational technology tools such as online maps, currency converters, world clock applications, and weather forecasting platforms may also be integrated to provide authentic learning experiences. During the processing stage, encourage learners to explain how mathematics helps travelers manage expenses, organize schedules, prepare for varying weather conditions, and make informed decisions. This activity serves as a meaningful bridge between learners' prior knowledge and the lesson's intended learning outcomes by highlighting the relevance of mathematics in everyday life. *Processing Questions*: 1. Which country would you like to visit, and why? 2. What important information should a traveler gather before visiting another country? 3. Why is it important for travelers to understand currency values and time differences before traveling internationally? 4. In what ways can mathematics help travelers make informed decisions about budgeting, scheduling, and international travel planning? 5. Why is understanding temperature conversion important when traveling or preparing food in another country?

		6. If you had a limited travel budget, how would mathematical information such as exchange rates, time differences, and temperature conditions influence your travel decisions? ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1 **Exploring Key Concepts: Travel, Time, and Temperature** Mathematics is often used in practical situations that involve travel, budgeting, and scheduling. Whether planning a school activity, preparing for international travel, or coordinating schedules across locations, mathematical reasoning helps in making informed decisions. In this activity, you will examine practical situations where map scales, currency conversion, and time zone conversion are applied. *Instructions*: 1. Form groups of 3–4 learners. 2. Read and analyze the assigned scenario. 3. Discuss the questions provided with your group. 4. Identify the mathematical concept involved and explain how it applies to the situation. 5. Use digital tools, such as online maps, currency converters, or world clock applications, if needed. 6. Prepare a short presentation, written summary, or visual organizer showing the mathematical concept involved, the information needed, and its practical application. 7. Answer the processing questions after the activity. Scenario 1. **Budgeting for International Travel** A family is preparing for an international trip to Japan and needs to exchange Philippine pesos for Japanese yen to manage travel expenses. The family plans to exchange ₱25,000 for travel expenses. Suppose the exchange rate is: 1 Philippine Peso (PHP) = 2.60 Japanese Yen (JPY) The family needs to estimate the equivalent amount in Japanese yen before the trip. Answer the following questions: 1. What information is needed for the conversion? 2. What mathematical operation should be used?	Activity B.1 **Exploring Key Concepts: Travel, Time, and Temperature** This activity introduces the key concepts of currency conversion, time conversion, and temperature conversion through practical situations that learners may encounter in travel, budgeting, communication, food safety, and daily decision-making. By examining authentic scenarios, learners recognize the value of mathematics in solving real-world problems and making informed choices. To promote collaboration and active participation, the teacher may organize learners into small groups and assign a different scenario for analysis. Learners are encouraged to identify the mathematical concept involved, interpret the given information, discuss possible solutions, and explain how mathematics applies to the situation. The activity provides opportunities for learners to connect prior knowledge with new concepts and to develop critical thinking, problem-solving, communication, and collaborative skills. Through situations involving international travel, virtual meetings, and food storage, learners appreciate the practical applications of mathematics in personal, academic, and future professional contexts. To enrich the learning experience, the teacher may integrate educational technology (EdTech) tools such as online currency converters, world clock applications, temperature conversion calculators, spreadsheet applications, and learning management systems. These tools support computation, visualization, collaboration, and authentic application of mathematical concepts. Throughout the discussion, the teacher should emphasize the importance of accuracy when converting currencies, determining time differences, and converting temperatures, since errors may lead to poor financial decisions, missed schedules, unsafe food storage, and unnecessary energy consumption. Learners should also be encouraged to justify their answers and relate the concepts to their own experiences.

	3. Why is currency conversion important when preparing for international travel? 4. What budgeting problems may arise from incorrect conversion? Scenario 2. **Coordinating an Online Meeting** A group of learners is participating in an online mentoring session with a university student in Sydney, Australia. The meeting is scheduled at 6:00 PM in Sydney (UTC+10). The Philippines follows UTC+8. The learners need to determine the corresponding Philippine time for the meeting. Answer the following questions: 1. What is the time difference between the two locations? 2. How can the corresponding time be determined? 3. Why is accurate time conversion important in virtual meetings? 4. What could happen if the time difference is misunderstood? Scenario 3. **Food Storage and Energy Efficiency** A school canteen stores perishable goods at 4°C, but a newly installed refrigerator displays temperature in Fahrenheit. The staff need to determine the equivalent temperature to maintain food safety. Answer the following questions: 1. What mathematical concept is involved? 2. Why is accurate temperature conversion important? 3. How can incorrect temperature settings affect food quality and energy consumption?	To promote inclusive participation, provide structured note sheets, calculator support, guided computation templates, visual organizers, and pair-assisted tasks for learners who need these accommodations. These supports enable learners to participate actively while demonstrating their understanding of the mathematical concepts and their practical applications. During the discussion, possible learner responses may include recognizing that currency conversion supports budgeting, time conversion prevents scheduling conflicts, and temperature conversion ensures food safety and energy efficiency. Encourage learners to connect these concepts with their own experiences and future responsibilities. *Processing Questions*: 1. What mathematical concepts are shown in the three scenarios? 2. How does mathematics support informed decision-making in practical situations? 3. Why is accuracy important when dealing with distance, money, and time? 4. Which scenario do you think is most relevant to your present or future experiences? Explain. 5. How can these mathematical concepts help you in academic, personal, or future professional situations?
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding** Mathematical concepts such as map scales, currency conversion, and time zone conversion are essential in making informed decisions in everyday situations. These concepts are commonly applied in travel planning, budgeting, online transactions, remittances, and international communication. In this activity, learners will deepen their understanding of these concepts by examining definitions, analyzing examples, and applying mathematical reasoning in practical contexts. *Instructions:* 1. Examine how each mathematical concept is applied in the given real-life situations.	Activity B.2. **Deepening Conceptual Understanding** This activity deepens learners' understanding of currency conversion, time zone conversion, and temperature conversion through guided discussion, worked examples, and structured practice. Using authentic situations such as international travel, virtual meetings, remittances, food preparation, and food storage, learners recognize the practical applications of mathematics in everyday life. Guide learners in analyzing the mathematical procedures, interpreting the given information, and explaining how the concepts apply to real-life situations. Encourage them to share their reasoning and connect the concepts to their own experiences. Possible learner responses may include recognizing that currency conversion supports budgeting, time conversion prevents scheduling conflicts,

	2. Follow the mathematical processes presented in solving each example. 3. Answer the guided practice items by applying the concepts discussed. 4. Share your ideas, answers, and insights during class discussion. **A. Currency Conversion** Different countries use different currencies for financial transactions. When engaging in international travel, online purchases, educational payments, or remittance transactions, money often needs to be converted from one currency to another through **currency conversion**. **Currency conversion** is the process of changing the value of one currency into its equivalent value in another currency. This process uses an **exchange rate**, which is the value of one currency in relation to another currency. Exchange rates indicate how much of one currency can be exchanged for a specific amount of another currency. Understanding currency conversion and exchange rates is important for budgeting, making financial decisions, and accurately calculating costs in international transactions. **Important Note:** Exchange rates may change due to economic and global factors. For this activity, fixed exchange rates are provided to help you focus on the conversion process. Example: A learner is preparing to participate in an international youth leadership program in Singapore and needs to exchange PHP15,000 into Singapore dollars (SGD) to cover meals, local transportation, entrance fees, and other travel-related expenses. Suppose the exchange rate is: $1 \text{ Singapore Dollar } (SGD) = PHP41.00$ Determine the amount of Singapore dollars the learner will receive. Solution: To convert Philippine pesos (PHP) to Singapore dollars (SGD), divide the amount in pesos by the exchange rate. $Amount\ in\ Foreign\ Currency = \frac{Amount\ in\ Philippine\ Peso}{Exchange\ Rate}$ $Singapore\ Dollar = \frac{15{,}000}{41}$ $Singapore\ Dollar = SGD365.85$ Answer: The learner will receive approximately $SGD365.85$.	and temperature conversion promotes food safety and energy efficiency. To enhance engagement, teachers may integrate educational technology tools such as online currency converters, world clock applications, temperature conversion calculators, and spreadsheet applications. Provide structured note sheets, guided computation templates, conversion charts, calculator support, visual organizers, and pair-assisted tasks to ensure inclusive participation. This activity strengthens conceptual understanding and prepares learners for more independent problem-solving tasks in the succeeding activity. *Processing Questions*: 1. How does currency conversion help individuals make informed financial decisions in travel, online payments, and remittances? 2. Why is it important to understand time zones and UTC offsets when participating in international activities and virtual communication? 3. How can temperature conversion help in recipe adjustments, food storage, weather interpretation, and energy efficiency? 4. How can incorrect interpretation of exchange rates, time zones, or temperature measurements affect decision-making in real-life situations? 5. In what other real-life situations can currency conversion, time zone conversion, and temperature conversion be applied?

Guided Practice:

1. A Grade 12 learner plans to enroll in an online university preparation program offered by an institution in Australia. The registration fee is 320 Australian Dollars (AUD).
   Suppose the exchange rate is:
   1 Australian Dollar (AUD) = PHP36
   Determine the cost of the registration fee in Philippine pesos.
2. A family also receives a remittance of 500 Canadian Dollars (CAD) from a relative working abroad.
   Suppose the exchange rate is:
   1 Canadian Dollar (CAD) = PHP40
   Determine the value of the remittance in Philippine pesos.

B. Time Zone Conversion

Countries around the world observe different local times based on their geographical locations. A **time zone** is a region that follows the same standard time. Time differences between locations are determined using **Coordinated Universal Time (UTC)**, a global time standard used as the reference point for world timekeeping. A **UTC offset** indicates the number of hours a location is ahead of or behind UTC. **Time conversion** is the process of determining the equivalent local time in another location by comparing their respective UTC offsets.

Examples of UTC offsets include:

1. Philippines – UTC+8
2. Japan – UTC+9
3. Australia (Sydney) – UTC+10
4. United Kingdom – UTC+0
5. Germany – UTC+1
6. United States (New York) – UTC−5 *(standard time)*
7. United Arab Emirates – UTC+4

Understanding **time zones, UTC offsets, and time conversion** is important for coordinating international travel, academic programs, virtual meetings, and communication with individuals in different parts of the world.

Example:
A learner from the Philippines will attend an online scholarship interview with an institution in New York City. The interview is scheduled for 10:00 AM New York City time (Eastern Time, UTC−4). Since the learner will attend the interview from the Philippines, which

follows Philippine Time (UTC+8), determine the equivalent local time in the Philippines to ensure timely attendance.

Solution:
To determine the equivalent local time in the Philippines, compare the time zones of New York City and the Philippines.
Given:

1. New York City: UTC−4
2. Philippines: UTC+8
3. Interview Schedule: 10:00 AM (New York City Time)

Step 1: Determine the time difference.
Compute the difference between the two time zones:

$$UTC+8 - UTC-4 = 12 \text{ hours}$$

This means that the Philippines is 12 hours ahead of New York City.

Step 2: Adjust the scheduled interview time.
Since the Philippines is ahead, add 12 hours to the interview time in New York City:

$$10:00 \text{ AM} + 12 \text{ hours} = 10:00 \text{ PM}$$

Answer:
The equivalent local time in the Philippines is 10:00 PM Philippine Time. Therefore, the learner should attend the online scholarship interview at 10:00 PM.

Guided Practice

1. A learner from the Philippines will attend an online university orientation in Tokyo (UTC+9) scheduled at 3:00 PM. Since the participant will attend from the Philippines, which follows Philippine Time (UTC+8), determine the corresponding local time in the Philippines.
2. A Senior High School student from the Philippines is preparing to submit a research paper to an international student research conference hosted by an institution in California, United States (UTC−7). The submission deadline is 11:59 PM California Time. Since the student will submit the research paper from the Philippines, which follows Philippine Time (UTC+8), determine the corresponding submission deadline in the Philippines.

Note: You may use the provided guided conversion charts, pre-structured time-zone tables, simplified map tasks, or explain your solution orally if you need additional support.

C. Temperature Conversion

Temperature is a measure of the degree of hotness or coldness of an object or environment. It is commonly used in weather forecasting, food preparation, food storage, scientific investigations, and energy management. Different countries use different temperature scales; therefore, understanding temperature conversion is important for interpreting and comparing temperature measurements.

The two most used temperature scales are Celsius (°C) and Fahrenheit (°F). The Celsius scale is widely used in the Philippines and many other countries, while the Fahrenheit scale is commonly used in the United States.

The reference points of the two temperature scales are shown below:

Temperature	Celsius	Fahrenheit
Freezing point of water	0°C	32°F
Boiling point of water	100°C	212°F

Temperature conversion is the process of determining the equivalent value of a temperature from one scale to another. The following formulas are commonly used:

To convert Celsius to Fahrenheit

$$F = \frac{9}{5}C + 32$$

To convert Fahrenheit to Celsius

$$C = \frac{5}{9}(F - 32)$$

When converting temperatures, it is important to:

1. Identify the given temperature scale.
2. Select the appropriate conversion formula.
3. Substitute the given value correctly.
4. Perform the mathematical operations carefully.
5. Express the final answer using the correct unit (°C or °F).

Understanding temperature conversion is important when preparing food using international recipes, interpreting weather reports, maintaining proper food storage conditions, conducting scientific experiments, and managing energy-efficient appliances.

Example 1.

A Senior High School student is preparing a dessert using an online recipe from the United States. The recipe requires baking at 350°F, but the oven available at home uses the Celsius scale. Determine the equivalent baking temperature in Celsius.

$$C = \frac{5}{9}(F - 32)$$
$$C = \frac{5}{9}(350 - 32)$$
$$C = \frac{5}{9}(318)$$
$$C \approx 176.67°C$$

Final Answer: 176.67°C

Example 2

A school canteen manager stores fresh vegetables in a refrigerator maintained at **5°C**, but the imported refrigerator displays the temperature in Fahrenheit. Determine the equivalent temperature in Fahrenheit.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5}(5) + 32$$
$$F = 9 + 32$$
$$F = 41°F$$

Final Answer: 41°F

Guided Practice

1. A Senior High School TVL-Cookery learner is preparing baked products for the school's entrepreneurship fair. The recipe requires the oven to be set at 180°C, but the imported oven displays the temperature in Fahrenheit. Determine the equivalent temperature in Fahrenheit.
2. A Filipino family is preparing for a vacation in Canada. The weather forecast predicts a temperature of 50°F. Determine the equivalent temperature in Celsius to help the family prepare appropriate clothing.

