LESSON PLAN TEMPLATE

Lesson Title	Understanding Square Roots, Cube Roots, and Irrational Numbers
Learning Area/s	Mathematics
Name of Teacher/s	DEPED TAMBAYAN PH (Visit www.depedtambayanph.net for more downloads.)
Grade Level and Section	Grade 7
No. of Sessions	4 Sessions
References	None specified
Declaration of AI use	This lesson plan was co-created using Gemini AI to assist with unpacking competencies into a 4-session learning design, structuring activities, and assessment formulation.

Intentions.

Meaningful learning experiences are anchored in how we frame them. Start by deciding what you want learners to master by the end of the lesson – keep it clear and simple.

Learning Competency and Curriculum Standards:	**Learning Competency:** • Determine the square roots of perfect squares and the cube roots of perfect cubes. • Identify irrational numbers involving square roots and cube roots, and their locations on the number line. **Content Standards:** The learners should have knowledge and understanding of: • regular and irregular polygons and their features/properties • determination of measures of angles and number of sides of polygons • application of percentages • use of rates • rational numbers • square roots of perfect squares, cube roots of perfect cubes, and irrational numbers **Performance Standards:** By the end of the term, the learners are able to: • draw, and describe the features/properties of, regular and irregular polygons. • use percentages in different contexts. • identify and use rates. • create a financial plan. • describe, order, and perform operations on, rational numbers. • determine square roots of perfect squares and cube roots of perfect cubes, and identify irrational numbers.

	Session 1	Session 2	Session 3	Session 4
Learning Objectives:	● Identify perfect squares from 1 to 225. ● Determine the square roots of perfect squares accurately. ● Apply the concept of square roots to solve problems involving the area of square-shaped objects in the Filipino household.	● Define perfect cubes and determine their cube roots. ● Distinguish between squaring a number and cubing a number. ● Relate cube roots to the volume of cube-shaped containers like 'balikbayan boxes' or 'ice cubes'.	● Differentiate between rational numbers and irrational numbers. ● Estimate the square roots of non-perfect squares to the nearest hundredth. ● Identify common irrational numbers involving roots (e.g., $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$).	● Locate square roots and cube roots (rational and irrational) on a number line. ● Order a set of real numbers involving roots from least to greatest. ● Demonstrate precision in plotting approximate values.
Learner Context:	● Learners show high engagement when using visual aids like grid paper and local objects (e.g., square floor tiles or 'banig' patterns). ● Many students have a strong grasp of basic multiplication but struggle with the inverse relationship of squaring. ● Barriers include difficulty in	● Students have recently mastered square roots but often confuse the index of a cube root with a coefficient. ● Interest is high when using 3D manipulatives. ● A barrier for some is the rapid growth of cubic numbers, leading to calculation errors.	● Learners are comfortable with whole numbers but show anxiety when dealing with decimals that 'do not end'. ● Most students prefer using calculators but need to develop estimation skills for number sense. ● Strength: They are good at comparing	● Students have difficulty with the spatial representation of decimals between integers on a number line. ● They enjoy 'floor activities' where they can move physically. ● Barriers: Precision in plotting; some students place $\sqrt{5}$ at 5 instead of ~2.23.

	memorizing larger perfect squares (above 100) and occasional confusion between 'half of a number' and 'square root'.		sizes of objects relative to one another.	
Learning Experience. **A learning experience is like a thoughtfully designed journey. Each activity and interaction builds towards meaningful understanding and growth. Identify activities and interactions to help learners gain knowledge, skills, or understanding in a purposeful way.**				
Pre-Lesson:	● **Multiplication Relay:** A quick 5-minute drill where rows compete to complete a list of square numbers (1x1 to 15x15) on the board. ● **Visual Hook:** Showing a photo of a typical 30x30 cm floor tile and asking how many small 1x1 cm squares fit on one side if the total area is 900 sq cm.	● **Building Blocks:** Using small plastic cubes to build a 2x2x2 cube and a 3x3x3 cube. ● **Comparison Discussion:** Asking students the difference between a square 'parol' frame (2D) and a cubic box (3D).	● **The 'Perfect' Hunt:** List numbers 1-20 and ask students to circle which ones have whole-number square roots. ● **Discussion:** Ask 'What happens to the remaining numbers like √2?'	● **Number Line Warm-up:** Placing integers -5 to 5 on a long masking tape on the classroom floor. ● **Mental Recall:** Rapid fire estimation of √2, √3, and √8.