Processing Questions

1. How does currency conversion help individuals make informed financial decisions in travel, online payments, and remittances?
2. Why is it important to understand time zones and UTC offsets when participating in international activities and virtual communication?
3. How can temperature conversion help in recipe adjustments, food storage, weather interpretation, and energy efficiency?

	4. How can incorrect interpretation of exchange rates, time zones, or temperature measurements affect decision-making in real-life situations? 5. In what other real-life situations can currency conversion, time zone conversion, and temperature conversion be applied? Having examined and applied these concepts through guided examples, you are now ready to solve related problems independently in the next activity.	
	B.3. Developing Mastery	
	Activity B.3. **Practicing Learned Skills** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This activity provides learners with opportunities to independently apply the concepts of time zone conversion, currency conversion, and temperature conversion through contextualized problem-solving tasks. As part of the Developing Mastery phase, it strengthens learners' ability to apply appropriate mathematical procedures, perform accurate computations, and use logical reasoning in practical situations involving travel, scheduling, budgeting, and everyday decision-making. The teacher should encourage learners to present complete and organized solutions, including formulas, computations, and clearly stated final answers using the appropriate units or currency symbols. During the checking and discussion of answers, common misconceptions related to exchange rates, time differences, and temperature conversion may be clarified. Learners should also be encouraged to explain their mathematical reasoning and relate the concepts to real-life situations. To reinforce authentic learning, the teacher may integrate educational technology (EdTech) tools such as online currency converters, world clock applications, temperature conversion calculators, spreadsheet applications, and digital calculators to support computation, verification, and computational accuracy. These technology-enhanced strategies help learners connect mathematical concepts with practical digital tools used in everyday life. This activity also serves as a formative assessment that enables the teacher to monitor learners' mastery of the concepts and identify areas requiring further reinforcement before progressing to more complex application or performance-based tasks.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1. **Making Real-World Connections: Global Travel and Climate Simulation** In this activity, you will apply the concepts of currency conversion, time conversion, and temperature conversion by planning and simulating an international trip. Through collaborative problem-solving, you will use mathematical reasoning to manage travel schedules, budgets, and climate-related decisions in authentic real-world situations.	Activity C.1. **Making Real-World Connections: Global Travel and Climate Simulation** This activity provides learners with an authentic opportunity to apply the concepts of currency, time, and temperature conversions in an integrated real-world context through collaborative travel planning. As part of the Finding Practical Application phase, learners identify relevant information and conversion factors, interpret exchange rates, time zones, and temperature scales, perform mathematical

Instructions:

1. Form a group of 3–4 learners.
2. Select two to three countries from different regions, each with distinct currencies, time zones, and climate conditions.
3. Choose your preferred simulation format:
   - Option A – Digital Simulation: Use available digital tools such as online world clocks, currency conversion platforms, weather websites, spreadsheet applications, or presentation tools.
   - Option B – Pen-and-Paper Simulation: Use the provided time zone chart, currency exchange table, temperature data, and other classroom reference materials.
4. Gather the necessary information for each selected country, including the local currency, exchange rate, time zone, and average temperature data provided by your teacher or reference materials.
5. Determine the corresponding departure and arrival times for each destination by applying the appropriate time conversions based on the given travel schedule.
6. Convert the assigned travel budget of PHP 50,000 into the local currencies of the selected countries using the exchange rates provided. Show the complete mathematical process for each conversion.
7. Convert the given temperatures of the selected destinations to the required temperature scale and explain how the weather conditions may affect travel plans, clothing choices, or storage requirements.
8. Prepare a group output that includes:
   a. a travel itinerary;
   b. a time conversion schedule;
   c. a currency conversion summary;
   d. a temperature conversion chart; and
   e. complete mathematical computations.
9. Exchange your work with another group or submit it to your teacher for checking. Before the final presentation, use the checklist below to verify your computations:

Indicator	Yes	No
The required time conversions were completed correctly.		
The required currency conversions were completed correctly.		
The required temperature conversions were completed correctly.		
Mathematical solutions are complete and clearly shown.		

conversions, solve practical problems, and apply these concepts in planning an international trip.

The teacher should ensure that printed reference materials, including a time zone chart, updated currency exchange table, and temperature data, are prepared in advance, particularly for learners using the pen-and-paper simulation format. Learners may complete the activity through either a digital or a pen-and-paper simulation, depending on available classroom resources and accessibility. To enrich the activity, the teacher may integrate EdTech tools such as online world clocks, weather information platforms, currency conversion applications, spreadsheet software, and presentation tools to support computation, visualization, collaboration, and reporting.

Throughout the activity, the teacher should facilitate group collaboration, monitor learners' progress, clarify misconceptions, and provide timely feedback. This activity strengthens learners' ability to apply mathematical concepts accurately in practical situations while preparing them for more complex performance-based tasks.

Processing Questions:

1. What information and conversion factors did your group identify to accurately perform the currency, time, and temperature conversions required in the activity?
2. How did interpreting the exchange rates, time differences, and temperature scales help your group plan and organize the travel simulation?
3. What mathematical procedures and strategies did your group use to perform the currency, time, and temperature conversions accurately?
4. How did solving problems involving currency, time, and temperature conversions help your group make informed decisions about the travel budget, itinerary, and travel preparations?
5. In what ways can the skills learned from currency, time, and temperature conversions be applied to real-world situations such as travel planning, business transactions, project management, weather interpretation, scientific investigations, storage conditions, and energy efficiency?

	10. Revise your work, if needed, and present your completed travel simulation to the class, clearly explaining how currency, time, and temperature conversions were used to solve real-world problems.	
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson: Key Takeaways on Currency, Time, and Temperature Conversions** Option 1. **My Math Takeaways (See Teacher's Notes for Journal)** *Instructions*: 1. Complete the My Math Takeaways Journal Sheet by answering the questions below based on what you learned from the lesson. • What important concepts did you learn about time zone, currency and temperature conversions? • Why is accuracy important when solving problems involving time zone, currency and temperature conversions? • How can understanding exchange rates, time zones, and temperature scales help you make informed decisions in practical situations such as travel planning, business transactions, weather interpretation, or scientific investigations? • Which concept did you find most challenging to understand or apply? Explain your answer. 2. Review your answers and identify the most important lessons you learned. 3. Write a short summary (1–2 sentences) about your key takeaways from the lesson. Option 2. **Math Synthesis Circle** *Instructions:* 1. Assign group roles such as facilitator, recorder, timekeeper, and presenter. 2. Discuss how your group applied the concepts of currency, time, and temperature conversions in the lesson activities. 3. Identify the challenges your group encountered and discuss how these were addressed. 4. Create a concept map that includes the following parts: a. Mathematical Concepts – identify the key concepts and conversion factors learned in the lesson. b. Mathematical Procedures – explain how currency, time, and temperature conversions were performed. c. Real-World Applications – show how these concepts can be used in travel planning, business transactions, project management, weather interpretation, scientific investigations, storage conditions, and energy efficiency.	Activity C.2. **Wrapping Up the Lesson: Key Takeaways on Currency, Time, and Temperature Conversions** This activity provides learners with opportunities to consolidate, synthesize, and reflect on their understanding of currency, time, and temperature conversions through individual or collaborative learning tasks. Option A encourages personal reflection by allowing learners to examine the concepts, procedures, and real-world applications of the lesson, while Option B promotes collaborative learning through concept mapping and group discussion. To support diverse learning preferences and classroom contexts, the teacher may facilitate the activity using either traditional or digital formats. EdTech tools such as Microsoft Word, PowerPoint, Google Docs, Google Slides, Google Classroom, or Microsoft Teams may be used for journal writing, collaborative concept mapping, presentation preparation, and submission of outputs. Throughout the activity, the teacher should encourage learners to revisit the mathematical processes used in the lesson, identify misconceptions, and articulate the practical value of currency, time, and temperature conversions. The teacher should also provide timely feedback and guide learners in connecting mathematical concepts to authentic situations. This activity reinforces conceptual understanding, mathematical communication, critical thinking, and reflective learning while strengthening learners' ability to apply currency, time, and temperature conversions in real-world contexts such as travel planning, business transactions, project management, weather interpretation, scientific investigations, storage conditions, and energy efficiency.

	d. Key Learning Insights – summarize the important lessons gained from the activity. 5. Review your concept map and ensure that the ideas are clearly connected and logically organized. 6. Select one representative to present your group's concept map and summarize your group's key insights to the class.	
	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.3. **Assessing Learning Outcomes** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This activity serves as the culminating assessment of the lesson by providing learners with an authentic opportunity to demonstrate their understanding of currency, time, and temperature conversions in an integrated real-world context. Building on the concepts and skills developed from the previous activities, learners identify relevant information, interpret conversion factors, perform mathematical procedures, solve practical problems, and apply their learning to informed decision-making. The teacher may provide calculators, conversion tables, or digital tools to support computation while ensuring that learners clearly demonstrate the mathematical processes involved. Learners' outputs should be evaluated not only for computational accuracy but also for their ability to explain the practical significance of their solutions. This assessment reinforces mathematical reasoning, problem-solving, communication, and reflective thinking while strengthening learners' readiness to apply mathematics in authentic situations such as travel planning, business transactions, project management, weather interpretation, scientific investigations, storage conditions, and energy efficiency.	
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)	
	Activity C.4. **Extending and Reinforcing Learning** This activity provides differentiated learning opportunities to address learners' varying levels of understanding. The Remediation tasks reinforce foundational knowledge and computational skills in currency conversion, time zone conversion, and temperature conversion through focused individual practice. The Enhancement tasks provide opportunities for learners to integrate multiple concepts in realistic situations that promote higher-order thinking, mathematical reasoning, and informed decision-making. The teacher may assign learners to remediation or enhancement activities based on their performance in the assessment phase. To support learning, EdTech tools such as digital calculators, spreadsheet applications, world clock applications, currency conversion platforms, and temperature conversion applications may be used for computation, verification, and visualization. To promote inclusive participation, teachers may provide guided computation templates, conversion charts, calculator support, visual organizers, and pair-assisted activities for learners who need additional assistance. This activity helps strengthen identified learning gaps while extending the learning of learners who demonstrate readiness for more advanced application.	
V. ASSESSMENT	**To evaluate learners' success in attaining the intended learning competencies, the assessment tools and strategies provided on the link in the table of contents can be utilized to measure understanding, skills, and application of concepts**	
VI. REFLECTION	**To assess and evaluate the effectiveness of the instruction, as well as to identify challenges and plan for improvements in this unit, teachers are encouraged to answer the reflective questions provided in the link indicated in the table of contents**	

Unit 4. FUNCTIONS AND GRAPHS

I. LEARNING GOALS	
Content Standard	The learners demonstrate knowledge and understanding functions and its graphs.
Performance Standard	By the end of the term, the learners are able create and present a digital financial report with graphs, equations, and justified real-life decisions.
Learning Competencies	The learners … 1. classify function based on their graphs and/or equations to determine if it is cubic, square root and cube root. 2. sketch the graph of the cubic, square root and cube root functions with or without technology. 3. apply the functions to model and solve real-life problems. 4. classify function based on their graphs and/or equations to determine if it is linear or quadratic. 5. sketch the graph of the linear and quadratic functions with or without technology. 6. apply the linear and functions to model and solve real-life problems.
II. REFERENCES and MATERIALS	
Textbook and Modules	**Textbooks** Demana, Waits, Clemens. Teacher's Edition *Precalculus Mathematics: A Graphing Approach*. Addison-Wesley Publishing Company, 2000. Alferez, Merle. *MSA Elementary Algebra*, MSA Academic Advancement Institute, 2007. Dr. Larson R. et. al, *Graphing Square Root Functions*, Big Ideas Learning, 2024. Semyanko N. *Graphing Square Root & Cube Root Functions*, Algebra I, 2023 Khurma M. *Cubic and Cube Root Function,* Cue Learn Private Limited, 2011 CHED-PNU General Math Teaching Guide Orines, F. (2016). Next Century Mathematics. General Mathematics for Senior High School. Phoenix Publishing House. Santos, D & Biason, M. G. (2016). Math Activated: Engage Yourself and Our World. General Mathematics. Senior High School. SALESIANA BOOKS. Stewart, J. (2016). *Precalculus: Mathematics for calculus* (7th ed.). Cengage Learning. Kachama C. *High Standards in Mathematics Teaching Notes on Cubic Functions*, CB-Mufulira @2022 Rawley E.et. al, *CK-12 Algebra I Second Edition,* CK-12 Foundation @2019
Websites	*Graphing Cube root Functions*. (2016, April). Retrieved May 26, 2026, from https://www.firelandsschools.org/Downloads/10-3GraphingCubeRoot2.pdf *Transformations of Parent Functions*. (2020, May). Retrieved May 26, 2026, from https://intranet.missouriwestern.edu/cas/wp-content/uploads/sites/17/2020/05/Transformations-of-Functions-2013.pdf Big Ideas Learning, LLC, *Square Root Functions and Geometry*. (2022, June). Retrieved May 26, 2026, from https://static.bigideasmath.com/protected/content/pe/alg1_pe_ch_10.pdf
Video Lessons	https://www.khanacademy.org/math/pisa-2025-math-supplement/x092b0b93d51c9e96:1/x092b0b93d51c9e96:algebraic-expressions/v/application-problem-with-graph. Accessed 9 May 2025. https://www.youtube.com/watch?v=jv8O5iKBIks https://www.youtube.com/watch?v=XVdVFQGf3aY https://www.youtube.com/watch?v=OYOXMyFKotc https://www.youtube.com/watch?v=1WFhDqOpjpU https://www.youtube.com/watch?v=yOrXqvO2M1M

	https://www.youtube.com/watch?v=SLV600BpHpE https://www.youtube.com/watch?v=3B1wm-Qan30 https://www.youtube.com/watch?v=PI6IV7K3DbM
Materials and EdTech	**Materials** ○ Desmos Calculator ○ Visual aids/PowerPoint presentation ○ Worksheets ○ Task cards **Application Software** Desmos. *Desmos Scientific Calculator*. Desmos, https://www.desmos.com/scientific. Accessed 9 May 2025. Geogebra. *GeoGebra Graphing Calculator*. Geogebra, https://www.geogebra.org/graphing. Accessed 2 October 2024. CANVA: https://pretest-on-functions.my.canva.site/ CANVA:: https://reyinandnoreen.my.canva.site/c9qd8ptjp52ewn8f CANVA: https://reyinandnoreen.my.canva.site/c9r0va2cqzfh0v9r
AI Declaration	AI tools were used to assist in generating activity ideas, refining instructions, organizing content, creating visual prompts and images, and improving the clarity of this Senior High School lesson exemplar. All AI-assisted outputs were reviewed, revised, and validated to ensure accuracy, relevance, appropriateness, and alignment with the curriculum and intended learning competencies.
III. CONTENT	**Lesson 4.1. Linear and Quadratic Functions**
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. recall the definition of function, domain and range; 2. identify and classify the function types from their equations as linear and quadratic based on their forms; 3. identify and classify the function types from the given graphs by analyzing their shapes and key features to determine if they represent a linear or quadratic function; 4. sketch the graph of linear and quadratic function; and **5.** apply the linear and quadratic functions to model and solve real-life problems.

V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
A. Activating Prior Knowledge	***A.1. Eliciting Prior Knowledge***	
	Activity A.1. **Leveling Learners Readiness: Pretest on Functions** *Instructions:* Choose the letter of the correct answer. 1. Which of the following best defines a function? A. A relation where each input has exactly one output B. A relation where inputs can have multiple outputs C. A set of ordered pairs D. A graph that forms a straight line 2. What is the slope of the linear function $f(x) = 5x - 2$? A. -2 B. 5	Activity A.1. **Leveling Learners Readiness: Pretest on Functions** To activate learners' prior knowledge on the topic, begin with a pretest using a multiple-choice questions. To facilitate this activity, ask the learners to write their answers on a clean sheet of paper.

C. 2
D. -5

3. Which of the following represents a quadratic function?
   A. y = 3x + 5
   B. $y = 3x^2 - 2x + 1$
   C. $y = \frac{1}{x}$
   D. $y = x^3$

4. What is the shape of the graph of a quadratic function?
   A. Line
   B. Circle
   C. Parabola
   D. Triangle

5. What is the y-intercept of the line y = -2x + 5?
   A. -2
   B. 5
   C. -5
   D. 2

Review the pretest by explaining the correct answers and addressing any misconceptions

Note: *Use the link or scan the QR code to access the Pretest on Function in CANVA*

CANVA: https://pretest-on-functions.my.canva.site/

Facilitate the Processing Questions below to further assess learners' prior knowledge.

1. What characteristic makes a relation a function, and how can you determine if a relation is a function?
2. How can you identify the slope and y-intercept of a linear function from its equation? Explain using an example from the activity.
3. What are the key differences between linear and quadratic functions in terms of their equations and the shapes of their graphs?

A.2. Establishing the Purpose of the Lesson

Activity A. 2:
Appreciating Lesson Relevance: Function in Everyday Life

Instructions:
1. Form a group as directed by your teacher.
2. Carefully examine the two real-life situations and the accompanying tables of values.

Situation A: Food Delivery Fee
A food delivery service charges a fixed fee of ₱50 plus ₱10 for every kilometer traveled.

Distance (km)	Delivery Fee (₱)
1	60
2	70
3	80
4	90

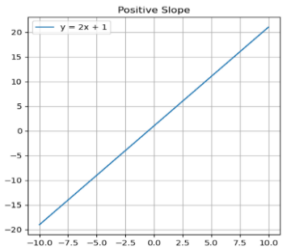
Situation B: Fireworks Display
The height of a firework after it is launched is recorded.

Time (s)	Height (m)
0	0

Activity A.2:
Appreciating Lesson Relevance: Function in Everyday Life

Facilitation Guide:
1. Present the two situations.
2. Ask learners to work in groups and discuss the guide questions.
3. Let groups share their observations.
4. Facilitate the Processing Questions:
   a. How can mathematics help us predict the delivery fee or the height of the firework?
   b. What differences do you notice between the patterns in the two situations?
   c. Why is it important to understand these patterns in everyday life, business, science, sports, or technology?
5. Conclude with:
   "Many real-life situations involve quantities that change. Some change at a constant rate, such as delivery fees and salaries, while others rise and fall, such as the path of a ball or fireworks. Mathematics uses functions to describe these relationships. Today, we will learn about two important types of functions: **linear functions** and **quadratic functions**."

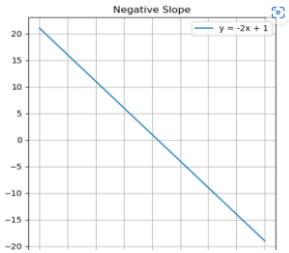
	1 20 2 32 3 36 4 32 3. Discuss with your group the pattern shown in each situation. Answer the following questions in your notebook: a. What is happening in each situation? b. How does the output change as the input increases? c. Which situation shows a constant rate of change? d. Which situation increases and then decreases? e. What do you think will happen if the pattern continues? 5. Be prepared to share your group's observations and explanations with the class. 6. Listen to the ideas of other groups and compare them with your own findings.	***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1. **Exploring Key Concepts: Classifying the Functions as Linear or Quadratic Through Graphs** *Instructions*: 1. Classify the Function as Linear, Quadratic, or Neither 2. The class will be divided into groups. 3. Graphs will be shown one at a time on the board. 4. You have 20 seconds to analyze each graph and decide whether it represents a linear, quadratic, or neither function. 5. After 20 seconds, each group must raise their answer cards. The group with the correct answer gets one point. 6. The group with the highest total score at the end of the game wins!	Activity B.1. **Exploring Key Concepts: Classifying the Functions as Linear or Quadratic Through Graphs** **Materials Needed** ● Graph cards or slides (Graphs is provided in the Teacher's Notes or you can provide your own.) ● Mini whiteboards or answer cards . Facilitation Guide: 1. Divide the class into groups and explain the mechanics of the game. 2. Show one graph at a time and give groups 20 seconds to analyze it. 3. Ask groups to raise their answer cards simultaneously. 4. Award one point for each correct answer. 5. Ask learners to briefly explain their answers before revealing the correct classification. *Processing Questions*: 1. What characteristics helped you identify a linear function? 2. What characteristics helped you identify a quadratic function? 3. How do the graphs of linear and quadratic functions differ? Transition to the Lesson

		"The activity showed that different graph shapes represent different types of functions. Straight-line graphs represent **linear functions**, while parabola-shaped graphs represent **quadratic functions**. Let us now explore their characteristics and applications."
	B.2. Discussing the Concept	
	Activity B.2. **Deepening Conceptual Understanding: Linear Functions and Quadratic Functions** *Instructions***:** Study the information and examples and prepare for class discussion. Part I. **Key Characteristics and Graph of Linear Functions** 1. **Equation Form**: The general form of a linear function is $y = mx + b$, where: • m *is the slope.* • b *is the* $y-$ *intercept.* 2. **Graph Shape**: The graph of a linear function is a **straight line**. 3. **Slope**: The **slope** (m) indicates the steepness and direction of the line. • Positive slope: Line rises from left to right. • Negative slope: Line falls from left to right. • Zero slope: Line is horizontal. • Undefined slope: Line is vertical. Example: Linear function with positive slope: $y = 2x + 1$ The line rises from left to right. Slope = 2, Y-intercept = 1. 	Activity B.2. **Deepening Conceptual Understanding: Linear Functions and Quadratic Functions** To effectively deliver the discussion on Linear and Quadratic Functions, you may employ the following strategies: 1. Guided Discovery 2. Explicit Teaching **A. Explicit Teaching** Part I**. Linear Functions** Focus: **Equation, slope, intercept, and graph behavior** Instructions: 1. Present the general form: **y = mx + b** 2. Clearly define: a. slope (m) b. y-intercept (b) 3. Model each example (positive, negative, zero, undefined slope) 4. Draw graphs step-by-step on the board 5. Demonstrate how slope generates points (rise/run) Key Explanation Strategy Use **"I DO" modeling** "Watch how I identify slope and intercept." "Watch how I plot points using slope." Focus Concepts to Emphasize 1. Linear function = **straight line** 2. Slope = **constant rate of change** 3. y-intercept = **starting point on y-axis** 4. Direction depends on sign of slope Check for Understanding Questions 1. What does the slope tell us about the graph? 2. What happens when slope = 0? 3. Where do we find the y-intercept? Part II. Quadratic Functions

Example: Linear function with negative slope:

$$y = -2x + 1$$

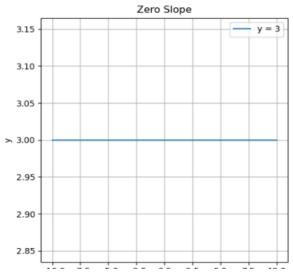
The line falls from left to right.
Slope = -2, Y-intercept = 1.



Example: Linear function with zero slope:

$$y = 3$$

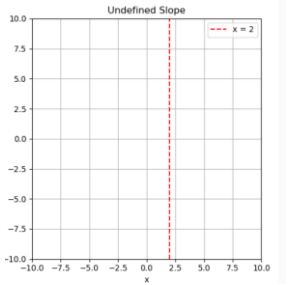
The graph is horizontal.
The Slope = 0 and y-intercept = 3.



Example: Linear function with undefined slope:

$$x = 2$$

The graph is a vertical line.
Slope is undefined, passes through x = 2.



1. **Y-Intercept**:
   The **y-intercept** (b) is the point where the line crosses the y-axis.
2. **Rate of Change**:
   Linear functions have a **constant rate of change**.

The rate of change is the slope of the linear function.

Example 1. In the given function y = 3x + 2, find the slope and the y-intercept. Then, sketch the graph.

Focus: Parabola, vertex, direction, and key features
Instructions:
1. Present general form: **y = ax² + bx + c**
2. Explain:
   a. parabola shape
   b. vertex (maximum/minimum point)
   c. axis of symmetry
3. Show how a affects direction and width
4. Demonstrate identifying:
   a. vertex
   b. y-intercept
   c. roots (brief introduction only)

Key Explanation Strategy
1. Use **visual comparison**
2. upward vs downward parabola
3. narrow vs wide graphs

Focus Concepts to Emphasize
1. Quadratic graph = **parabola**
2. Vertex = **turning point**
3. Axis of symmetry = **mirror line**
4. a determines **direction and width**

Check for Understanding Questions
1. What happens when a > 0?
2. What is the role of the vertex?
3. How do we kno w if the graph opens upward or downward?

Part III. **Vertex Form (Direct Instruction)**
Focus: Efficient graphing using vertex form
Teacher Actions
1. Present: **y = a(x − h)² + k**
2. Highlight: vertex = (h, k)
3. Demonstrate step-by-step graphing:
   a. Plot vertex
   b. Determine direction
   c. Apply 1–3–5 rule
   d. Draw symmetry
4. Model conversion briefly from standard form

Focus Concepts
1. Vertex form gives **instant graph structure**
2. Symmetry simplifies plotting
3. Transformation from standard form

Solutions:

Step 1: Identify the slope and y-intercept

Slope (m): The coefficient of (x) is **3**.

Y-intercept (b): The constant term is **2**, meaning the graph crosses the y-axis at ((0, 2)).

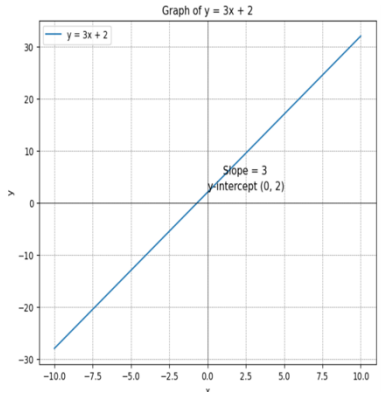
Step 2: Sketch the graph

Start at the **y-intercept** (0, 2).

Use the **slope** to find another point:

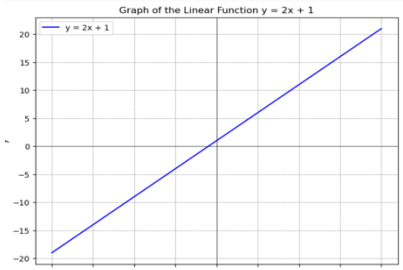
Since the slope is 3, go **up 3 units** and **right 1 unit** from the y-intercept to get the point (1, 5).

Draw a straight line through these points.



Example 2: Graph the function $y = 2x + 1$.

Answer:



Guide Questions:

1. What do you notice on the graphs of the three functions?
2. How do you determine the points on the third function?

Part II. **Properties and Graphs of Quadratic Functions**

1. The general form of a quadratic function is $y = ax^2 + bx + c$, where:
   (a) , (b) , and (c) are constants and a is not equal to zero.
   (a) determines the **direction** and **width** of the parabola.
2. The graph of a quadratic function is a **parabola**.
3. The **vertex** is the highest or lowest point on the graph, depending on the direction of the parabola.
   - If (a > 0), the parabola opens upwards, and the vertex is the **minimum** point.
   - If (a < 0), the parabola opens downwards, and the vertex is the **maximum** point.
4. The **axis of symmetry** is a vertical line that passes through the vertex, given by
   $x = -\frac{b}{2a}$

Check Questions

1. How do we find the vertex immediately?
2. Why do we plot symmetric points?
3. What does "a" change in the graph?

Part IV. **Table of Values + Technology (GeoGebra/Desmos)**

Focus: Representation and verification

Teacher Actions

1. Demonstrate table completion
2. Show plotting of ordered pairs
3. Guide GeoGebra/Desmos input
4. Compare manual vs digital graph

Focus Concepts

1. Multiple representations:
   a. equation
   b. table
   c. graph
2. Technology confirms accuracy

B. Guided Discovery Phase

Part I. **Linear Functions Exploration**

Teacher Role: Facilitator

Learner Task

1. Observe given graphs
2. Classify linear functions
3. Identify patterns of slope behavior

Guiding Questions

1. What pattern do you notice among all straight-line graphs?
2. How does the graph change when slope becomes negative?
3. How can you describe the movement of the line?