Flow:	• **Scaffolding:** Begin by illustrating perfect squares using a 'Square Array' on grid paper. Students shade areas for 4, 9, 16, and 25 to see the physical 'square' shape. • **Checks for Understanding (CFU):** Use 'Thumbs Up/Down' to verify if a given number (e.g., 20) is a perfect square. • **Social Learning:** Pair-Share activity where students list 5 square-shaped items found in their community (e.g., 'panyo', 'biscuits') and estimate their side lengths given an area. • **Active Retrieval:**	• **Scaffolding:** Start with a table comparing n, n^2, and n^3 for n=1 to 5. Highlight how quickly n^3 grows. • **Direct Instruction:** Define the cube root as the side of a cube given its volume. Demonstrate the notation with index 3. • **CFU:** 'Stop or Go' game—Teacher says a number; students shout 'Cube!' if it's a perfect cube (1, 8, 27, 64, 125). • **Social Learning:** Small groups calculate the side length of 'magic cubes' or boxes with volumes like 216 or 343 cubic inches. • **Active Retrieval:** 'Cube Root Bingo' using perfect cubes from 1 to 1000.	• **Scaffolding:** Use the 'Squeeze Method'. To find $\sqrt{7}$, find the perfect squares it lies between (4 and 9). Therefore, $\sqrt{7}$ is between 2 and 3. • **Direct Instruction:** Define irrational numbers as non-terminating, non-repeating decimals. Explain that they cannot be written as simple fractions. • **CFU:** 'Flashcard Sort'—Students categorize numbers shown on screen as Rational or Irrational. • **Social Learning:** 'Estimation Challenge'—Groups compete to get the closest decimal estimate for $\sqrt{10}$ without using a calculator. • **Active Retrieval:**	• **Scaffolding:** Provide number lines that already have perfect squares/cubes marked at their integer positions (e.g., 2 is marked as $\sqrt{4}$). • **Direct Instruction:** Demonstrate how to use the estimated decimal value (from Session 3) to pinpoint the location on the line. • **Social Learning:** 'Human Number Line'—Students are given cards with values like $\sqrt{2}$, 1.5, $\sqrt{9}$, $\sqrt[3]{8}$, and $\sqrt{5}$. They must stand in the correct order across the room. • **CFU:** Give a point on a projected number line and ask students to guess which radical it represents. • **Active**

	Use a 'Square Root Tree' graphic organizer where the 'roots' are the base numbers and the 'fruits' are the perfect squares. ● **Direct Instruction:** Define square root as the side length of a square with a given area. Introduce the radical symbol.		Mapping the logic: If √9 = 3 and √16 = 4, then √12 must be approximately 3.4 or 3.5.	**Retrieval:** Ordering 'Philippine Fruit Weights' (represented as roots, e.g., √2 kg of mango vs 1.5 kg of banana).
Learning Resources:	● Grid paper/Graphing paper ● Rulers ● Slide presentation showing local Philippine square-shaped crafts ● Individual whiteboards or 'show-me' boards	● Plastic stacking cubes or dice ● Empty boxes (cubical) ● Worksheets with 3D illustrations ● Scientific calculators (for verification only)	● Number cards ● Large 'Rational/Irrational' sorting bins ● Projector for visual estimation graphs	● Masking tape for floor number line ● Large index cards with radical expressions ● Rulers and printed number line worksheets
Opportunities for integration:	● **Arts:** Exploring geometric patterns in indigenous Filipino weaving. ● **TLE (Home Economics**	● **Science:** Discussing the volume of water and displacement. ● **TLE:** Packaging and storage	● **English/Literacy:** Understanding the prefix 'ir-' (not) in irrational. ● **History:** Briefly mentioning	● **Geography:** Comparing distances between local landmarks using approximate radical values.

	): Measuring floor areas for room layout.	in small businesses.	the Pythagorean discovery of √2.	● **Physical Education:** Organizing students by height/distance in a calculated manner.
Assessment. **Assessments reveal what learners have gained and what they still need help with. These are helpful in providing you with information to guide your future instruction throughout the entire session.**				
Formative Assessment:	● **Board Blast:** Randomly calling students to find the square root of numbers written on 'calamansi-shaped' cards. ● **Quick Quiz:** A 5-item identification test at the end of the session focusing on roots of 121, 144, 169, 196, and 225.	● **Ticket out the Door:** Students must write the cube root of 64 and 1000 before leaving. ● **Problem Solving:** A short word problem involving the volume of a cubic water tank in a local 'barangay'.	● **Matching Type:** Match the irrational square root to its closest two integers (e.g., √5 fits between 2 and 3). ● **Think-Aloud:** Ask a student to explain the steps they took to estimate √15.	● **Plotting Task:** A worksheet where students must plot √2, √11, ∛27, and ∛50 on a single number line. ● **Comparison Exit Slip:** Use <, >, or = to compare pairs like √10 ___ 3 and ∛27 ___ √9.
Ways Forward. **Meaningful learning can also happen beyond the classroom – for both the learners and the teacher. Pause and reflect on what happened today.**				
Extended learning opportunities:	● Ask students to find one square	● Challenge students to find the cube root of	● Research the value of Pi (π) and why it is	● Create a 'Radical Number Line' poster

	object at home, measure its side, and calculate the square of that side to find the area.	1,331 and 2,744 using prime factorization .	considered the most famous irrational number.	for the classroom wall showing the location of roots from 1 to 100.
Reflections:	● How many students were able to identify perfect squares beyond 100? ● Did the use of grid paper help kinesthetic learners understand the concept of a 'square' root?	● Did students differentiate the radical symbols for square and cube roots correctly? ● Which manipulative was most effective in showing 3D volume?	● Did students understand why $\sqrt{25}$ is NOT irrational while $\sqrt{20}$ IS? ● Are students able to justify their estimations using perfect square boundaries?	● Were students able to transition from estimated values to physical points on a line? ● Which group struggled most with cube roots versus square roots on the number line?