Expected Discovery

1. Linear functions always form straight lines
2. Slope controls direction and steepness

Part II. Quadratic Functions Exploration

Learner Task

1. Compare parabolas
2. Identify opening direction and vertex location
3. Analyze effects of coefficient a

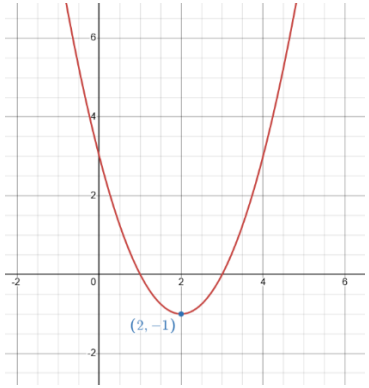
5. The **y-intercept** is the point where the parabola crosses the y-axis, found by evaluating (y) when (x = 0).
6. The coefficient (a) affects the **direction** and **width** of the parabola.
   - Larger absolute value of (a): Narrower parabola.
   - Smaller absolute value of (a): Wider parabola.
7. The **roots** or **zeros** of the quadratic function are the points where the graph intersects with the x-axis, found by solving $ax^2 + bx + c = 0$.

Example 3**.** Work in group to construct the graph of $y = x^2 - 4x + 3$ in large poster.

Part III. **Graph of Quadratic Function**

*Instructions***:**

1. The class will be divided into groups..
2. In a Large Poster, graph the function $y = x^2 - 4x + 3$
3. You are free to use any techniques in graphing.
4. Each group presents their graph, explaining the process and features of the parabola.



Answer: Sample graph of $y = x^2 - 4x + 3$.

For better understanding elaborate the easy way to graph the quadratic functions using the vertex form:

Vertex Form of a Quadratic Function: $y = a(x-h)^2 + k$

Where:

- ((h, k)) is the **vertex**
- (a) determines the **direction** and **width** of the parabola

Shortcut Steps to Graph

Step 1. **Identify the Vertex**

- From the equation, extract (h) and (k)
- Example: (y = (x - 3)^2 + 2) → Vertex is ((3, 2))

Step 2. **Plot the Vertex**

- This is the turning point of the parabola.

Guiding Questions

1. What shape do all quadratic graphs have?
2. What changes when a is positive vs negative?
3. Where is the turning point located?

Expected Discovery

1. All quadratic graphs are parabolas
2. Vertex is the highest or lowest point
3. a controls opening direction and width

Part III. **Vertex Form Investigation**

Leaner Task

1. Analyze vertex form equations
2. Predict vertex without graphing
3. Use 1–3–5 rule patterns

Guiding Questions

1. What part of the equation tells the vertex?
2. How does changing h and k affect the graph?
3. What pattern do the points follow from the vertex?

Expected Discovery

1. Vertex can be read directly from equation
2. Graph is symmetric around vertex
3. Distance pattern follows predictable growth

Part IV. **Table and Technology Exploration**

Learner Task

1. Complete tables collaboratively
2. Plot points
3. Compare with GeoGebra/Desmos output

Guiding Questions

1. What pattern do you observe in x and y values?
2. How does the graph behave as x increases?
3. Does the digital graph match your manual graph?

Expected Discovery

1. Linear shows constant change
2. Quadratic shows increasing/decreasing rate of change
3. Technology validates accuracy

Step 3. **Determine the Direction**

- If (a > 0): Parabola opens **upward**
- If (a < 0): Parabola opens **downward**

Step 4. **Use "1-3-5" Rule for Standard Width**

- From the vertex, move:
  - **1 unit left/right → 1 unit up/down**
  - **2 units left/right → 4 units up/down**
  - **3 units left/right → 9 units up/down**
- Multiply these values by (|a|) if (a ≠ 1).

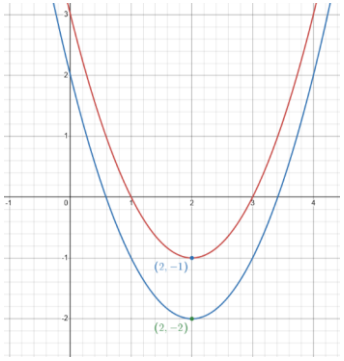
Step 5. **Draw the Axis of Symmetry**

- A vertical line through ($x = h$)

Step 6. **Sketch the Parabola**

- Plot symmetric points on both sides of the vertex
- Connect the points with a smooth curve

Note if quadratic equation in standard form $y = ax^2 + bx + c$, convert into vertex form $y = a(x - h)^2 + k$.
Show the steps of converting standard form into vertex form.
Watch the steps in the YouTube video:
Introduction to vertex form of a quadratic
https://www.youtube.com/watch?v=_QqhuLixNEk



Example 4. Graph the function $y = x^2 - 4x + 2$. Then compare the graph of $y = x^2 - 4x + 3$.
Answer:

The comparison of the graphs of $y = x^2 - 4x + 2$ and $y = x^2 - 4x + 3$:

Vertex:

- Both functions have the same vertex x - coordinate, which is x = 2.
- The y-coordinates of the vertices are different:
  For $y = x^2 - 4x + 2$, the vertex is at (2,-2)
  For $y = x^2 - 4x + 3$, the vertex is at (2,-1)

Part III.
Graph of Linear and Quadratic Function Using Table of Values

Instructions:
1. Study the given function.

2. Compute the missing values.
3. Plot the ordered pairs.
4. Draw the graph.
5. Describe the pattern shown by the graph.

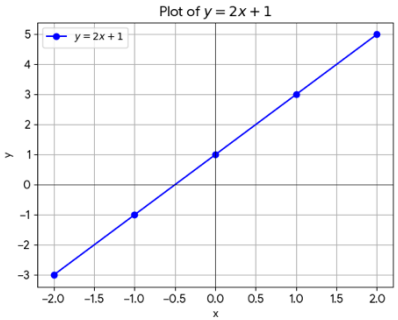
. y = 2x + 1

Complete the table below.

x	-2	-1	0	1	2	3
y						

Solutions:

x-coordinate	y = 2x + 1	Ordered Pair (x, y)
-2	y = 2(-2) + 1 = -4 + 1 = -3	(-2, -3)
-1	y = 2(-1) + 1 = -2 + 1 = -1	(-1, -1)
0	y = 2(0) + 1 = 0 + 1 = 1	(0, 1)
1	y = 2(1) + 1 = 2 + 1 = 3	(1, 3)
2	y = 2(2) + 1 = 4 + 1 = 5	(2, 5)



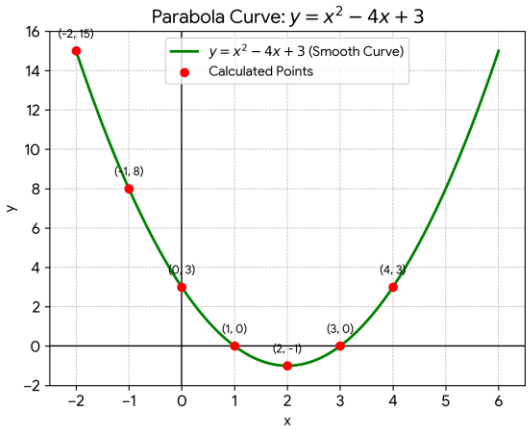
2. $y=x^2 - 4x + 3$

Complete the table below.

x	-2	-1	0	1	2	3
y						

x-coordinate	$y = x^2 - 4x + 3$	Ordered Pair (x, y)
-2	$y = (-2)^2 - 4(-2) + 3$ $= 4 + 8 + 3$ $= 15$	(-2, 15)
-1	$y = (-1)^2 - 4(-1) + 3$ $= 1 + 4 + 3$ $= 8$	(-1, 8)
0	$y = (0)^2 - 4(0) + 3$ $= 0 - 0 + 3$ $= 3$	(0, 3)
1	$y = (1)^2 - 4(1) + 3$ $= 1 - 4 + 3$ $= 0$	(1, 0)
2	$y = (2)^2 - 4(2) + 3 =$ $4 - 8 + 3$ $= -1$	(2, -1)

3	$y = (3)^2 - 4(3) + 3$ $= 9 - 12 + 3$ $= 0$	(3, 0)
4	$y = (4)^2 - 4(4) + 3$ $= 16 - 16 + 3$ $= 3$	(4, 3)



Part IV.

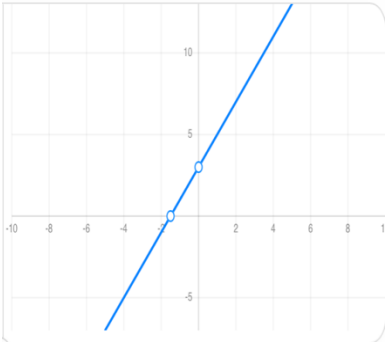
Graphing Linear and Quadratic Function Using GeoGebra or Desmos

Instructions:

1. Your teacher will demonstrate how to navigate GeoGebra and Desmos.
2. Follow the steps to graph each function using GeobGebra or Desmos.

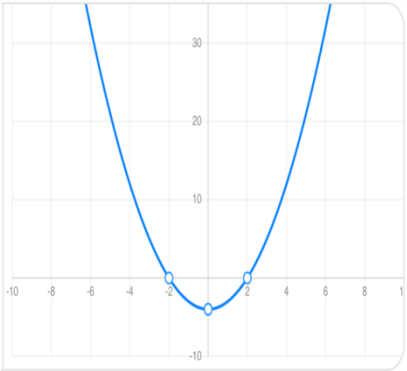
a. Graph y = 2x + b using GeoGebra or Desmos

Solution:
Open GeoGebra Graphing Calculator or Desmos.
Locate the input bar.
Type: y = 2x + 3
Press Enter.
Discussion:
As you observe, the graph is a straight line that intersects the y-axis at (0, 3). The y-intercept is 3. The line rises two units as the point moves one unit to the right, or falls two units as it moves one unit to the left. Therefore, the slope is 2.



b. Graph $y = x^2 - 4$ using GeoGebra or Desmos

Solution:
Open GeoGebra Graphing Calculator or Desmos.
Locate the input bar.
Type: $y = x^2 - 4$
Press Enter
Discussion:
As you observe, the graph is a parabola that intersects the y-axis at (0, -1). The y-intercept is -1. The parabola opens upward.



B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3: Practicing Learned Skills: Group Work

Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.

Instructions:
1. Learners will be grouped and assigned one function from the Learning Activity sheet.
2. Learners may sketch the graph manually or with the aid of software application.
3. Graphing Guidelines:
   a. Label the **x- and y-axes** clearly.
   b. Plot at least **5 points** for your function.
   c. Use a **ruler** for straight lines and a **smooth curve** for parabolas.
   d. Label your graph with the **equation**.
   e. Identify and label key features:
   - For **linear functions**: slope and y-intercept
   - For **quadratic functions**: vertex, axis of symmetry, and intercepts

4. Collaboration:
   a. Work together to analyze the function and plot it accurately.
   b. Make sure everyone in the group understands the process.
   c. Assign roles (e.g., plotter, checker, explainer, presenter).
5. Presentation:
   1. Be ready to **present your graph** to the class.
   2. Explain how you graphed it and describe its key features.

6. Submission:
Submit your group's graph with the names of all members.

CANVA Graph Navigation: https://pretest-on-functions.my.canva.site/visualizing-graph-of-functions
After navigating the function and its graph ask the students
"How does changing the function affect the shape and position of the graph on the coordinate plane?
What observations can you make when comparing two or more functions at the same time?"

C. Demonstrating Knowledge and Skills

C.1. Finding Practical Application

Activity C.1.
Making Real-World Connections: Problems Involving Linear and Quadratic Functions

Instructions:
Solve the following real-life problems involving linear functions, quadratic functions, and mathematical modeling. Read each situation carefully, identify the given information, and show complete solutions and reasoning for your answers.
For each problem:
3. Identify the variables and important information.
4. Write the appropriate mathematical model or function.
5. Show complete solutions and computations.
6. Use correct mathematical notation and units.
7. Explain your answers clearly when required.
8. Check your computations before submitting your work.

Problem 1. **Know Your Household Consumption**
A household pays:
a fixed monthly connection fee of ₱300
₱10 per kilowatt-hour (kWh) of electricity consumed.

Tasks:
a. Write a linear function $B(k)$representing the monthly electricity bill based on the number of kilowatt-hours $k$consumed.
b. Calculate the total monthly bill if the household consumes 150 kilowatt-hours.

Activity C.1.
Making Real-World Connections: Problems Involving Linear and Quadratic Functions

This activity allows learners to apply concepts of linear functions, quadratic functions, and mathematical modeling to authentic real-life situations involving electricity consumption, fundraising, projectile motion, pricing strategies, and optimization problems.

Strategy 1**. Classroom-Based Facilitation**
Facilitation Guide:
1. Introduce the Activity
Begin the activity by explaining that mathematics is widely used in:
   a. budgeting and utility expenses
   b. business profit analysis
   c. scientific applications
   d. pricing decisions
   e. optimization and planning

You may say:
"Today, you will solve real-life problems using linear and quadratic functions. These situations show how mathematics helps people make practical decisions in business, science, and everyday life."

2. Review Key Concepts
Briefly review:
   a. linear functions
   b. quadratic functions
   c. slope and intercept
   d. vertex of a parabola
   e. mathematical modeling

	Guide Questions: a. What represents the fixed cost? b. What part of the function changes depending on electricity consumption? c. How does the linear function represent the relationship between usage and cost? Use the linear function: $B(k) = 300 + 10k$ Problem 2. **School Fundraiser** Scenario: Your school is organizing a fundraising event. Each ticket costs ₱100, and the total fixed expense for organizing the event is ₱5,000. Tasks: a. Write a profit function representing the relationship between profit and the number of tickets sold. b. Calculate the profit when: • 50 tickets are sold • 100 tickets are sold • 200 tickets are sold • 350 tickets are sold Guide Questions: a. What does the fixed cost represent? b. How does increasing ticket sales affect profit? c. At what point does the fundraiser begin earning profit? Use the profit function: $P(x) = 100x - 5000$ Problem 3: Projectile Motion Scenario: A ball is thrown into the air, and its height is modeled by the function: $h(t) = -4.9t^2 + 20t + 1.5$ where: t= time in seconds $h(t)$= height in meters Tasks: a. Determine the time when the ball reaches its maximum height. b. Find the maximum height of the ball. c. Determine when the ball hits the ground. d. Graph the function and describe the shape of the parabola in relation to the ball's motion.	You may also review: a. substitution b. factoring c. graph interpretation d. quadratic formula 3. Guide Learners Through the Problems Allow learners to work individually, in pairs, or in small groups. Remind learners to: a. identify the variables b. determine the important information c. write the correct mathematical model d. show complete solutions e. explain their reasoning clearly Encourage learners to: a. analyze the meaning of the function b. connect the solution to the real-life scenario c. interpret graphs and results 4. Facilitate Discussion After each problem, ask selected learners to explain: a. their solution process b. why they chose a particular formula c. how the mathematical model represents the situation Encourage learners to compare different strategies and interpretations. 5. Monitor and Provide Support While learners are solving: a. observe their progress b. clarify misconceptions c. guide struggling learners without directly giving answers d. check proper use of notation and units **Processing Questions** Conceptual Understanding a. "How can a function represent a real-life situation?" b. "What makes a situation linear or quadratic?" c. "Why is the vertex important in optimization problems?" Real-Life Application a. "How are functions used in business and budgeting?" b. "Why is mathematical modeling useful in decision-making?" c. "How can graphs help us understand real-life situations?" Critical Thinking a. "How does changing one variable affect the entire situation?"

Guide Questions:
a. Why does the graph form a parabola?
b. What does the vertex represent?
c. Why are there two solutions when solving $h(t) = 0$?

Use the vertex formula:

$$t = \frac{-b}{2a}$$

Problem 4: Halo-Halo Stand in Burnham Park
Scenario: A small halo-halo stand in Baguio City sells each cup for ₱40 and serves 120 customers per day.
The owner plans to increase the price. For every ₱2 increase, the owner expects to lose 6 customers.

Tasks:
a. Define a variable representing the number of ₱2 price increases.
b. Write a quadratic model representing the daily profit.
c. Analyze the function and determine:
   - the maximum daily profit
   - the price that gives the maximum profit
   - the corresponding number of customers

Guide Questions:
Why does the situation form a quadratic function?
What does the vertex represent in this problem?
How does increasing the price affect customer demand?
Use the quadratic model:

$$P(x) = (40 + 2x)(120 - 6x)$$

Problem 5: Vegetable Garden Optimization
Scenario: A farmer in Nueva Ecija plans to build a rectangular vegetable garden beside a barn using 30 meters of fencing.
Since one side is against the barn, only three sides need fencing.

Tasks:
a. Define the variables.
b. Write a quadratic function representing the area of the garden.
c. Determine the dimensions that maximize the area.
d. Find the maximum possible area.

b. "Why do some quadratic functions have maximum values?"
c. "How can mathematics help people predict outcomes?"

Strategy 2. **EdTech Integration**
Teacher Reminders
The teacher should:
a. Ensure a stable internet connection.
b. Provide QR codes or shortened links for easier learner access.
c. Guide learners in navigating the interactive activity.
d. Monitor learner participation and provide technical assistance when needed.

Interactive Canva Activity

Making Real-World Connections

https://reyinandnoreen.my.canva.site/c9qd8ptjp52ewn8f

Facilitation Guide:
1. Briefly demonstrate how to navigate the interactive Canva activity.
2. Explain that learners should:
   a. read each scenario carefully
   b. analyze the given information
   c. write the correct function
   d. solve step-by-step
   e. explain their reasoning
3. Encourage learners to:
   a. work carefully through each problem
   b. use the hints or guide questions when needed
   c. compare answers and strategies with classmates
   d. check graphs and interpretations carefully
4. Monitor learners and assist with:
   a. graph interpretation
   b. writing functions
   c. optimization problems
   d. identifying variables
5. Facilitate a short discussion by asking:
   a. Which problem was most realistic or relatable?
   b. Which problem was the most challenging?

Guide Questions:
Why is this an optimization problem?
Why does the quadratic function open downward?
What does the vertex represent in the situation?
Use the area function:

$$A(x) = -2x^2 + 30x$$

c. How did graphs help you understand the situation?
d. How can mathematical models help in real-life decision-making?

Processing Questions

1. Linear Functions
   a. What do the slope and intercept represent in real-life situations?
   b. How does changing the input affect the output?
2. Quadratic Functions
   a. Why do quadratic graphs form parabolas?
   b. What does the vertex represent in optimization problems?
3. Real-Life Application
   a. How can functions help businesses estimate profits or expenses?
   b. Why is mathematical modeling important in science and engineering?
   c. How can these concepts help people make better decisions?

C.2. Making Generalization

Activity C.2. **Wrapping Up the Lesson: Compare and Conclude**

In this activity, you will compare linear functions and quadratic functions by analyzing their graphs, equations, key features, rates of change, and real-life applications.

Part 1: Complete the Table
Using your notes, previous activities, and discussions, complete the table below:

Feature	Linear Function	Quadratic Function
Graph Shape		
Equation		
Key Features		
Rate of Change		
Real-Life Examples		

Processing Questions:
After completing the table, answer the following questions clearly and discuss your ideas with your classmates.

1. Graph Shape
   - How does the graph of a linear function differ from that of a quadratic function?
   - What does the shape of each graph tell you about the relationship between $x$and y?

Activity C.2. **Wrapping Up the Lesson: Compare and Conclude**

Facilitation Guide:

1. Introduce the Activity
Begin by explaining:
"Today, you will compare and summarize what you have learned about linear and quadratic functions. You will identify their similarities, differences, and real-life uses to deepen your understanding of mathematical models."

2. Distribute the Comparison Table
a. Provide learners with the comparison table or display it on the board or screen.
b. Allow learners to answer individually, in pairs, or in small groups.

Encourage learners to use:
a. previous notes
b. solved examples
c. graphs
d. classroom discussions

3. Facilitate Guided Discussion
After learners complete the table, discuss each guide question as a class.
Encourage learners to:
a. explain their answers
b. justify their reasoning
c. compare observations
d. connect concepts to earlier activities

	2. Equation Structure ● Compare the equations of linear and quadratic functions. What do you notice about the highest power of x? ● How does the highest power of $x$affect the shape of the graph? 3. Key Features ● What are the important features of a linear graph? Of a quadratic graph? ● Why is the slope important in a linear function? ● Why is the vertex important in a quadratic function? 4. Rate of Change ● Describe the rate of change in a linear function. ● How is the rate of change different in a quadratic function? 5. Real-Life Applications ● In what situations can linear functions be used? ● In what situations can quadratic functions be used? ● Why is it important to know which function model fits a real-life situation? ***Reflection*** *Think about the lessons and activities you completed.* ● *Which type of function was easier for you to understand? Why?* ● *How do graphs help you understand relationships between variables?* ● *How can linear and quadratic functions help people solve real-life problems?*	**4. Highlight Key Ideas** Emphasize the following: a. Linear functions form straight lines and have constant rate of change. b. Quadratic functions form parabolas and have changing rates of change. c. The highest exponent determines the type of function. d. The slope is important in linear functions. e. The vertex is important in quadratic functions, especially in optimization problems. **5. Encourage Real-Life Connections** Guide learners in identifying situations where each function can be applied, such as: a. electricity bills b. fundraising profit c. projectile motion d. pricing strategies e. area optimization **6. Conduct Reflection and Synthesis** Allow learners to reflect on: a. similarities and differences between functions b. challenges encountered during the lesson c. practical uses of functions in everyday life **Processing Questions:** Conceptual Understanding 1. "How can you identify whether a function is linear or quadratic?" 2. "How does the graph help describe the relationship between variables?" 3. "Why is the highest exponent important?" Mathematical Reasoning 1. "Why does a quadratic graph form a parabola?" 2. "What does the slope represent in a linear function?" 3. "What information does the vertex provide?" Real-Life Application 1. "Why is mathematical modeling important?" 2. "How can functions help people make decisions?" 3. "Which real-life situations are better represented by linear or quadratic functions?"

	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.3**. Assessing Learning Outcomes: Checking for Mastery** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. *Facilitation Guide:* 1. **Introduce the Activity** Explain to learners that they will solve real-life problems using linear and quadratic functions. You may say: "Today, you will apply what you learned about linear and quadratic functions to real-life situations. Read each problem carefully, show complete solutions, and explain your answers clearly." 2. **Review Important Concepts** Briefly review: a. linear functions b. quadratic functions c. vertex formula d. graph interpretation 3. **Distribute Learning Activity Sheet**. Remind learners to: a. show complete solutions b. use correct notation and units c. check their answers carefully 4. **Monitor Learners** While learners are working: a. walk around the classroom b. observe their progress c. answer clarification questions d. guide learners without giving direct answers 5. **Discuss the Answers** After the activity: a. ask selected learners to explain their solutions b. discuss common mistakes c. clarify misconceptions 6. **Connect to Real Life** Emphasize that functions are used in: a. transportation fares b. business profit analysis c. projectile motion d. pricing and optimization

C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)

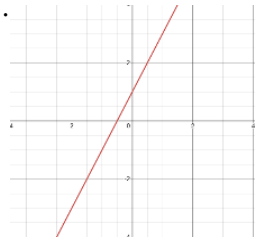
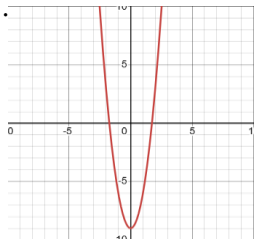
Activity C.4. **Extending and Reinforcing Learning: Graphing Linear and Quadratic Functions**

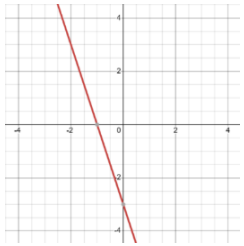
Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.

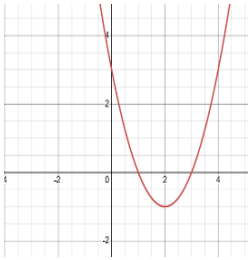
Instructions:
1. Distribute the LAS or open the Canva activity using the link provided by your teacher.
2. Read each problem carefully.
3. Identify the needed information such as slope, intercepts, vertex, and axis of symmetry.
4. Plot the points and draw the graphs.
5. Solve the packaging problem and determine the value that minimizes the cost.
6. Show your solutions in your notebook or worksheet.
7. Participate actively in class discussions and ask questions if needed.

Interactive Activity Link:
Graphing Linear and Quadratic Functions
https://reyinandnoreen.my.canva.site/c9r0va2cqzfh0v9r

III. CONTENT	**Lesson 4.2. The Cubic, Square Root and Cube Root Functions**
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. classify the functions $y = x^3$, $y = \sqrt{x}$, and $y = \sqrt[3]{x}$ based on their equations and graphs as cubic, square root, and cube root functions respectively; 2. sketch and interpret the graphs of cubic, square root, and cube root functions manually and using technology; and 3. solve real-life problems involving cubic, square root, and cube root functions and justify the mathematical model used.

V. PROCEDURES	**LEARNERS ACTIVITIES**	**ANNOTATION FOR TEACHERS**
	A.1. Eliciting *Prior Knowledge*	
A. Activating Prior Knowledge	Activity A.1. **Leveling Learner Readiness: Graph Identification Game** *Instructions:* Identify the following graph of the function, whether it is linear, or quadrati 1.  2.  3	Activity A.1. **Leveling Learner Readiness: Graph Identification Game** **Identification Game** This activity is a quick and interactive way to reinforce students' ability to recognize and classify various types of function graphs based on their visual characteristics. It supports visual learning and sharpens pattern recognition in mathematical functions, particularly linear, or quadratic. To facilitate this activity, the teacher may apply one of the following strategies below: Strategy 1. **Game-Based Formative Assessment** *Instructions:* 1. Prepare the point-point presentation and screen projector. 2. Divide the class into 4 small groups.

4. 

5. 

Processing Questions:
1. What do you notice about the shape of the graph?
2. What makes a function linear?
3. What is the general shape of a quadratic graph?
4. Do you think there are types of functions whose graphs differ from linear and quadratic functions?

3. Introduce the activity entitled Graph Identification Game
4. Provide the materials needed for the activity such as pen and meta cards.
5. Inform the learner of the mechanics of the game and scoring.
6. Facilitate the discussion by briefly reviewing the guide questions.

Strategy 2. **Think-Pair-Share**
Instructions:
1. Prepare a set of graph cards or slides showing different types of function graphs
2. Arrange the classroom for easy pairing and sharing.
3. Briefly review key characteristics of different types of functions.
4. Explain the purpose of the activity and the Think-Pair-Share strategy:
   Think: Individual reflection
   Pair: Discuss with a partner
   Share: Present to the whole class
5. Distribute one or two printed graphs to each learner.
6. Ask learners to individually observe and write down their classification of the function
7. Encourage the learners to justify their answer with at least one characteristic.
8. Have learners' pair-up with a seatmate or assigned partner.
9. Instruct them to compare their answers.
   - Discuss differences or agreements in classification.
   - Reach a consensus and prepare a short explanation.
10. Invite each pair to share their classification and reasoning with the class.

Strategy3: ICT Integrated Strategy
Instructions:
1. Prepare your gadget (cellphone, tablet, or laptop) and make sure it is connected to the internet.
2. Open the Kahoot! app or visit
3. Kahoot! Official Website
4. Enter the Game PIN provided by your teacher.
5. Type your name or assigned nickname, then click Join.
6. Carefully observe each graph shown in the activity.
7. Identify whether the graph represents a linear function or a quadratic function.
8. Select the correct answer as quickly and accurately as possible to earn higher points.
9. Wait for the next graph or question to appear on the screen.

		10. Observe the leaderboard after every round and continue participating actively. 11. At the end of the activity, review the correct answers and participate in the class discussion. 12. Show honesty, respect, and sportsmanship throughout the activity.
	A.2. Establishing the Purpose of the Lesson	
	Activity A. 2. **Appreciating Lesson Relevance: Function Match-Up** *Instructions:* There are two sets of cards: one set contains real-life scenarios, and the other set shows different types of functions – linear, and quadratic. Read each scenario carefully and discuss with your group which type of function best fits the situation. Scenario 1. Mang Jun sells *bangus* (milkfish) at ₱180 per kilo. The total cost depends on how many kilos a customer buys. Scenario 2. The stream of water from the fountain at Luneta follows a curved path that rises and falls symmetrically. Scenario 3. When a player shoots a basketball during the barangay league, the ball follows a parabolic arc. Scenario 4. Jane uses ₱3 of load per minute for mobile data. Her remaining balance decreases with time. Scenario 5: A tourist buys strawberry jam bottles at ₱150 each. The total cost depends on how many jars are bought. *Processing Questions:* 1. How can you identify whether a real-life situation represents a linear or quadratic function? 2. What are the differences between the graph of a linear function and a quadratic function? 3. Why is it important to connect mathematical functions to real-life situations?	Activity A. 2. **Appreciating Lesson Relevance: Function Match-Up** To facilitate this activity, the teacher may apply one of the following strategies below: Strategy 1: Experiential Learning Approach *Instructions:* 1. Divide the class into four small groups. 2. Provide materials with 5 different scenarios and possible answers. 3. Inform the learners of the mechanics of the activity. 4. Let the learners analyze, discuss, and match-up the scenario to the correct functions. 5. Provide an answer sheet. Strategy 2: Gallery Walk *Instructions:* 1. Divide the class into four small groups. 2. Prepare material with 5 different pictures with scenarios. 3. Assign 5 different stations within the classroom only. 4. Provide the mechanics of the activity. 5. The learner will walk in every station, then analyze the scenario given and determine the type of function. 6. Each group has 60 seconds to analyze the problem. Strategy 3. Function Match-Up – Real-Life Connections *Instructions:* 1. Prepare your gadget (cellphone, tablet, tablet, or laptop) and ensure that you are connected to the internet. 2. Open the digital platform assigned by your teacher such as Google Classroom, Canva, or Quizizz. 3. Access the "Function Match-Up: Real-Life Connections" activity link provided by your teacher. 4. Read each real-life scenario carefully and analyze the situation presented.

		5. Discuss with your group whether the scenario represents a linear function or a quadratic function. 6. Match the correct function type to each scenario using the digital cards or drag-and-drop activity. 7. Submit your group's answers before the allotted time ends. 8. Review the correct answers presented by the teacher and participate actively in class discussions. 9. Explain why each situation represents a linear or quadratic function using real-life reasoning. 10. Show cooperation, respect, and active participation throughout the activity. ***After facilitating the activity, establish a clear connection to the lesson by presenting the content and performance standards, learning competencies, specific objectives, and the unit performance task.***
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Activity B.1 Exploring Key Concepts Part I. Exploring Functions *Instructions:* Read and analyze the situation carefully. Work with your group to answer the guide questions and solve the problem. Scenario 1. A farmer wants to fence a square piece of land. He needs to know how much fencing material he will need. If the farmer knows the area of the land, how can he calculate its perimeter? Given a square with side x. Perimeter $P = 4x$ Area $A = x^2$ Scenario 2. A shipping company wants to design a cube-shaped storage box. To determine how much material the box can hold, they need to know its volume. If the side length of the box is known, how can they calculate its volume? Scenario 3. An engineer is designing cube-shaped water tanks. The required volume of each tank is already known. To construct the tank, the	**Activity B.1 Exploring Key Concepts** . Strategy 1. Collaborative Inquiry-Based Mathematical Modeling *Instructions* 1. Divide the class into small groups (3–5 learners per group). 2. Provide each group with the activity sheet containing the three real-life modeling scenarios (the farmer's square land, the cube-shaped storage box, and the cube-shaped water tank). 3. Present and briefly explain the physical contexts. Emphasize that learners will be exploring how geometric dimensions (side lengths) dictate spaces (area and volume)—and conversely, how spaces dictate the required dimensions. 4. Instruct learners to analyze the three scenarios systematically within their groups. Have them discuss: a. How perimeter relates to area when side length is unknown (Scenario 1). b. How volume relates to side length (Scenario 2). c. How side length relates back to a known volume (Scenario 3). 5. Facilitate group discussion and ensure all learners are participating in the task. 6. Encourage learners to justify their answers using mathematical reasoning. 7. Call selected groups to present and compare their answers in class.

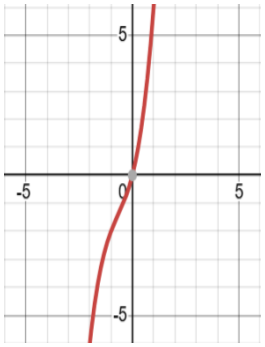
	engineer needs to determine the length of each edge. If the volume is known, how can the side length be calculated? Part II. Function Type Sort *Instructions:* Sketch the graphs of the following functions using application software like Desmos Graphing Calculator. Then, classify whether the following functions are cubic, square root or cube root. 1. $y = -x^3 + 4$ 2. $f(x) = \sqrt{x+3}$ 3. $g(x) = \sqrt[3]{x}$ 4. $y = x^3$ 5. $h(x) = \sqrt[3]{x+2}$ *Processing Questions:* 1. What is the highest exponent of the variable in the function? 2. How does the function of a cubic differ from that of a cube root or square root function?	8. Synthesize responses and clarify misconceptions, highlighting the correct relationship between perimeter and area as functions. 9. Conclude by reinforcing the concept of function relationships in real-life contexts. This Part II promotes the use of dynamic graphing tools like Desmos, encouraging technological integration into mathematical visualization. Ensure that learners are guided on how to input each function into Desmos and how to identify visual characteristics of each graph type before classifying. To facilitate this activity, the teacher may apply one of the following strategies below: Strategy: Graphing Tool–Assisted Learning Strategy *Instructions:* 1. Divide the class into 5 small groups. 2. Prepare the learning materials needed for the activity such as computer laboratory, cellphones, online or offline application software for graphing tool like Desmos. 3. Let the learners explore the graphing of different functions using Desmos and classify the type of function. 4. Facilitate the discussion to answer the guided questions.
	B.2. Discussing the Concept	
	Activity B.2. Deepening Conceptual Understanding The Function $y = x^3$, $y = \sqrt{x}$, and $y = \sqrt[3]{x}$ *Instructions:* Study the information and examples and prepare for class discussion. 1. Function: $y = x^3$ Definition: A function of the form $f(x) = ax^3 + bx^2 + cx + d$ where is called a cubic function. In other words, a cubic function is a polynomial with degree of 3 (the highest power of the variable x is 3).	**Activity B.2. Deepening Conceptual Understanding** This activity is designed to develop learners' deep conceptual understanding of cubic, square root, and cube root functions through guided study of definitions, properties, transformations, and graph behavior. It promotes meaningful learning by allowing students to analyze and interpret mathematical representations, including algebraic expressions, tables of values, and graphical sketches. The lesson emphasizes the relationships among domain, range, symmetry, intercepts, and end behavior of functions, helping learners understand how these properties define the shape and behavior of graphs. The activity also supports conceptual mastery of function transformations, including shifts, reflections, and stretches/compressions, enabling learners to connect algebraic

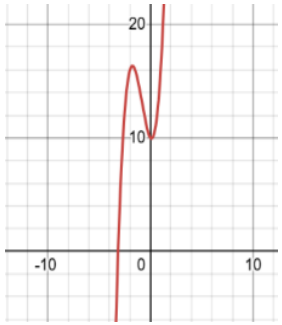
Examples of cubic functions include:

a. $f(x) = x^3 - 2x^2 + 3$
ii. $f(x) = 4 - x^3$
iii. $f(x) = x^3$

The graph of a cubic function has one of the following shapes depending on the sign of a in $f(x) = ax^3 + bx^2 + cx + d$. That is whether a is positive or negative.

For $a > 0$ (a *is Positive*)





For $a < 0$ (a *is Negative*)

Key Properties

Domain: All Real Numbers (R) or (-∞,∞)

Range: All Real Numbers (R) or (-∞,∞)

Intercepts:

- x-intercept: (0, 0)
- y-intercept: (0, 0)
- The function passes through the origin

changes with graphical outcomes. Through structured examples and guided discussion, learners are encouraged to compare function types, recognize patterns, and explain mathematical reasoning.

Hence, the activity strengthens learners' analytical thinking, problem-solving skills, and ability to communicate mathematical ideas, preparing them for higher-level function analysis and real-life applications of mathematics.

To facilitate this activity, the teacher may apply one of the following strategies below:

Strategy1: Guided Inquiry Learning Strategy

Instructions:

1. Present the functions $y = x^3$, $y = \sqrt{x}$, and $y = \sqrt[3]{x}$to the class.
2. Ask learners to observe definitions, properties, and sample graphs.
3. Guide learners using probing questions such as:
   - What similarities do you notice among the graphs?
   - How does each function behave as $x$increases or decreases?
4. Facilitate discussion to help learners discover key concepts (domain, range, symmetry, and graph behavior).
5. Summarize learners' responses and clarify misconceptions.

Strategy 2. Graphical Analysis Strategy Using Visualization

Instructions:

1. Present sample graphs of the functions or allow learners to sketch them manually or using tools like GeoGebra or Desmos (if available).
2. Instruct learners to identify key features such as intercepts, symmetry, and shape.
3. Guide learners in comparing how transformations affect each graph.
4. Ask learners to explain how algebraic changes reflect in the graph.
5. Conclude with a class discussion summarizing observations and patterns.

Strategy 3. Think–Pair–Share

Symmetry:

- Odd function:

$$f(-x) = -f(x)$$

- This means the graph is symmetric about the origin

End Behavior:

- As $x \to \infty, then\ y \to \infty$
- As $x \to -\infty, then\ y \to -\infty$

Graph Shape:

- An S-shaped curve that passes through the origin, bending upward on the right and downward on the left.

Transformation

General Form of Transformation:

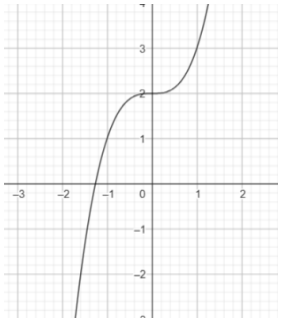
$$f(x) = a(x-h)^2 + k$$

Where:

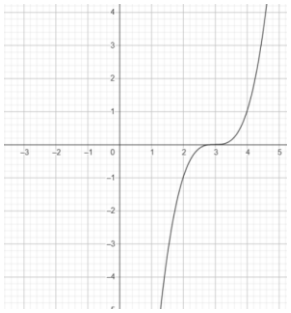
- a: Affects vertical stretch/compression and reflection over the x-axis
- h: Shifts the graph horizontally (left/right)
- k: Shifts the graph vertically (up/down)

Example of Transformations

1. Vertical Shift: $f(x) = x^3 + 2$
   - Moves the graph up 2 units.



2. Horizontal Shift: $f(x) = (x-3)^3$
   −Moves the graph right 3 units.



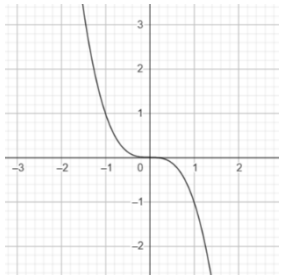
Instructions:

1. Ask learners to individually analyze one function (cubic, square root, or cube root).
2. Have learners pair up to compare answers and discuss graph behavior and transformations.
3. Let pairs share their ideas with the whole class.
4. Encourage learners to justify their answers using mathematical reasoning (not just memorization).
5. Teacher synthesizes responses and highlights correct interpretations.

3. Reflection Across the x-axis:

$f(x) = -x^3$

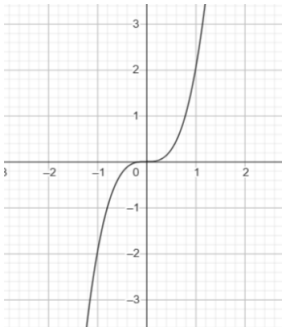
$-$Flip the graph upside down.



4. Vertical Stretch/Compression

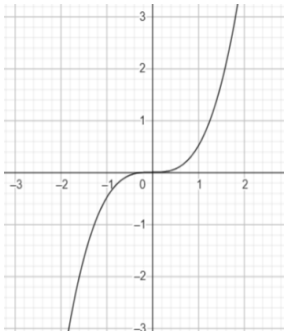
$f(x) = 2x^3$

- Stretch the graph taller (steeper)



$f(x) = \frac{1}{2}x^3$

- Compresses the graph shorter (flatter).

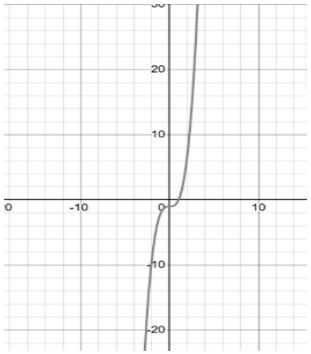


Example:
Sketch the graph of the function
$f(x) = x^3 - 1$ for $-2 \leq x \leq 3$..

Solution
Using the table of values, we get

x	-2	-1	0	1	2	3
y	-9	-2	-1	0	7	26

By sketching the graph of function $f(x) = x^3 - 1$, we get



2. Function: $y = \sqrt{x}$

Definition:
A square root function is a function that contains a square root with the independent variable in the radicand. The parent function for the family of square root functions is $f(x) = \sqrt{x}$. The domain of f is $x \geq 0$, and the range of f is $y \geq 0$.

Key Properties
Domain:
- The domain is $x \geq 0$.
- Since you cannot take the square root of a negative in the real number system, then the function is defined for non-negative real numbers.

Range:
- The range is $y \geq 0$.
- The output is always non-negative real numbers.

Intercepts:
- x-intercept: (0, 0)
- y-intercept: (0, 0)
- The function passes through the origin.

End Behavior:
- As $x \to \infty, then\ y \to \infty$
- As $x \to 0^+, then\ y \to 0$

- The function is increasing on its entire domain $[0, \infty)$. However, it increases slowly – the rate of increase decreases as x increases.

Symmetry
- The function is neither even nor odd.
- It is not symmetric about the y-axis or origin.

Graph Shape:
- Starts at the origin and curves upward.

Transformation
General Form of Transformation:

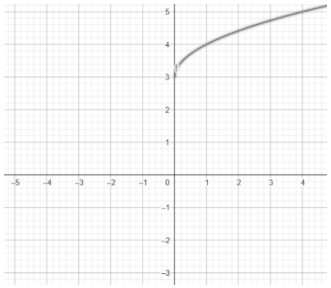
$$y = a\sqrt{b(x-h)} + k$$

Each parameter transforms the graph in a specific way:
- a: Vertical stretch/compression and reflection over the x-axis
- b: Horizontal stretch/compression and reflection over the y-axis
- h: Horizontal shift (left/right)
- k: Vertical shift (up/down)

Examples of Transformations:
1. Vertical Shift

$$y = \sqrt{x} + 3$$

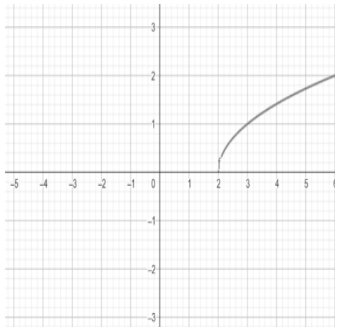
- Moves the graph up to 3 units.



2. Horizontal Shift

$$y = \sqrt{x-2}$$

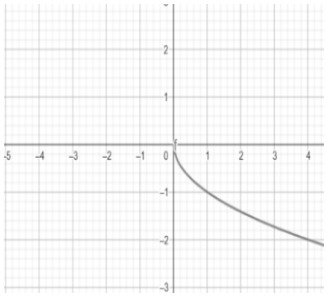
- Moves the graph to the right 2 units.



3. Reflection Across the x-axis

$$y = -\sqrt{x}$$

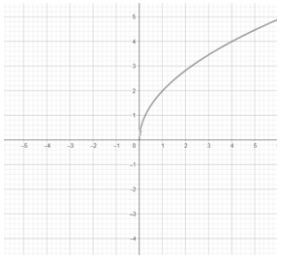
- Flips the graph upside down.



4. Vertical Stretch/Compression

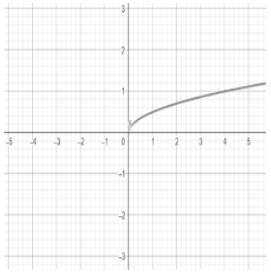
a. $y = 2\sqrt{x}$

-Stretch the graph taller.



b. $y = \frac{1}{2}\sqrt{x}$

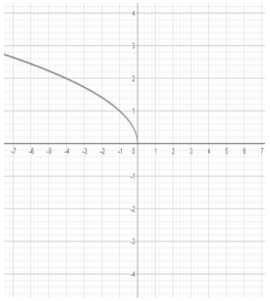
- Compresses the graph shorter.



5. Reflection Across the y-axis (involves inside the root)

$$y = \sqrt{-x}$$

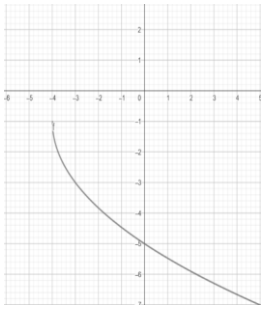
- Reflects over the y-axis. (Note: Domain changes to $x \leq 0$)



6. Combined Transformations

$$y = -2\sqrt{x+4} - 1$$

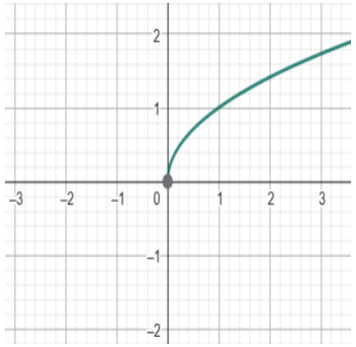
- Reflect over x-axis, stretch vertically by 2, shift left 4 units, and down 1 unit.



Example:
Sketch the graph of the function $f(x) = \sqrt{x}$.

Solution.
Using the table of values, we get

x	1	2	3	4	5	6	7
y	1.00	1.41	1.73	2.00	2.24	2.45	2.65



By sketching the graph of function $f(x) = \sqrt{x}$, we get

3. Function: $f(x) = \sqrt[3]{x}$

Definition:
A cube root function is a radical function with an index of 3. The parent function of cube root functions is $f(x) = \sqrt[3]{x}$. The domain and range of f are all real numbers.

The graph of $f(x) = \sqrt[3]{x}$ increases on the entire domain.

Key Properties
Domain:
1. All real numbers (R) or (-∞,∞)

Range:
2. All real numbers (R) or (-∞,∞)

Intercept:
- x-intercept: (0, 0)

- y-intercept: (0, 0)
- The function passes through the origin

Symmetry:

3. Odd function (symmetric about the origin)

Graph Shape:

4. S-shaped curve that increases gradually from left to right

Transformation

General Form of Transformation:

$$y = a\sqrt[3]{b(x-h)} + k$$

Where each parameter affects the graph in the following ways:

a: Vertical stretch/compression and reflection over x-axis

b: Horizontal stretch/compression and reflection over y-axis

h: Horizontal shift: moves the graph left/right

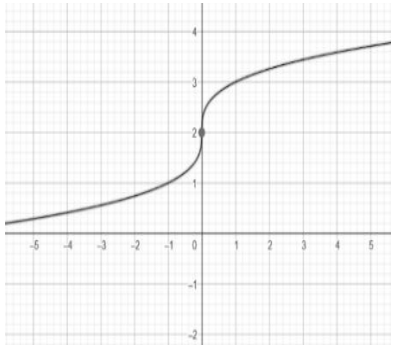
k: Vertical shift: moves the graph up/down

Examples of Transformations:

1. Vertical Shift

   $y = \sqrt[3]{x} + 2$

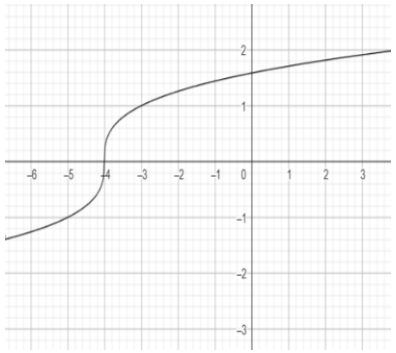
   - Moves the graph up 2 units.



2. Horizontal Shift

   $y = \sqrt[3]{x+4}$

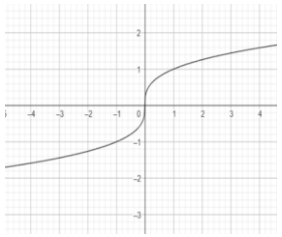
   - Moves the graph left 4 units.



3. Reflection Across the x-axis

$$y = \sqrt[3]{x}$$

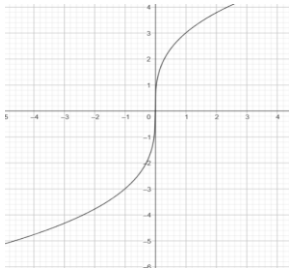
- Flips the graph upside down (reflects over the x-axis).



4. Vertical Stretch/Compression

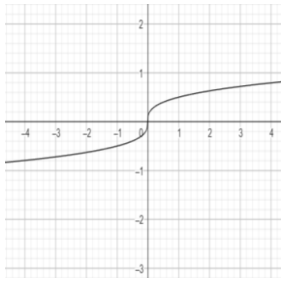
$$y = 3\sqrt[3]{x}$$

- Stretch the graph vertically.



$$y = \frac{1}{2}\sqrt[3]{x}$$

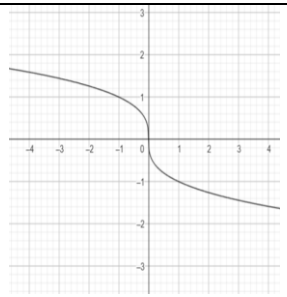
- Compresses the graph vertically (flatter).



5. Reflection Across the y-axis

$$y = \sqrt[3]{-x}$$

- Reflects the graph horizontally over the y-axis.



Example:
Sketch the graph of $y = \sqrt[3]{x}$.

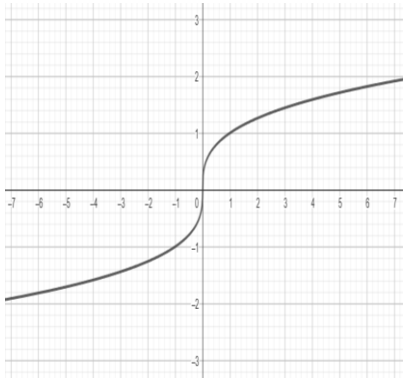
Note that $y = \sqrt[3]{x}$ can be express into exponential form $y = x^{\frac{1}{3}}$. By applying cube both sides, we have

$$y^3 = (\sqrt[3]{x})^3$$

Then $$y^3 = x.$$

Using the table of values, we get

x	-27	-8	-1	0	1	8	27
y	-3	-2	-1	0	1	2	3



By sketching the graph of the function $y = \sqrt[3]{x}$, we have

B.3. Developing Mastery (Please see the Learning Activity Sheet for learners instructions on this activity.)

Activity B.3: Practicing Learned Skills

Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies.

Strategy 1. Visual-Analytical Pairing
Instructions:
1. Allow the learners to analyze each function visually using the GeoGebra/Desmos graph and pair their observations with written explanations.
2. After graphing each function in GeoGebra, identify and write down key features:
   b. Domain and Range
   c. Intercepts
   d. End of behavior
   e. Symmetry

	3. Draw the graph on paper, labeling key points and features. Strategy 2: Graphing Tool–Assisted Learning *Instructions:* 1. Divide the class into 5 small groups. 2. Prepare the learning materials needed for the activity such as computer laboratory, cellphones, online or offline application software for graphing tool like GeoGebra/Desmos. 3. Let the learners explore the graphing of different functions using Desmos and classify the type of function. 4. Facilitate the discussion to answer the guided questions. Strategy 3: Differentiated Learning *Instructions:* 1. Divide the class into heterogeneous groups (mixed-ability learners). 2. Assign tasks based on differentiation: Group 1: Solve and graph the functions using Desmos or GeoGebra. Group 2: Solve and sketch the graphs manually using step-by-step procedures. 3. Allow groups to compare outputs and discuss similarities and differences between technology-based and manual graphing. 4. Facilitate a class discussion highlighting accuracy, efficiency, and understanding gained from both approaches.	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Activity C.1: Making Real-World Connections *Instructions:* The scenarios below are situations where we can apply functions. Carefully read and analyze each problem to identify the type of function represented. Use the correct mathematical formulas to solve each problem, making sure to show all steps of your work. Include the appropriate units in your final answers, and be ready to share and discuss your solutions in class. **Problem 1:** If the volume V of a cube is related to the side length s by $V=s^3$, how can you determine s given V? Which function would you use? a. Given the Volume V is 25 cm^3, what is the side length? **Problem 2:** In a small coastal town in Zamboanga, Aling Nena runs a sari-sari store that sells local brands of *sardinas*. One of the best-selling items is a cylindrical tin of sardines from a brand called "Masarap Sardines". The label on the can says it contains Volume: 350 cm^3 of sardines. Aling Nena measures the height of the can and finds it to be 10 cm	**Activity C.1: Making Real-World Connections** This activity aims to help learners understand how mathematical functions—specifically cubic and square root functions—can be applied to real-life situations involving volume and area calculations. It strengthens both algebraic thinking and problem-solving skills by showing how to reverse a function to find an unknown measurement. To facilitate this discussion, the teacher may apply one of the following strategies. Strategy 1. Problem-Based Learning (PBL) Strategy *Instructions:* 1. Present the three real-life word problems involving cube, cylinder, and surface area situations. 2. Divide learners into small groups and assign or let them choose a problem to solve. 3. Instruct learners to identify the given information, choose the appropriate formula, and determine the required variable. 4. Guide learners in showing complete solutions step-by-step with correct units. 5. Let groups present their solutions and explain the mathematical concepts used.

	She wants to stack the cans efficiently on her shelf and needs to know the radius of the base of each can, to calculate how much space she needs. **Problem 3:** Miguel, a Grade 9 student from Cebu, wants to surprise his younger sister with a gift. He chooses a small box shaped like a cube, which he plans to wrap with a colorful gift wrapper bought from the nearby market. The box has a volume of 64 cm^3, and Miguel wants to know how much wrapping paper he needs to cover the entire surface of the box without leaving any side exposed.	6. Facilitate discussion by connecting each solution to real-world applications of functions and formulas. Strategy 2. Collaborative Think–Solve–Share Strategy *Instructions:* 1. Have learners work in pairs or small groups to analyze each problem carefully. 2. Ask learners to first individually think of a solution, then discuss their ideas within the group. 3. Let them agree on a final solution and prepare a clear step-by-step explanation. 4. Encourage groups to answer the processing questions collaboratively. 5. Allow each group to share their answers and reasoning with the class. 6. Teacher synthesizes responses and corrects misconceptions. Strategy 3. **Inquiry-Based Guided Questioning Strategy** *Instructions:* 1. Present each problem one at a time and allow learners to analyze it independently or in groups. 2. Use guiding questions such as: • What is being asked in the problem? • What information is given? • Which formula or function applies? 3. Encourage learners to justify why they chose a specific mathematical model. 4. Facilitate class discussion using the processing questions provided. 5. Highlight how cube root and volume/surface area formulas are used in real-life contexts. 6. Summarize key learning insights and correct misunderstandings.
	C.2. Making Generalization	
	Activity C.2. **Wrapping Up the Lesson** *Instructions:* Learners will create a function property diagram based on their assigned function. They will graph the function using a digital tool such as Desmos or GeoGebra. After graphing, each group will write a short "generalization box" where they will state at least three	Activity C.2. **Wrapping Up the Lesson** This activity guides learners to analyze and summarize function behavior through visual graphing and collaborative reflection. It combines the use of digital graphing tools with critical thinking to help learners construct meaning from patterns they observe in different types of functions.

	observations or patterns about the behavior and properties of their function. Each group will present their output in class. Group 1: $y = x^3+1$ Group 2: $y = \sqrt{x}$ Group 3: $y = \sqrt[3]{x}$ Processing Questions: 1. What similarities exist among the three functions? 2. What makes each function unique? 3. Which Function is most useful in real-life applications?	To facilitate this discussion, the teacher may apply one of the following strategies. Strategy 1. **Collaborative Output-Based Learning Strategy** *Instructions*: 1. Divide the class into 3 groups and assign each group a function: • Group 1: $y = x^3 + 1$ • Group 2: $y = \sqrt{x}$ • Group 3: $y = \sqrt[3]{x}$ 2. Instruct each group to collaboratively create a function property diagram showing key features such as domain, range, intercepts, symmetry, and graph shape. 3. Let learners use Desmos or GeoGebra to graph their assigned function. 4. Guide learners in analyzing their graph and writing a generalization box containing at least three observations or patterns. 5. Allow each group to present their diagram and explain their findings to the class. 6. Facilitate synthesis and highlight similarities and differences among the functions. Strategy 2. **Technology-Enhanced Presentation Strategy** *Instructions:* 1. Assign each group a function and ensure access to digital graphing tools (e.g., Desmos or GeoGebra). 2. Instruct learners to graph their assigned function and explore its properties using the tool. 3. Have each group prepare a short digital presentation (or poster output) showing: • Graph of the function • Key properties (domain, range, intercepts, shape) • Generalization box with at least three observations 4. Let groups present their outputs in class. 5. Encourage peer questioning and clarification during presentations. 6. The teacher summarizes the key learning insights and connects all function behaviors.

	C.3. Evaluating Learning (Please see the Learning Activity Sheet for learners instructions on this activity).
	Activity C.3: Assessing Learning Outcomes Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. Strategy 1. Individual Performance Assessment Strategy *Instructions:* 1. Distribute the assessment sheet to all learners. 2. Instruct learners to answer the classification, graphing, and application tasks independently. 3. Remind learners to show complete solutions and label all necessary graph features. 4. Monitor learners while they work and provide clarification on instructions when necessary. 5. Collect and evaluate outputs using the provided rubric and scoring guide. 6. Discuss common errors and misconceptions after the assessment. Strategy 2: **Technology-Assisted Assessment Strategy** *Instructions***:** 1. Allow learners to answer Part I using digital platforms such as Kahoot, Quizizz, or Google Forms. 2. Require learners to sketch the graphs in Part II using GeoGebra or Desmos and submit screenshots of their outputs. 3. Let learners solve the real-life application problems individually and submit their solutions through Google Classroom. 4. Review submitted outputs and provide feedback based on the rubric. 5. Facilitate a brief reflection session where learners discuss challenges encountered during the
	C.4. Additional Activities (Please see the Learning Activity Sheet for learners instructions on this activity.)
	Activity C.4. **Extending and Reinforcing Learning** Facilitate the activity in the LAS. To enhance learner engagement, you may use any of the suggested strategies. This additional exercise may be given as an assignment or homework. Remediation should be provided to learners who have not yet achieved mastery of the lesson, while enrichment activities should be offered to those who are ready for further learning.
V. ASSESSMENT	**To evaluate learners' success in attaining the intended learning competencies, the assessment tools and strategies provided on the link in the table of contents can be utilized to measure understanding, skills, and application of concepts** **Revisit the Integrative Performance Task performed by the learners in Unit 3. Ask them to refine their outputs and present them together with outputs from the other Core subjects.**
VI. REFLECTION	**To assess and evaluate the effectiveness of the instruction, as well as to identify challenges and plan for improvements in this unit, teachers are encouraged to answer the reflective questions provided in the link indicated in the table of contents**

INTEGRATIVE PERFORMANCE TASK (IPT)			
Integrated Learning Area/s :	**General Science, General Mathematics, Life and Career Skills, Pag-aaral ng Kasaysayan at Lipunang Pilipino, Effective Communication, and Mabisang Komunikasyon**		
IPT Title:	**Community Innovation Advocacy Pitch**	**Duration:**	**term-long**

Goal : a. What should learners accomplish or produce at the end of the task? b. What real-world problems, issues, or challenges will learners address? c. What competencies or standards will the task measure?	1. Creation and presentation of a Community Innovation Advocacy Pitch that proposes a prototype-based solution to a disaster-related problem affecting the barangay. 2. Development of a proposed solution that responds to a disaster-related problem affecting the barangay while considering its geography, culture, experiences, existing practices, and community needs. Examples may include: • Flooding • Storm surges • Landslides • Drought • Water shortages • Poor evacuation conditions • Waste management issues during disasters • Other disaster-related concerns relevant to the barangay 3. Application of scale interpretation through: • Measurement, conversion, and proportional reasoning • Scale use in sketches, blueprints, diagrams, and layouts • Accurate representation of real-world spaces and distances 4. Evaluation of the proposed innovation based on: • Practicality • Safety • Affordability (conceptual cost) • Suitability for intended users and barangay needs 5. Demonstration of: • Mathematical reasoning, particularly measurement, conversion, scale interpretation, and representation • Scientific understanding and application of Physics concepts • Communication and advocacy skills • Socio-cultural and community awareness 6. Justification of design decisions considering: • Space and scale • Budget estimates (conceptual) • Materials (conceptual) • Number of beneficiaries • Community needs and conditions 7. Delivery of an advocacy pitch with a clear call to action that encourages the audience to support, improve, adopt, implement, pilot, or sponsor the proposed solution 8. Development of: • Self-awareness through reflection on experiences, strengths, and areas for improvement • Effective collaboration and social interaction

	• Responsible decision-making • Readiness for future studies, career goals, community involvement, and real-life situations
Role : a. What role will the learners assume in completing the task? b. Who are they pretending to be (e.g., researcher, entrepreneur, scientist, journalist, community leader)? How does this role reflect real-life responsibilities?	Learners will take on the role of **community innovation advocates**. In this role, they will study a local community problem, design a prototype, prepare scaled models and measurements, analyze cost and feasibility, create communication materials, and present an advocacy pitch to persuade others to support, improve, adopt, scale up, or scale down the innovation. This role reflects real-life responsibilities because learners perform tasks similar to young innovators, community researchers, project designers, financial planners, communicators, and advocates. They must use evidence, collaborate effectively, and make responsible decisions to address real community needs.
Audience : a. Who is the intended audience or beneficiary of the task? b. Who will view, use, evaluate, or be affected by the learners' output? c. How can the audience make the task more authentic and meaningful?	The intended audience includes: • teachers from the integrated learning areas; • invited stakeholders such as barangay officials, SK officials, community leaders, or other community representatives; and classmates. Teachers and invited stakeholders will serve as the panel of evaluators, while classmates will serve as the peer audience during the advocacy pitch. The peer audience and panel make the task more authentic and meaningful because learners must present and defend their proposed innovation before people who can evaluate its relevance, feasibility, and responsiveness to community needs and conditions. This encourages learners to support their recommendations with evidence and consider how community context, existing practices, safety, sustainability, and cost influence the design and implementation of their proposed innovation.
Situation : a. What real-life context or scenario will make the task meaningful? b. What challenges, issues, or needs must learners respond to? c. Why is the task important or relevant in the given situation?	Your barangay faces disaster-related problems that affect the safety, well-being, resources, or daily lives of its residents. Examples may include flooding, storm surges, landslides, drought, water shortages, poor evacuation conditions, or other community concerns. Existing coping, preparedness, or adaptation practices of the barangay may help address these problems, but they may also have limitations. *How can you, as a team of community innovation advocates, collaborate to design a feasible and sustainable innovation that addresses a disaster-related problem in the barangay, using Physics concepts, measurements, conversions, and scale, while considering its geography, culture, experiences, existing practices, and the needs of residents?* To answer this question, you will investigate the problem, analyze existing practices, develop a prototype-based innovation, evaluate its

	feasibility, and communicate your recommendations through an advocacy pitch. This task allows you to apply what you have learned in different subjects to a real community concern while considering feasibility, safety, sustainability, cost, and community needs.
Product/ Performance : a. What output, presentation, or performance will learners create? b. What evidence will demonstrate learners' understanding and skills? c. How will learners integrate knowledge and skills from different learning areas? d. What are the detailed instructions for the learners?	Learners will deliver a **Community Innovation Advocacy Pitch** supported by an Advocacy Brochure. The pitch will present a disaster-related barangay problem, existing coping/adaptation practices, proposed innovation, feasibility findings, and a call to action. The brochure will serve as an audience-friendly summary of the project. The following outputs will serve as evidence of learning: 1. Prototype Development Plan 2. Prototype Adaptability Plan 3. Feasibility and Comparison Report 4. Advocacy Brochure 5. Advocacy Pitch 6. Individual Monitoring Sheet and Work Gallery 7. Reflection Guide Before starting the project, review **Appendix A (Innovator's Roadmap)** to understand the project phases, sequence of tasks, expected outputs, and learning areas integrated throughout the project. **LEARNER INSTRUCTIONS** 1. **Form your group and assign specific roles based on each member's strengths, interests, and skills.** Roles may include leaders, researchers, designers, computation handlers, finance handlers, science explainers, writers, and documenters. Roles may be combined or adjusted depending on group size. Discuss and agree on each member's responsibilities to ensure meaningful participation and collaboration throughout the project. Each member must actively contribute to the project and participate in the final advocacy pitch. 2. **Review Appendix A (Innovator's Roadmap)** to understand the project phases, sequence of tasks, and expected outputs. 3. **Accomplish the Individual Monitoring Sheet (Appendix F)** throughout the project to document assigned tasks, accomplishments, means of verification, and supporting evidence. Update the sheet regularly as you complete project activities. Attach evidence in the Work Gallery, such as photos, sketches, computations, drafts, meeting notes, and short narratives. 4. **Brainstorm possible disaster-related problems affecting your barangay.** Discuss which problems are observable, relevant, and feasible to address through an innovation-based solution. As a group, select one problem to investigate and address throughout the project. Describe the problem by explaining who is affected, where it occurs, and why it is

	important to address. Record your responses in the Description of Problem subsection of Section I. Barangay Problem of the Prototype Development Plan (Appendix B). 5. **Describe how the identified problem is connected to the barangay's geography, culture, way of life, traditions, experiences, or history.** Understanding these factors can help you better understand the problem and design a solution that is appropriate, acceptable, and sustainable for the barangay and its residents. Record your responses in the Community Context subsection of Section I of the Prototype Development Plan (Appendix B). 6. **Investigate the existing coping, preparedness, or adaptation practices used by the barangay or residents in addressing the identified problem.** Gather information through observations, interviews, barangay documents, reports, plans, or other credible sources. Complete Section II. Existing Coping/Adaptation Practices of the Prototype Development Plan (Appendix B) by identifying the supporting evidence, describing the existing practice, and analyzing its strengths and limitations. 7. **Develop a proposed innovation that addresses the identified barangay problem** based on your analysis of the problem, community context, and existing coping/adaptation practices. The innovation should respond to the limitations of existing practices and be appropriate, acceptable, and sustainable for the barangay and its residents. Complete Section III. Proposed Innovation of the Prototype Development Plan (Appendix B) by describing the innovation concept, identifying the intended beneficiaries, explaining how the innovation responds to the community context identified in Section I, and discussing the science or Physics concept(s) that support its design and function. 8. **Prepare a scaled sketch, blueprint, layout, or diagram of the proposed innovation.** Clearly indicate the scale used and label the dimensions and measurements needed to understand the design. Attach the visual model and complete Section IV. Visual Model with Scaling of the Prototype Development Plan (Appendix B). 9. **Identify the key measurements, quantities, units, and design specifications** used in the proposed innovation. Complete the Key Measurements and Design Specifications table in Section IV of the Prototype Development Plan (Appendix B) by indicating the component or part, measurement or quantity, unit, and purpose or function of each item. 10. **Complete the Prototype Adaptability Plan (Appendix C).** Real-world solutions often need to be adjusted to meet changing community needs, resources, or environmental conditions. Using the information gathered about the barangay's geography, culture, livelihood, population, available resources, or environmental conditions, select a realistic scale-up or scale-down scenario (e.g., larger or smaller service area, increased or decreased number of users, limited budget, availability of materials, or changing environmental conditions). Revise the measurements as

needed, show the required scale and conversion computations, and explain how the changes affect the design and its intended use.

11. **Analyze the feasibility of the proposed innovation using the Feasibility and Comparison Report (Appendix D).** Estimate the costs and expected benefits of the proposed innovation and determine whether it is practical to implement in the barangay. Consider factors such as efficiency, safety, sustainability, accessibility, available resources, and community needs. Support your analysis with appropriate computations, tables, graphs, or other evidence when needed.
12. **Using the results of your investigation and feasibility analysis, compare the existing coping/adaptation practices and the proposed innovation.** Evaluate their effectiveness, cost, efficiency, safety, sustainability, accessibility, and community impact. Record your findings in the Solution Comparison section of the Feasibility and Comparison Report (Appendix D) and justify whether the proposed innovation should be adopted, improved, or reconsidered.
13. **Create an Advocacy Brochure using the required contents listed in Appendix E.** Present the community problem, community context, existing coping/adaptation practices, proposed innovation, visual model solution comparison, Filipino paninindigan, and call to action in a clear, organized, and audience-friendly format.
14. **Submit the Prototype Development Plan, Prototype Adaptability Plan, Feasibility and Comparison Report, and Advocacy Brochure to the evaluation panel** at least three (3) days before the advocacy pitch.
15. **Deliver a group advocacy pitch in which every member speaks and presents a part related to their assigned role.** Present the identified barangay problem, community context, existing coping/adaptation practices, proposed innovation, feasibility and comparison findings, Filipino paninindigan, and call to action. Support your recommendations with evidence from your investigation and analysis. Explain how the proposed innovation addresses community needs and why it should be considered for adoption, improvement, implementation, support, or sponsorship. The pitch will be presented to a panel composed of subject teachers and invited stakeholders, such as barangay officials, SK officials, community leaders, or other relevant representatives. After the presentation, participate in a question-and-answer session and respond to the panel's questions based on your assigned role and project findings.
16. **After the advocacy pitch, complete the Reflection Guide (Appendix G).** Reflect on your role, contributions, collaboration, challenges, learning, and personal growth throughout the project. Submit the completed Reflection Guide together with the Individual Monitoring Sheet and Work Gallery (Appendix F).

Standards : a. What criteria will be used to assess the task? b. What indicators will show quality performance and mastery? How will learners know they have successfully completed the task?	The Community Innovation Advocacy Pitch will be assessed through multiple measures to capture learners' knowledge, skills, collaboration, and reflection. The Panel-Rated Rubric evaluates Community Context and Socio-Cultural Responsiveness, Physics Application and Scientific Justification, Scale, Measurement, Conversion, and Representation, Communication and Advocacy, Collaboration and Healthy Relationships, and Integration of Learning Areas and Advocacy Brochure. The Engagement, Reflection, and Personal Growth Assessment evaluates learners' role performance, project engagement, self-reflection, and personal growth. Invited stakeholders may also provide feedback on the relevance, responsiveness, feasibility, potential impact, and persuasiveness of the proposed innovation. Learners will have successfully completed the task when they present a community-based innovation that is relevant, feasible, evidence-based, and responsive to local needs; demonstrate accurate application of scientific, mathematical, communication, and socio-cultural concepts; collaborate effectively with others; and communicate a clear and persuasive advocacy message supported by appropriate evidence and reasoning.